

# COLLEGE OF GRADUATE STUDIES & RESEARCH

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Note: The year that a faculty member's term will be reviewed according to the college criteria is indicated following each name.

M.H. Abd-El-Barr (2001)  
S.R. Abrams (2003)  
G.P. Adams (2002)  
G.S. Aikenhead (2003)  
A.E. Aitken (2003)  
A. Akkerman (2001)  
L. Alexitch (2000)  
R.T. Alisaukas (2001)

B. Allan (2002)  
A. Allen (2003)  
M. Altman (2004)  
A.B. Anderson (2003)  
D. Anderson (2004)  
D.W. Anderson (2003)  
J.F. Angel (2003)  
K. Ansdell (2001)  
G.D. Appleyard (2004)  
K. Arbuthnott (2002)  
O.W. Archibold (2003)  
S. Arimoto (2001)  
M.T. Arts (2004)  
K. Ash (2004)  
L.A. Babiuk (2003)  
A. Backman (2001)  
D.A. Bailey (2003)  
J.V. Bailey (2001)  
R.J. Baker (2000)  
R. Balachandar (2000)  
G.M. Bancroft (2004)  
A.S. Baranski (2000)  
E.M. Barber (2000)  
S.M. Barber (2001)  
S.L. Barbour (2004)  
B. Barl (2000)  
A. Barr (2001)  
W. Barr (2003)  
A.D. Barth (2000)  
W.M. Bartley (2002)  
J.F. Basinger (2001)  
G.S. Basran (2004)  
M. Battiste (2003)  
G. Baxter (2003)  
M.A. Beavis (2004)  
R.G. Beck (2004)  
K.W. Belcher (2004)  
K. Bell (2002)  
L.S. Bell (2001)  
V.L. Bennett (2001)  
M.L. Benson (2003)  
S. Berenbaum (2004)  
A.T. Bergan (2003)  
D.J. Bergstrom (2003)  
J. Bergstrom (2003)  
S. Berman (2003)  
C. Bernhardson (2003)  
C. Berthelot (2003)  
R.W. Besant (2003)  
J.R. Bettany (2003)  
M.G. Bickis (2001)  
P.M. Bidwell (2003)  
C.L. Biggs (2002)  
R. Billinton (2004)  
W. Bishopp (2003)  
B.R. Blakley (2004)  
K.L.N. Blocka (2001)  
J.M. Blondeau (2002)  
A. Blunt (2003)  
M. Boehm (2003)  
J.O. Boison (2002)  
B.S. Bolaria (2003)  
R.J. Bolton (2004)  
D. Bond (2003)  
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R. Borowsky (2000)  
G.R. Bortolotti (2003)  
A.A. Boulton (2004)

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C. Boyd (2000)  
S.M. Boyetchko (2003)  
M.R. Bremner (2003)  
D. Brenna (2000)  
P.A. Bretscher (2002)  
J.A. Brooke (2000)  
H.G. Brooks (2001)  
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Y.M.R. Brown (2001)  
P. Browne (2001)  
H. Bryant (2003)  
F. Buchanan (2000)  
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R.L. Calder (2003)  
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W.G.E. Caldwell (2002)  
D.C. Campbell (2001)  
G.L. Campbell (2000)  
J.I.D. Campbell (2001)  
J.R. Campbell (2002)  
H.S. Caplan (2003)  
C. Card (2002)  
R.T. Card (2004)  
S. Carlsen (2004)  
R.A. Carlson (2003)  
D.J. Carrier (2001)  
L. Carroll (2001)  
T. Carruthers (2000)  
A.B. Carson (2003)  
J.A. Carter (2000)  
N. Caulkett (2000)  
K. Chad (2001)  
A.K. Chakravarti (2003)  
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A. Chehab (2003)  
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A. Chigogidze (2003)  
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M. Chirino-Trejo (2004)  
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M. Collins (2001)  
M.R. Conlon (2000)  
J.B. Conway (2003)  
A. Coode (2000)  
J.E. Cooke (2003)  
R.W. Cooley (2000)  
K. Cooper-Stephenson (2003)  
K. Corrigan (2002)

D. Cotton (2004)  
M. Cottrell (2002)  
J.C. Courtney (2003)  
P.S. Covello (2004)  
P.H. Cribb (2000)  
L. Crone (2000)  
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B. Cross (2002)  
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P. Currie (2001)  
D. Cushman (2003)  
C. D'Arcy (2000)  
B.L.F. Daku (2001)  
A.K. Dalai (2002)  
J.E. Dart (2003)  
A.R. Davis (2004)  
B. Davis (2000)  
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M. Day (2002)  
E.B. Dayton (2004)  
D. de Boer (2001)  
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J. DeCoteau (2003)  
W.E. DeCoteau (2003)  
L.T.J. Delbaere (2003)  
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S. Deng (2000)  
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K. Deonandan (2003)  
M. Desautels (2003)  
G. DesBrisay (2000)  
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M. Devine (2003)  
A. Devito (2000)  
R. Devon (2004)  
H. Dhand (2003)  
H. Dhingra (2003)  
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H.D. Dickinson (2000)  
G. Dickson (2002)  
J.R. Dimmock (2000)  
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T. Duke (2000)  
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P. Dwyer (2004)  
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R.F. Dyck (2004)  
D.L. Eager (2000)  
C. Echevarria (2002)  
M. Eckroth (2002)  
R. Edmonds (2003)  
D. Edney (2003)

- A.M. El-Serafi (2004)  
P. Elabor-Idemudia (2000)  
J.A. Ellis (2002)  
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G. Enns (2004)  
G. Entwistle (2000)  
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K. Komiyama (2000)  
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V. Korinek (2002)  
A.V. Koustov (2000)  
H-B. Kraatz (2003)  
S. Krakowka (2004)
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K. Lal (2003)  
H.O. Langlois (2004)  
R. Lansing (2003)  
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W.H. Lavery (2003)  
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F.A. Leighton (2000)  
A. Leis (2000)  
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P. Leonard (2003)  
C.K. Leong (2001)  
R. Lepnum (2000)  
J. Leszczynski (2003)  
M-K. Leung (2004)  
P. Li (2003)  
X-M. Li (2000)  
K. Liber 30-Aug-01  
R. M. Lindsay (2003)  
W.D. Lindsay (2004)  
G. Links (2003)  
U. Linnamae (2003)  
A. Livingston (2004)  
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N.H. Low (2004)  
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M.E. Lyon (2003)  
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J.E. MacLennan (2004)  
A. MacLeod (2000)  
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J.D. MacNeil (2000)  
J.D. Mahon (2000)  
M. Majewski (2001)  
A.H. Manson (2003)  
A.A. Mansour (2001)  
R.J. Mapletoft (2003)  
T.A. Marchant (2003)  
T. Marche (2000)  
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M.C. Marino (2003)  
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P. Marsh (2002)  
M.A. Marshall (2003)

- J.R. Martin (2003)  
P. Martin McGuire (2000)  
L.W. Martz (2001)  
K.L. Massey (2002)  
T.J. Matheson (2004)  
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G. Melville (2003)  
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A.R. Mermut (2003)  
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F. Messier (2003)  
D.A. Meyer (2003)  
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P.W.B. Phillips (2002)  
A. Phoenix (2003)  
R.A. Pierson (2004)  
A. Pietroniro (2004)  
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K. Post (2000)  
A.A. Potter (2000)  
J.C. Potter-MacKinnon (2002)  
K. Prasad (2003)  
B.R. Pratt (2000)  
L. D. Pressé, (2001)  
L.F. Proctor (2003)  
T. Prowse (2002)  
A.F. Prugger (2000)  
D.E. Pufahl (2000)  
P.A.C. Purdue (2002)  
G. Putz (2000)  
R.E. Pywell (2001)  
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T. Quigley (2004)  
O.M. Radoslits (2003)  
A. Rajput (2003)  
G.F. Rakow (2000)  
E. Ralph (2000)  
M.A. Ramsay (2003)  
J.E. Randall (2004)  
J.M. Randhi (2004)  
C. Rangacharyulu (2004)  
G.H. Rank (2003)  
C. Rasmussen (2002)  
N.C. Rawlings (2003)
- B.A. Reeder (2000)  
F.A. Reekie (2000)  
A. Reese (2000)  
M.J. Reeves (2003)  
T.D. Regehr (2000)  
R. Regnier (2004)  
R.S. Reid (2000)  
D.M.A. Relke (2003)  
A.M. Remedios (2002)  
A.J. Remillard (2004)  
G. Remus (2004)  
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P. Renihan (2004)  
D.C. Rennie (2004)  
K.S. Rezakallah (2003)  
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J.S. Richardson (2004)  
C. Riddell (2000)  
J. Rigby (2003)  
C. Ringness (2003)  
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B.G. Rossnagel (2000)  
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S.I. Rubin (2001)  
K. Russell (2001)  
R.S. Russell (2000)  
A. Ryan (2004)  
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L.E. Sackney (2004)  
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F. Saleh (2003)  
J.E. Salt (2002)  
L.M. Samuelson (2004)  
K. Sankaran (2004)  
C.M. Sargeant (2003)  
W.A.S. Sarjeant (2003)  
A. Sarkar (2003)  
G. Sarty (2000)  
E.K. Sauer (2003)  
J.E. Sawatzky (2002)  
V.K. Sawhney (2003)  
A. Saxena (2000)  
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B. Schissel (2004)  
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R. Schoney (2004)  
B.T. Schreiner (2003)  
D.J. Schreyer (2000)  
V. Schwean (2003)  
R.A. Schwier (2004)  
E.H. Scissons (2004)  
G.J. Scoles (2003)  
D. Scott (2003)  
R.I. Scott (2003) - Emeritus
- G.P. Searcy (2003)  
G. Séguin-Swartz (2003)  
T.W. Selover (2002)  
G. Selvaraj (2003)  
K.M. Semchuk (2000)  
N. Senior (2003)  
P.J. Shand (2001)  
S.D. Shantz (2001)  
R.K. Sharma (2001)  
S.P. Sharma (2003)  
L. Shepel (2003)  
D.P. Sheridan (2001)  
Y.M. Shevchuk (2003)  
S. Shewchuk (2003)  
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A.S. Shoker (2002)  
J. Sibley (2001)  
R.D. Sider (2000)  
N. Sidhu (2003)  
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R. Sileroova (2002)  
E. Simko (2004)  
G.M. Simpson (2003)  
B. Singh (2004)  
M.P. Singh (2002)  
B.M. Sinha (2004)  
L.K. Sippola (2002)  
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L.F. Skinnider (2003) - Emeritus  
R.P. Skomro (2004)  
D.M. Skopik (2001)  
C.W. Slights (2004)  
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A.E. Slinkard (2003)  
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A. Smolyakov (2000)  
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K. Solose (2004)  
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V. St. Denis (2002)  
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R.G. St. Pierre (2000)  
J.C. Stabler (2003)  
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T.G. Steele (2002)  
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C. A.M. Stephen (2003)  
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- J.W. Stephenson (2003)  
 W.L. Stevenson (2001)  
 L. Stewart (2004)  
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 R.P. Stoicheff (2003)  
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 D.C. Story (2003)  
 P.V. Sulakhe (2003)  
 D. Sumner (2004)  
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 P.M. Swan (2004)  
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 J. Szmigielski (2002)  
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 H. Tabel (2001)  
 K. Takaya (2004)  
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 H.G.G. Townsend (2000)  
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 R.T. Tyler (2000)  
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 P.R. Ukrainetz (2003)  
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 A.G. Van Kessel (2002)  
 K.C.J. Van Rees (2001)  
 A. Vandenberg (2003)  
 L.M. Vargo (2000)  
 J. Vassileva (2003)  
 R. Venne (2003)  
 V.M.K. Verge (2002)  
 S.P. Verma (2004)  
 R.E. Verrall (2004)  
 M.T. Vinaygamoorthy (2001)  
 C.L. von Baeyer (2000)  
 M.I. Vrbancic (2004)  
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 W.A. Waiser (2001)  
 C.L. Waldner (2004)  
 J.B. Waldram (2001)  
 E.G. Walker (2001)
- K.D. Walker (2002)  
 W.L. Waltz (2004)  
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 R. Wang (2003)  
 A. Ward (2000)  
 D.E. Ward (2001)  
 R.C. Warrington (2003)  
 L. Wason-Ellam (2003)  
 L.I. Wassenaar (2001)  
 D.R. Waterer (2004)  
 E.H. Waters (2004)  
 L.G. Watson (2004)  
 E.B. Waygood (2003)  
 H. West (2004)  
 N.H. West (2004)  
 N.D. Westcott (2000)  
 K. Wetzel (2003)  
 R.C. Wheeler (2003)  
 S.M. Whiting (2004)  
 R.E.Y. Wickett (2002)  
 M.L. Wickstrom (2003)  
 K.L. Wiebe (2000)  
 A. Williams (2004)  
 D. Williams (2003)  
 K. Williams (2003)  
 K.E. Williams (2004)  
 C. Williamson (2003)  
 R.G. Williamson (2003)  
 P.J. Willson (2000)  
 J.N. Wilson (2003)  
 G.W. Wilson (2003)  
 K.A. Wilson (2004)  
 M.R. Wilson (2001)  
 T.W. Wilson (2004)  
 E.C. Wirrell (2004)  
 T.B. Wishart (2003)  
 G.A. Wobeser (2003)  
 G.M. Wolfaardt (2001)  
 A. Wollin (2004)  
 A.T. Wong (2003)  
 S. Wong (2002)  
 H. Wood (2003)  
 M.R. Woodbury (2004)  
 H. Woodhouse (2001)  
 L.J. Worobetz (2001)  
 T.L. Wotherspoon (2004)  
 K.E. Wright (2003)  
 D. Wulfsohn (2001)  
 D. Wyman (2002)  
 J. Xiang (2003)  
 W. Xiao (2003)  
 C. Xiao (2004)  
 R.A. Yaansah (2004)  
 R.A. Yackulic (2004)  
 J.Y. Yager (2002)  
 H. Yang (2000)  
 S. Yannacopoulos (2002)  
 P. Yates (2003)  
 W.D.G. Yates (2000)  
 K. Yong-Hing (2002)  
 P. Yu (2004)  
 G.A. Zello (2002)  
 R.P. Zentner (2000)  
 C. Zhang (2003)  
 F.A. Zichy (2004)  
 B. Ziola (2004)
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- M. Abd-El-Barr, Ph.D., (King Fahd University of Petroleum and Minerals), Computer Science (2001)  
 S. Abrams, Ph.D., (Plant Biotechnology Institute), Chemistry (2003)  
 S. K. Ali, M.B.B.S., (Saskatoon Cancer Centre), Oncology (2003)  
 R.T. Alisaukas, Ph.D., (Environment Canada), Biology (2001)  
 B. Allan, Ph.D., (Veterinary Infectious Disease Organization), Veterinary Pathology (2002)  
 G.D. Appleyard, Ph.D., (Veterinary Pathology), Veterinary Pathology (2004) and Veterinary Microbiology (2004)  
 K. Arbutnott, Ph.D., (University of Regina), Psychology (2002)  
 S. Arimoto, Ph.D., (Institute for Fundamental Chemistry, Kyoto), Chemistry (2001)  
 M.T. Arts, Ph.D., (National Hydrology Research Institute), Toxicology Group (2003)  
 J. Asai, Ph.D., (Saskatchewan Accelerator Laboratory), Physics (2002)  
 G. Asmundson, Ph.D. (Clinical Research and Development for the Regina Health District), Psychiatry (2004)  
 B. Barl, Ph.D., (Horticulture Science), Horticulture Science (2000)  
 A. Barr, Ph.D., (National Hydrology Research Institute), Geography (2001)  
 M. Baca-Estrada, Ph.D., (Veterinary Infectious Disease Organization), Pharmacy and Nutrition (2002)  
 G.M. Bancroft, Ph.D., (Canadian Light Source), Chemistry (2004)  
 N. Bate, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Biochemistry (2003)  
 H.J. Beckie, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Soil Science (2001)  
 M. Benmerrouche, Ph.D., (Saskatchewan Accelerator Laboratory), Physics and Engineering Physics (2003)  
 M. Berry, B.Sc(Hons.), (Alviva Biopharmaceuticals Inc.), Department of Psychiatry (2004)  
 J. Billinton, Ph.D., (retired from Univ. of Saskatchewan), Educational Administration (2004)  
 J.M. Blondeau, Ph.D., (Royal University Hospital), Microbiology (2001)  
 M. Boehm, Ph.D., (Centre for Studies in Agriculture, Law and the Environment), Soil Science (2003)  
 J.O. Boison, Ph.D., (Canada Food Inspection Agency), Chemistry (2002)  
 T. Bollinger, D.V.Sc., (Veterinary Pathology), Veterinary Pathology (2004)  
 S.M. Boyetchko, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Applied Microbiology and Food Science (2003)  
 N.W. Braroe, Ph.D., (Massachusetts Institute of Technology), Anthropology and Archaeology (2000)
- H.G. Brooks, Ph.D., (Canadian Wheat Board), Agricultural Economics (2001)  
 M.M. Brugman, Ph.D., (National Hydrology Research Institute), Geography (2001)  
 H. Bryant, Ph.D., (Royal Saskatchewan Museum), Geological Sciences (2003)  
 W.G.E. Caldwell, Ph.D., (University of Western Ontario), Geological Sciences (2002)  
 L. Carroll, Ph.D., (Clinical Health Psychology and Institute for Health and Outcomes Research, Royal University Hospital), Psychology (2001)  
 R.N. Chibbar, Ph.D., (Plant Biotechnology Institute), Plant Sciences (2000)  
 E.G. Clark, M.V.Sc., (Prairie Diagnostic Services), Veterinary Pathology (2004)  
 R.G. Clark, Ph.D., (Canadian Wildlife Service), Biology (2004)  
 G.D. Conway, Ph.D., (Joint European Torus, Oxford), Physics and Engineering Physics (2002)  
 A. Coode, Ph.D., (Central Canada Potash Division), Civil Engineering (2000)  
 B.E. Coulman, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2004)  
 P.S. Covello, Ph.D., (National Research Council Canada), Biochemistry (2004)  
 W.L. Crosby, Ph.D., (Plant Biotechnology Institute), Biology (2000)  
 B. Cross, M.Sc., (Animal Resources Centre), Veterinary Pathology (2002)  
 J.M. Culp, Ph.D., (National Hydrology Research Institute), Biology (2001)  
 P.J. Currie, Ph.D., (Royal Tyrrell Museum of Palaeontology), Geological Sciences (2001)  
 P.W. Davall, Ph.D., (SaskPower), Electrical Engineering (2000)  
 J.R. de Freitas, Ph.D., (Soil Science), Soil Science (2000)  
 A. Devito, Ph.D., (self employed), Computer Science (2000)  
 I. Dyck, Ph.D., (Canadian Museum of Civilization), Anthropology and Archaeology (2003)  
 J.A. Elliott, Ph.D., (National Hydrology Research Institute), Soil Science (2001)  
 G. Enns, Ph.D., (Youth and Family Therapy), Educational Psychology & Special Education (2004)  
 M. Erlandson, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Applied Microbiology and Food Science (2004)  
 A.E. Estrada, Ph.D., (Animal and Poultry Science), Animal and Poultry Science (2000) and Veterinary Microbiology (2004)  
 M.S. Evans, Ph.D., (National Hydrology Research Institute), Biology (2001)  
 R. Farrell, Ph.D., (Saskatchewan Centre for Soil Research), Soil Science (2003)  
 J. Fang, Ph.D., (Pharmacy and Nutrition), College of Pharmacy and Nutrition (2000)  
 J.A. Feather, M.A., (Community Health and Epidemiology), Community Health and Epidemiology (2001)

- J.J.R. Feddes, Ph.D., (University of Alberta), Agricultural and Bioresource Engineering (2004)
- P. Fobert, Ph.D., (Plant Biotechnology Institute), Biology (2001)
- D. Forsyth, Ph.D., (Canadian Wildlife Service), Soil Science (2003)
- C.M. R. Fowler, Ph.D. (Royal Holloway and Bedford New College, University of London), Geological Sciences (2001)
- D. Friesen, Ph.D., (National Water Research Centre), Division of Environmental Engineering (2004)
- A.A. Gajadhar, Ph.D., (Canadian Food Inspection Agency), Veterinary Microbiology (2003)
- R.S.J. Gall, Ph.D., (self-employed), Educational Psychology & Special Education (2004)
- C.G. Gallagher, M.B., MRCPI, FRCP(C), (Trinity College Dublin Medical School), Medicine (2002)
- R.L. Gattinger, Ph.D., (Herzberg Institute of Astrophysics), Physics and Engineering Physics (2000)
- F.F.Z. Georges, Ph.D., (Plant Biotechnology Institute), Biochemistry (2000)
- N.S. Gerrard, Ph.D., (Saskatoon District Health), Community Health and Epidemiology (2004)
- T. Gibson, Ph.D., (Western Heritage Services, Inc.), Anthropology and Archaeology (2003)
- D.L. Godson, Ph.D., (Veterinary Infectious Disease Organization), Veterinary Microbiology (2004)
- H.W. Gonyou, Ph.D., (Prairie Swine Centre Inc.), Animal and Poultry Science (2001)
- B.R. Gordon, Ph.D., (Alvin Buckwold Child Development Program), Education of Exceptional Children (2002)
- R. Goodman, Ph.D., (Imperial Oil Resources Limited), Environmental Engineering (2004)
- S. Greenberg, Ph.D., (University of Calgary), Computer Science (2004)
- M.C.J. Grevers, Ph.D., (Soil Science), Soil Science (2002)
- J.W.D. GrootWassink, Ph.D., (Plant Biotechnology Institute), Applied Microbiology and Food Science (2001)
- P. Gu (Mechanical Engineering), Mechanical Engineering (2002)
- P.A. Hackett, Ph.D., (National Research Council of Canada, Ottawa), Chemistry (2000)
- J. Halmo, Ph.D., (self employed), Music (2003)
- M. Hamilton, Ph.D., (Defense Research Establishment), Pharmacology (2004)
- M. Hanna, Ph.D., (Royal Saskatchewan Museum), Anthropology and Archaeology (2003)
- R. Harland, Ph.D., (self employed), Veterinary Microbiology (2000)
- D. Hay, Ph.D., (Royal University Hospital), Psychology (2003)
- J.V. Headley, Ph.D., (National Hydrology Research Institute), Civil Engineering (2002)
- R.W. Heber, Ph.D., (Saskatchewan Indian Federated College), Anthropology and Archaeology (2003)
- A. Hedayat, Ph.D., (Bregma International Trading Company Ltd.), Mechanical Engineering (2000)
- D.D. Hegedus, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Applied Microbiology and Food Science (2003)
- S. Hemmingsen, Ph.D., (National Research Council), Microbiology (2003)
- T.Y. Henderson, Ph.D., (Professor Emeritus), Philosophy (2004)
- E.P. Hoberg, Ph.D., (Biosystematics and National Parasite Collection Unit, USDA), Veterinary Microbiology (2000)
- K.A. Hobson, Ph.D., (Environment Canada), Biology (2004)
- M.M. Hrabok, Ph.D., (Moneco AGRA Consultants), Civil Engineering (2000)
- J.C. Hudson, M.Sc., (Royal Canadian Mounted Police), Toxicology Group (2000)
- C.S. Huang, Ph.D., (Institute of Space and Atmospheric Studies), Physics and Engineering Physics (2003)
- R.K. Hynes, Ph.D., (Agrium Inc. Biologicals), Soil Science (2001)
- J. Irudayaraj, Ph.D., (Utah State University), Agricultural and Bioresource Engineering (2000) and Civil Engineering (2000)
- D.G. Irvine, Ph.D., (Toxicology Centre), Toxicology Group (2000)
- P.G. Jefferson, Ph.D., (Semiarid Prairie Agricultural Research Centre), Animal and Poultry Science (2004)
- G.K. Jim, D.V.M., (Feedlot Health Management Services), Herd Medicine and Theriogenology (2001)
- J. Ji-yun, Ph.D., (Chinese Academy of Agricultural Sciences/Potash and Phosphate Institute of Canada), Soil Science (2001)
- A.M. Jobson, Ph.D., (Stanley Consulting Group Ltd.), Environmental Engineering (2002)
- M. Johnston, Ph.D., (Saskatchewan Environment and Resource Management), Soil Science (2002)
- R. Karamanos, Ph.D., (Western Cooperative Fertilizers Ltd.), Department of Soil Science (2004)
- J.P. Kastelic, Ph.D., (Agriculture and Agri-Food Canada Research Station, Lethbridge), Herd Medicine and Theriogenology (2001)
- W.A. Keller, Ph.D., (National Research Council), Plant Sciences (2002)
- B.C. Kenney, Ph.D., (National Hydrology Research Institute), Agricultural and Bioresource Engineering (2000)
- M.E. Kerr, M.V.Sc., (Prairie Diagnostic Services), Veterinary Pathology (2004)
- J.D. Knight, Ph.D., (Saskatchewan Centre for Soil Research), Soil Science (2003)
- D.R. Korber, Ph.D., (Applied Microbiology and Food Science), Applied Microbiology and Food Science (2001)
- L.M. Kozak, Ph.D., (Centre for Land and Biological Resources Research), Soil Science (2000)
- S. Krakowka, Ph.D., (Veterinary Biosciences, Ohio State University), Veterinary Microbiology (2004)
- S. Kumar, Ph.D., (Wavecom Electronics), Electrical Engineering (2003)
- T.K. Kyser, Ph.D., (Queen's University), Geological Sciences (2000)
- J.R. Lawrence, Ph.D., (National Hydrology Research Institute), Applied Microbiology and Food Science (2002)
- A. Légère, Ph.D., (AAFC Saskatchewan Research Center), Plant Sciences (2000)
- S.P. Lemay, Ph.D., (Research Scientist), Agricultural and Bioresource Engineering (2002)
- D. Lydiate, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2002)
- R. Macaulay, MD, FRCP(C), (Royal University Hospital), Veterinary Pathology (2001)
- J.D. MacNeil, Ph.D., (Canada Food Inspection Agency), Toxicology Group (2000)
- D.D. Maenz, Ph.D., (Prairie Feed Resource Centre (Canada) Inc.), Animal and Poultry Science (2004)
- J. Mahon, Ph.D., (Plant Biotechnology Institute), Plant Sciences (2000)
- S.S. Malhi, Ph.D., (Agriculture and Agri-Food Canada Research Station, Melfort), Soil Science (2004)
- G.P. Marchildon, Ph.D. (Deputy Minister to the Premier and Cabinet Secretary), Agricultural Economics (2002)
- R. Marles, Ph.D., (Brandon University), Biology (2004)
- P. Marsh, Ph.D., (National Hydrology Research Institute), Geography (2002)
- P. Martin-McGuire, Ph.D., (Dept. of Indian Affairs), Anthropology and Archeology (2000) and Native Studies (2000)
- D.R. McCreary, Ph.D., (Regina Health District), Psychology (2004)
- D.R. McDiarmid, Ph.D., (National Research Council of Canada, Ottawa), Physics and Engineering Physics (2002)
- P. McDonald, Ph.D., (Health Services Utilization and Research Commission), Psychology (2003)
- W.R. McGregor, Ph.D., (DowElanco), Soil Science (2000)
- E.E. McIver, Ph.D., (self employed), Geological Sciences (2000)
- G. Melville, Ph.D., (Saskatchewan Research Council), Environmental Engineering (2003)
- A.R. Mermut, Ph.D., (Saskatchewan Institute of Pedology), Soil Science (2003)
- J. Middleton, M.N., (Parkridge Centre), Nursing (2004)
- K.K. Midha, Ph.D., (self employed), College of Pharmacy and Nutrition (2000) and Academic Family Medicine (2000)
- B.J. Milne, Ph.D., (University of Calgary), Chemical Engineering (2002)
- R.E. Morlan, Ph.D., (Canadian Museum of Civilization), Anthropology and Archaeology (2000)
- D. Morrison, Ph.D., (Canadian Museum of Civilization), Anthropology and Archaeology (2003)
- S. Myers, M.V.Sc., (Prairie Diagnostic Services), Veterinary Pathology (2004)
- J.L. Nanson, Ph.D., (Alvin Buckwold Child Development Program), Psychology (2001)
- M. Ngeleka, Ph.D., D.V.M. (Prairie Diagnostic Services), Veterinary Microbiology (2004)
- B.A. Nicholson, Ph.D., (Brandon University), Anthropology and Archaeology (2000)
- W.E. Norum, Ph.D., (Saskatchewan Accelerator Laboratory), Physics and Engineering Physics (2002)
- A. Obenaus, Ph.D., (Medical Imaging), Medical Imaging (2002) and Anatomy and Cell Biology (2002)
- J.P. Orr, M.V.Sc., (Prairie Diagnostic Services), Veterinary Pathology (2004)
- M. Owen, Ph.D., (Ryerson Polytechnic University), History (2002)
- I. Oznovich, Ph.D., (Canadian Space Agency), Physics and Engineering Physics (2000)
- S. Paivio, Ph.D., (University of Windsor), Psychology (2000)
- S.M. Pan, Ph.D., (SED Systems Inc.), Electrical Engineering (2000)
- J.F. Patience, Ph.D., (Prairie Swine Centre), Animal and Poultry Science (2001)
- H.G. Peterson, Ph.D., (Saskatchewan Research Council), Environmental Engineering (2002)
- A. Pietroniro, Ph.D. (National Water Research Institute), Agricultural and Bioresource Engineering (2004)
- Y. Plante, Ph.D., (Saskatchewan Research Council), Animal and Poultry Science (2001)
- J.W. Pomeroy, Ph.D., (National Hydrology Research Institute), Agricultural and Bioresource Engineering (2000)
- A.A. Potter, Ph.D., (Veterinary Infectious Disease Organization), Veterinary Microbiology (2000)
- L. Pressé, Ph.D., (Regional Psychiatric Centre), Psychology (2001)
- T. Prowse, Ph.D., (National Hydrology Research Institute), Agricultural and Bioresource Engineering (2002) and Geography (2004)
- A.F. Prugger, Ph.D., (Potash Corporation of Saskatchewan Inc.), Geological Sciences (2000)
- L.A. Quinn, Ph.D., (University of Brandon), Geological Sciences (2001)
- G.F.W. Rakow, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2000)
- C.J. Richardson, Ph.D., (Royal University Hospital), College of Pharmacy and Nutrition (2001)

## GRADUATE STUDIES & RESEARCH

- R.D. Roberts, Ph.D., (National Hydrology Research Institute), Applied Microbiology and Food Science (2000)
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- B.E. Robertson, Ph.D., (University of Regina), Chemistry, (2000)
- I.H. Salcedo, Ph.D., (Federal University of Pernambuco, Brazil), Soil Science (2000)
- E.V. Sampaio, Ph.D., (Federal University of Pernambuco, Brazil), Soil Science (2000)
- A. Schmitz, Ph.D., (University of California Berkeley), Agricultural Economics (2000)
- J. Schoenau, Ph.D., (Soil Science), Soil Science (2002)
- B.T. Schreiner, Ph.D., (Saskatchewan Research Council), Environmental Engineering (2003)
- G. Séguin-Swartz, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2003)
- G. Selvaraj, Ph.D., (National Research Council), Plant Sciences (2003)
- S. R. Shewchuk, Ph.D., (Saskatchewan Research Council), Environmental Engineering (2003)
- Y.M. Shin, Ph.D., (Physics and Engineering Physics), Physics and Engineering Physics (2003)
- A. Shuaib, F.R.C.P.C. (University of Alberta), Division of Neurology (2004)
- R.D. Sider, Ph.D., (Dickinson College, Pennsylvania), History (2000)
- N. Sidhu, Ph.D., (Saskatoon Cancer Centre), Physics and Engineering Physics (2003)
- E.G. Smith, Ph.D., (Agriculture and Agri-Food Canada Research Station, Lethbridge), Agricultural Economics (2004)
- J.E.G. Smits, Ph.D., (Toxicology Centre), Toxicology Group (2002)
- D. Somers, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2003)
- K. Sosulski, Ph.D. (Saskatchewan Research Council), Department of Applied Microbiology and Food Science (2005)
- R. St. Pierre, Ph.D., (Horticulture Science), Horticulture Science (2000)
- D. Stead, Ph.D., (University of Exeter), Geological Sciences (2003)
- D.P. Steele, Ph.D., (Canadian Space Agency), Physics and Engineering Physics (2000)
- C. Stephen, Ph.D., (Centre for Coastal Health, University of British Columbia), Herd Medicine and Theriogenology (2001)
- H. Steppuhn, Ph.D., (Semiarid Prairie Agricultural Research Centre), Agricultural and Bioresource Engineering (2003)
- W.L. Stevenson, M.A. (Saskatchewan Indian Federated College), Native Studies (2001)
- J.E. Storer, Ph.D., (Yukon Heritage Branch), Geological Sciences (2001)
- S.M. Swanson, Ph.D., (Golder Associates Ltd.), Biology (2001)
- M. Tai, Ph.D., (Parkview Presbyterian Church), Religious Studies (2003)
- Y. Tao, Ph.D., (Tennessee State University College of Engineering and Technology), Mechanical Engineering (2003)
- D.C. Taylor, Ph.D., (Plant Biotechnology Institute), Plant Sciences (2000)
- J.L. Taylor, Ph.D., (Plant Biotechnology Institute), Biology (2000)
- A.G. Thomas, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Plant Sciences (2002)
- K.C. Thomas, Ph.D., (Applied Microbiology and Food Science), Applied Microbiology and Food Science (2001)
- P. Thomas, Ph.D., (Toxicology Centre/self employed), Toxicology Group (2004)
- J. Thorpe, Ph.D., (Saskatchewan Research Council), Plant Sciences (2000)
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- F. Tough, Ph.D., (University of Alberta), Native Studies (2003)
- G. van der Kamp, Ph.D., (National Hydrology Research Institute), Civil Engineering (2002)
- A.G. Van Kessel, Ph.D., (Animal Biotechnology Group), Animal and Poultry Science (2002)
- C.H.J. van Kessel, Ph.D., (University California Davis), Soil Science (2002)
- J. Vassileva, Ph.D., (Computer Science), Computer Science (2003)
- M.T. Vinayagamoorthy, Ph.D. (self employed), Medicine (2001)
- S. Vincent, Ph.D., (self employed), Anthropology and Archaeology (2000)
- M.I. Vrbancic, Ph.D., (Royal University Hospital), Psychology (2004)
- D.T. Waite, Ph.D., (Ecological Research Division, Environment Canada), Toxicology (2000)
- F.L. Walley, Ph.D., (Soil Science), Soil Science (2001)
- H. Wang, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Biology (2003)
- L.I. Wassenaar, Ph.D., (National Hydrology Research Institute), Geological Sciences (2001)
- E.H. Waters, M.V.Sc., (Prairie Diagnostic Services), Veterinary Pathology (2004)
- K.H. West, Ph.D., D.V.M., (Veterinary Diagnostic Services), Veterinary Microbiology (2004)
- N.D. Westcott, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Toxicology Group (2000)
- E. Wheaton, M.Sc. (Saskatchewan Research Council), Geography (2002)
- P. Willson, Ph.D., (Veterinary Infectious Disease Organization), Microbiology (2000)
- T. Wolf, Ph.D., (Agriculture and Agri-Food Canada, Saskatoon Research Centre), Civil Engineering (2004)
- G.M. Wolfaardt, Ph.D., (Applied Microbiology and Food Science), Applied Microbiology and Food Science (2001)
- S. Wong, Ph.D., (Regional Psychiatric Centre), Psychology (2002)
- S.B.M. Wright, Ph.D. (Agriculture and Agri-Food Canada Research Station, Melfort), Animal and Poultry Science (2000)
- D. Wyman, Ph.D., (Key Centre for Teaching and Research in Mineral Deposits), Geological Sciences (2002)
- P. Yates, Ph.D., (Regional Psychiatric Centre), Psychology (2003)
- W.D.G. Yates, Ph.D., (Animal Diseases Research Institute, Lethbridge), Veterinary Pathology (2000)
- R.P. Zentner, Ph.D., (Agriculture and Agri-Food Canada Research Station, Lethbridge), Agricultural Economics (2000)
- R.T. Zijlstra, Ph.D., (Prairie Swine Centre, Inc.), Animal and Poultry Science (2003)

### PROFESSIONAL AFFILIATES\*

- A. Adams, M.A., (Victoria Union Hospital), Psychology (2001)
- N. Ahmad, M.A., (Clinical Health Psychology, Royal University Hospital), Psychology (2001)
- W.J. Arnold, Ph.D., (self employed), Psychology (2004)
- M. Bantle, M.Sc., (self employed), Agricultural and Bioresource Engineering (2001)
- G. Barnhart, Ph.D., (University of Saskatchewan International), Political Studies (2004)
- R.G. Barsi, B.Sc., (Saskatchewan Environment and Resource Management), Civil Engineering (2003)
- R.E. Bell, Ph.D., (Child and Youth Services, Saskatoon City Hospital), Psychology (2003)
- S. Boechler, Ph.D., (Saskatoon District Health, Mental Health Services Division), Psychology (2001)
- H. Brenneman, Ph.D., (self employed), Psychology (2001)
- R.A. Carr, B.Sc., (POS Pilot Plant Corporation), Agricultural and Bioresource Engineering (2000)
- R.W. Chursinoff, M.Sc., (Saskatchewan Highways and Transportation), Civil Engineering (2001)
- W. Clark, M.Ed., (Alvin Buckwold Child Development Program), Psychology (2001)
- J. Cross, M.E.Sc., (Philom Bios Inc.), Chemical Engineering (2001)
- J.E. Cunningham, M.Sc., (self employed), Agricultural and Bioresource Engineering (2001)
- S. Darcangelo, Ph.D. (Regional Psychiatric Centre), Department of Psychology (2004)
- R.J. Devrome, Ph.D., (R.J. Devrome & Associates), Educational Administration (2004)
- L. Duvall, M.F.A., (self employed), Art and Art History (2000)
- L. Ebbesen, M.Sc./M.Ed., (Saskatchewan Heart Health Program), Community Health and Epidemiology (2000)
- C. Edwards, M.Sc., (Cameco Corporation), Chemical Engineering (2003)
- J. Gerstmar, M.L.A., (Meewasin Valley Authority), Environmental Engineering (2003)
- D. Gleave, Ph.D., (retired from Saskatoon Public School System), Educational Administration (2004)
- M. Gloutney, Ph.D., (Stanley Consulting Group Limited), Biology (2002)
- B.R. Gordon, Ph.D., (Alvin Buckwold Child Development Program), Psychology (2001)
- D. Hawley, Ph.D., (Sask. Educational Leadership Unit), Educational Administration (2004)
- C. Hwang, M.Sc., (City of Saskatoon), Environmental Engineering (2003)
- D. Jackson, Ph.D., (Mental Health Services, Saskatoon City Hospital), Psychology (2004)
- K.B. Kawchuk, M.A. (Saskatchewan Indian Federated College), Political Studies (2002)
- R. Kinzel, Ph.D., (Kinzel, Cadrin and Associates), Psychology (2003)
- D. Lake, Ph.D., (Alvin Buckwold Child Development Program), Psychology (2001)
- L. Leonard, Ph.D., (self-employed), Educational Administration (2004)
- B. Nelson, Ph.D. (self-employed), Department of Psychology (2005)
- B. Noonan, Ph.D., (Saskatoon Catholic Schools), Educational Administration (2002) and Educational Psychology (2002)
- G.A. Padbury, M.Sc., (Saskatchewan Land Resource Unit), Soil Science (2000)
- G. Pancyr, Ph.D., (Clinical Health Psychology, Royal University Hospital), Psychology (2001)
- J. Pando, M.Sc. (self employed), Agricultural Economics (2000)
- H. Parris, Ph.D., (self employed), Educational Foundations (2000)
- H. Philibert, MVSc., (Veterinary Pathology), Veterinary Pathology (2004)
- R.G. Schwab, Ph.D., (Meewasin Valley United Church), Political Studies (2002)
- B. Sheppard, Ph.D., (Right Honourable John G. Diefenbaker Centre), Political Studies (2000)
- J. Smits, Ph.D., (Veterinary Pathology), Veterinary Pathology (2001)
- D.A. Spalding, B.Sc. (Kanata Heritage Research and Presentation Corporation), Geological Sciences (2000)
- E.D. Spratt, Ph.D., (Canadian International Development Agency), Soil Science (2000)
- H.B. Stonehouse, M.Sc., (Saskatchewan Land Resource Unit), Soil Science (2000)
- D. Storer, Ph.D., (Potash Corporation of Saskatchewan, Inc.) Chemical Engineering (2003)
- L.C. Tollefson, M.Sc., (Agriculture Canada Prairie Farm Rehabilitation Administration), Agricultural and Bioresource Engineering (2004)
- D. C. Winkelman-Sim, Ph.D. (self-employed), Department of Animal and Poultry Science (2004)
- J. Zemore, Ph.D., (MacNeil Clinic), Psychology (2001)

\*Denotes non-members of faculty.

**THE UNIVERSITY OF SASKATCHEWAN**

The University of Saskatchewan was established in 1907 by an Act passed by the Legislative Assembly of the Province. The Campus is located on the South Saskatchewan River at the edge of the City of Saskatoon.

Saskatoon is a city with a population of 212,136 located on a rolling type of prairie land which is dotted with aspen bluffs. The agriculture in the region about Saskatoon includes the production of livestock and dairy products as well as of grains. The utilization of large deposits of oil, natural gas and potash in the Province is rapidly providing a source of income equal in importance to agriculture.

January, with an average daily temperature of about -18°C is the coldest month. July, with an average daily high of about 25°C is the warmest month. Most winters are characterized by alternate spells of cold and mild weather. While minimum temperatures during the cold periods may drop to -30°C and lower, daytime temperatures during the warm periods may rise above 0°C. Summer temperatures seldom rise above 30°C, and the nights are often cool and invigorating. The average annual precipitation is about 38 cm. with about one-quarter as snow. Both winter and summer are noteworthy for the number of days with bright sunny weather: few years have less than 2000 hours of bright sunshine.

Travel between Saskatoon and other parts of Canada and the United States can be done quickly and conveniently by air. Hard-surface, all-weather highways connect Saskatoon to most places of interest in Saskatchewan and the neighbouring Provinces and States.

The University of Saskatchewan offers numerous fields of specialized study through its school and colleges. They are in the Colleges of Agriculture, Arts and Science, Commerce, Dentistry, Education, Engineering, Graduate Studies and Research, Kinesiology, Law, Medicine, Nursing, Pharmacy and Nutrition, Veterinary Medicine, the School of Physical Therapy, and the Extension Division.

Most colleges offer graduate training to the Master's level (LL.M., M.A., M.Agr., M.B.A., M.C.Ed., M.Ed., M.Eng., M.F.A., M.Math., M.Mus., M.N., M.P.Acc., M.Sc., M.Vet.Sc.). Training to the Ph.D. level is available in the majority of the fundamental disciplines offered by the College of Arts and Science, and most of the professional colleges. Programs of study and research depend on the special interests of the staff and facilities that are available. Interdisciplinary programs are available in many areas. Programs leading to a Postgraduate Diploma are available in some departments, groups, or divisions.

The Royal University Hospital is located on campus and a large successful research park, Innovation Place, is on the north side of the campus. Numerous private research companies and government agencies reside in Innovation Place.

Several other research intensive organizations reside on campus. National Research Council - Plant Biotechnology Institutes; Agriculture and Agri-Food Canada - Research Station, Health of Animals Laboratory, and Prairie Farm Rehabilitation Administration; Environment Canada - Prairie and Northern Wildlife Research Centre of the Canadian Wildlife Service and the National Hydrology Research Institute (Innovation Place); Regional Psychiatric Centre; Saskatchewan Research Council; Protein, Oil & Starch (POS) Pilot Plant.

The University has a number of specialized research groups and facilities. For a full listing, please see *Research Centres, Divisions, and Institutes in the Calendar*.

Degree enrolment totalled 17,590 students in the 1998-99 Regular Session and of this number 1,828 were doing graduate work.

University residence accommodation is available. Rooms with board, and self-contained suites or apartments can usually be obtained within walking distance of the university or close to bus lines. Parking facilities are available on the campus for students with cars. Meals or lunches can be obtained on campus.

Most graduate degrees granted by the university require a substantial amount of research and the submission of a satisfactory thesis based on the research. For this reason prospective students should consult, either personally or by correspondence, with the department in which they intend to work about research facilities and supervision prior to making formal application for admission. Requests for scholarships, teaching and research assistantships should also be addressed to the departments.

**APPLICATION PROCEDURES**

Applications for admission should be submitted on forms available on request from the department the applicant is interested in studying with (or from the Office of the Dean of Graduate Studies and Research). Applicants other than graduates of the University of Saskatchewan must arrange for official transcripts of their academic records from each institution attended to be sent directly to the Head of the department in which they wish to work. In certain cases, an attested copy of each transcript or diploma may be accepted. They must also arrange for at least three confidential letters of recommendation (forms supplied by departments or the College of Graduate Studies and Research Office) to be sent from professors or others, acquainted sufficiently with their training and experience to express an opinion on their ability to undertake graduate training.

Some departments require applicants to take the Graduate Record Examination, National Program for Graduate School Selection and to obtain a satisfactory score on the aptitude test, or the Advanced Test, or both. The departments concerned will inform the prospective applicants of this condition. Arrangements for these tests should be made early in the year by

students who expect to start graduate work the following September. Inquiries about the tests should be addressed to G.R.E., Educational Testing Service, P.O. Box 6000, Princeton, New Jersey, 08541-6000.

An application is submitted to the department in which the applicant wishes to work for a recommendation concerning acceptance or non-acceptance. Applicants will be advised of department or college decision. If the department recommends acceptance, the application is referred to the College of Graduate Studies and Research Office for further action. Non-acceptance of an applicant often depends on considerations other than those listed in the section on Requirements for Admission. These include availability of facilities for the type of research which the applicant wishes to pursue and of a member of the graduate faculty with time to supervise the proposed research. Applicants should not apply to more than one department at the same time. Successful applicants receive a letter of acceptance signed by the Dean or the Admissions Officer. Any special conditions pertaining to the student's admission are noted in the letter.

Applicants who need financial support through scholarships, teaching assistantships and fellowships, research assistantships, etc., in order to undertake graduate work should correspond with the Head of the department in which they wish to study or the professors whom they anticipate will supervise their research work.

**APPLICATION FEE**

Applicants for admission or re-admission are required to submit a non-refundable application fee of \$50. This should be in the form of a certified cheque or money order, in Canadian or U.S. funds, made payable to the University of Saskatchewan.

**APPLICATION FOR ADMISSION DEADLINES**

The College of Graduate Studies and Research normally admits applicants to commence in September of each year. However, some academic units may consider applicants to commence in January or May. Some departments and colleges have established their own deadlines for application which are earlier than the following University deadlines. Applicants are reminded that applications for admission must be received by February 1st if they wish to be considered for University-administered financial support beginning the following September. The College of Graduate Studies and Research has developed scholarship funding for some departments. Contact the department in which you are interested or the College of Graduate Studies and Research for further information. University deadlines for submission of complete applications for admission to departments or colleges are as follows:

- Applications for admission to regular programs when previous post secondary study was done at a Canadian or U.S.

university: *2 months prior to date of expected first registration*

- Applications for admission to regular programs when previous post-secondary study was done outside North America: *4 months prior to date of expected first registration*

- Applications for admission to special case Master's programs when previous post-secondary study was done at a Canadian or U.S. university: *5 months prior to date of expected first registration*

- Applications for admission to special case Master's programs when previous post-secondary study was done outside North America: *6 months prior to date of expected first registration*

- Applications for admission to special case Ph.D. programs: *6 months prior to date of expected first registration*

It is expected that departments and colleges will be able to process complete applications for admission in no more than four weeks, after which time they will either advise the candidate that their application could not be accepted or send a recommendation for admission, along with all necessary documentation, to the College of Graduate Studies and Research.

**GRADUATE ACADEMIC SCHEDULE FOR 2000-2001**

**2000**

**March 31**

Final date for submission of an Application to Graduate for 2000 Spring Convocation

**March 31**

Final date for Master's and Ph.D. oral examinations and submission of all documents required for 2000 Spring Convocation

**April 15**

Final date for submission of theses for students wishing to graduate at 2000 Spring Convocation

**May 1**

Last day to register for Spring and Summer Session without penalty

**May 10**

Graduate Faculty meeting

**May 17**

Last day to add or change Intercession first-term and two-term classes.

**May 27**

Spring Convocation

**August 31**

Final date for submission of an Application to Graduate for 2000 Fall Convocation

**August 31**

Final date for Master's and Ph.D. oral examinations and submission of all documents required for 2000 Fall Convocation

**September 15**

Final date for submission of theses for students wishing to graduate at 2000 Fall Convocation

**October 21**

Fall Convocation for Graduate Candidates

# GRADUATE STUDIES & RESEARCH

## 2001

### April 2

Final date for submission of an Application to Graduate for 2001 Spring Convocation

### April 2

Final date for Master's and Ph.D. oral examinations and submission of all documents required for 2001 Spring Convocation

### April 16

Final date for submission of theses for students wishing to graduate at 2001 Spring Convocation

### May 30

Spring Convocation (tentative date for Graduate Candidates)

## ADMISSION REQUIREMENTS

The requirements for admission to the College of Graduate Studies and Research are as follows:

(1) Applicants must hold an Honours baccalaureate from a college or university of acceptable standing, and equivalent to the degree at this university that is required for admission to the proposed type of graduate work, or have training equivalent to that required for such a degree. An applicant with a three-year Bachelor's degree following Senior Matriculation or four years of study following Junior Matriculation is not eligible for admission. Applicants holding a four-year Bachelor's degree of this university may be admitted to the college if they have had sufficient specialization in their chosen field to require less than 18 credit units to meet the required level of specialization.

(2) Applicants must show promise of ability to pursue satisfactorily advanced study and research, as judged by their previous scholastic records or otherwise.

(3) Applicants should have adequate preparation to enter upon graduate study in their chosen field. Applicants who fail to meet this requirement but meet requirements 1 and 2 may still be admitted provided deficiencies can be rectified by taking some courses either prior to or in parallel with graduate courses.

(4) The language of instruction and examination at the University of Saskatchewan is English. Applicants for admission whose first language is not English must, therefore, present evidence of proficiency in English prior to initial registration. The approved tests of English proficiency are the Test of English as a Foreign Language - TOEFL (minimum score - 550[paper based] or 213 [computer based]), Canadian Test of English for Scholars and Trainees - CanTEST (minimum score - Band 4.5), International English Language Testing System - IELTS (minimum score - Band 6) and the Michigan English Language Assessment Battery - MELAB (minimum score - 85). Test scores must be forwarded directly to Admissions, College of Graduate Studies and Research, by the testing centre, to be received no later than the date of initial registration. Prospective students may also fulfil the English proficiency requirement

through successful completion of the ESL program (Level 50:Advanced) at the Centre for Second Language Instruction at the University of Saskatchewan.

(5) Depending on the research being done, graduate students may be asked to sign an agreement to hold confidential certain information or data which will be made available to them as part of their research training or because of an employment relationship with a particular project.

(6) Prospective graduate students who are full-time employees of the university should seek information on the university's policy in this area, available at the College of Graduate Studies and Research.

*Note:* Meeting the minimum English proficiency requirement does not assure acceptability to programs in the College of Graduate Studies and Research.

## SASKATCHEWAN HEALTH BENEFITS FOR STUDENTS

Students who are permanent residents of the province of Saskatchewan are eligible to receive benefits under all of the Saskatchewan Health Insurance Plans. All permanent residents of Saskatchewan should be in possession of a current Saskatchewan Health Services card.

Students from other provinces or territories in Canada who are present in Saskatchewan for educational purposes are not eligible for benefits under the Saskatchewan Health Plans. Such students should maintain Health Care Insurance from their home province while attending university in Saskatchewan.

International students, who are admitted to Canada through a Canadian Immigration Student Authorization and who take up residence in Saskatchewan, will need to take steps to insure provincial health insurance coverage. To be covered, they must establish residence in Saskatchewan before the first day of the third month following their arrival in Canada. To establish residence, they must register with the Health Insurance Registration Office. Once this registration is complete, the benefit period of Health Insurance will normally be for a maximum of the period of their Student Authorization. The benefit period may be extended by presenting an authorization for a student extension from Canadian Immigration.

International students, who have previously resided in another Canadian province and who move to Saskatchewan, are not covered by the Saskatchewan Health Plan for a period of ninety days. Some of the provinces from which a student might transfer will continue their Health Insurance support program for these three months and others will not. Students who are not covered by a provincial plan must acquire private insurance for this period of time. *All international students should immediately contact the International Student Office regarding their eligibility for the Saskatchewan Health Plan. Application forms are available in the International*

*Student Office (Room 60, Place Riel Student Centre).*

Family members accompanying students are subject to the same health care considerations.

## GRADUATE STUDENTS' ASSOCIATION (GSA)

As the official voice of graduate students, the Graduate Students' Association (GSA) represents your interests within the university, locally, provincially and nationally, by lobbying the Faculty, university administration and many levels of governments with respect to funding, representation and academic affairs. Currently the GSA holds two seats on the University Council, one seat on Senate, seven seats on Graduate Council and is represented on most of the committees and subcommittees of University Council and Graduate Council.

At the national level, the GSA is a voting member of the Canadian Graduate Council (CGC).

All Graduate students registered in the College of Graduate Studies and Research are members of the GSA. Members pay a fee upon registration which is used by the GSA to achieve its stated goals.

Members are represented through a council system which comprises an Executive (President, VP's Academic, External, Finance, Internal and a Past Executive Member), and representatives from a variety of departments known as Course Councils. Together the Executive and Course Councils form the General Council.

## GSA HEALTH AND DENTAL PLANS

Full time graduate students are entitled to coverage under an extended health benefits program administered by the GSA. This is a mandatory plan and provides for 80% reimbursement of a variety of benefits. In September of 1995, a managed Dental Care Plan was implemented. The plan is mandatory for all full-time graduate students and provides 50%-100% coverage for most dental work, with 100% coverage for one annual checkup per year. With Managed Dental Care, a network of participating dentists agree to perform all dental work in the defined plan.

Students have the option of enrolling dependents in both the Health and Dental plans, or opting out of the program if coverage is held under another extended benefits plan (Note: Provincial plans are not extended benefits plans).

The deadline to either opt out of the program or include dependents, is four weeks from the date of registration in classes in the fall, winter, or spring and summer session terms.

Further information is available from the Health Plan Administrator, GSA Office, telephone: (306)966-8471.

## CLASSIFICATION OF ADMITTED APPLICANTS

Applicants admitted to the College of Graduate Studies and Research are classified into one of several groups, depending on their preparation for graduate work and the type of graduate work which they propose to do.

### FULLY-QUALIFIED APPLICANT

Applicants who have an Honours B.A. or B.Sc. degree from this university, or a baccalaureate with Distinction from a professional college of this university, or equivalent standing from another university, and who intend to proceed with graduate work closely related to that for which they received their baccalaureate fall directly into this category. Students from this university, or any other university with equivalent standards of grading, who have a cumulative weighted average of at least 70% during the last two years or equivalent of their undergraduate study are usually included in this group. Special case admissions require a 75% average.

### CONDITIONALLY-QUALIFIED APPLICANT

Applicants qualified for admission to the College of Graduate Studies and Research who require additional undergraduate training in certain areas in order to proceed with the graduate courses and research in their selected field. Applicants in this category may take some of the graduate courses for which they have the prerequisite training in parallel with the required undergraduate courses. These applicants should not anticipate meeting the residence requirements for a graduate degree or diploma in the minimum time established by the College of Graduate Studies and Research. These applicants may also be required to pay additional fees depending on the number of courses required in order to become fully-qualified candidates for a graduate degree or diploma.

### PROBATIONARY APPLICANT

Applicants whose academic qualifications are difficult to assess, or whose qualifications are marginal for admission to the graduate program they wish to follow. Applicants in this category may be required to take a certain number of preparatory courses to improve their qualifications. In this case they will be required to pay additional fees. The student's status is reviewed after a specified amount of academic work is completed. If progress is satisfactory the department in which the student is working or the Advisory Committee may recommend to the College of Graduate Studies and Research that the student proceed in a fully-qualified category.

### POSTGRADUATE DIPLOMA PROGRAM APPLICANT

Applicants who are increasing their professional competence by completing the courses required for a postgraduate diploma. Only those applicants accepted into this category with the qualifications for admission to a degree program may apply



for admission to the degree program before completing the requirements for the postgraduate diploma. Applicants admitted in the Postgraduate Diploma program must have a cumulative weighted average of at least 65% during the last two years of undergraduate study.

## EXCHANGE GRADUATE APPLICANT

Students who are registered in a degree program at another university and who are engaged in course or research work at the University of Saskatchewan to be credited toward their degree program. Admission in this category requires the recommendation of the Dean of Graduate Studies and Research (or designate) of the institution at which the student is registered for a degree, showing that the work undertaken at the University of Saskatchewan is approved for credit at that institution. There are not normally any additional admission requirements.

The University of Regina students intending to take a course at the University of Saskatchewan should use the Saskatchewan Universities Graduate Agreement (SUGA) request form available through the Faculty of Graduate Studies and Research, The University of Regina and from the College of Graduate Studies and Research at the University of Saskatchewan.

Full-time, fully qualified graduate students at other universities in Western Canada may take courses at the University of Saskatchewan which are required for their program of studies but not available at their home university (normal maximum 6 credit units). A Western Dean's Agreement Authorization Form must be obtained and signed at the home university, then submitted to the host department at the University of Saskatchewan.

## NON-DEGREE APPLICANT

Applicants qualified to take selected graduate courses, but not working towards a postgraduate diploma or degree. Courses taken on a non-degree basis do not necessarily reduce the admission requirements or program requirements should the student decide subsequently to apply to a degree program at the University of Saskatchewan. Those who wish to take graduate courses on a non-degree basis must meet regular admission requirements (obtain form GSR105 *Permission to take a Graduate Course on a Non-degree Basis* from the College of Graduate Studies and Research Office or it can be found at [www.usask.ca/cgsr/](http://www.usask.ca/cgsr/)). Strict limits are placed by the college on the number of credit units taken by non-degree students.

## THE UNIVERSITY-INDUSTRY PARTNERSHIP PROGRAM

Faculty members and adjunct professors in many colleges at the University of Saskatchewan are engaged in research which receives funding from government or social agencies, affiliated institutes and private business or industry sources. This research often involves collaboration with researchers in government laboratories,

affiliated institutes, the private sector or other locations. As an integral part of their academic program, graduate students in Master's or Ph.D. programs are frequently involved in such research and receive funding support through it as research assistants. Graduate students involvement in this research may also take the form of employment in the course of the academic program or subsequent to it.

Affiliated with the university are many research institutes and centres. Adjacent to the campus is Innovation Place, one of Canada's most successful research parks. In addition, many links have been formed with private companies who are interested in placements of graduate students with appropriate qualifications.

The University of Saskatchewan is an active participant in the NSERC Industrial Postgraduate Program. This program, along with other forms of financial support, allows the university to offer funding to a number of graduate students who participate in the University-Industry Partnership program. Interested students should inquire at the department in which they plan to register. In many cases cooperative research projects involving the participation and support of graduate students will begin with a formal agreement signed by all concerned parties. The agreement will specify the role and responsibilities of the graduate student researcher, will indicate financial and material support to be provided to them, and will provide a statement regarding the ownership of any intellectual property used while doing the research or resulting from it. In all cases, students' academic rights will be protected by such agreements.

## INTERDISCIPLINARY PROGRAMS

The College of Graduate Studies and Research encourages re-alignment of traditional disciplines into new patterns, crossing departmental and college boundaries where this will foster the development of new areas of learning. The two formally approved interdisciplinary programs currently offering Postgraduate Diploma, Master's and Ph.D. programs are Biomedical Engineering, Environmental Engineering and Toxicology.

Many departments and colleges have graduate degree programs which are sufficiently flexible to allow students to take courses outside their home department, to undertake research under co-supervision with the support of an advisory committee drawn from two or more academic units, and to complete an interdisciplinary program while enjoying affiliation with an established academic unit. Examples of interdisciplinary areas which are already supported by a number of departments are Biotechnology (M.Agr., M.Sc., Ph.D.) and Reproductive Biology (M.Sc., Ph.D.).

A graduate program structure is in place which allows students to request admission into an interdisciplinary graduate program administered by an advisory committee representing the various disciplines involved and by the College of Graduate

Studies and Research Interdisciplinary Committee. Not all interdisciplinary interests can be supported. However, students interested in pursuing a graduate program where no established degree program exists are invited to discuss their study and research interests with faculty members and appropriate departments, and to seek the advice of the Chair of the College of Graduate Studies and Research Interdisciplinary Committee.

## POSTGRADUATE DIPLOMA REQUIREMENTS

Programs leading to a Postgraduate Diploma are available in a number of departments, and colleges without departments. They are designed particularly for people who have been away from university for some time and wish to broaden their knowledge at the graduate level on subjects peculiar to their professional interests. Full-time attendance for a regular academic session (September to April inclusive), or its equivalent, may be required by the department. Research is not a basic part of such programs, although candidates in some fields may be given the opportunity to become acquainted with research techniques.

The general regulations applicable to Postgraduate Diploma Programs are:

- For admission to a Postgraduate Diploma program, students must have a Bachelor's degree from a professional college or a Bachelor of Arts degree with specialization in some subject or discipline comparable to that required for a B.A. (Honours) degree from this university, and a cumulative weighted average of at least 65% in each of the final two years of their undergraduate program. Some departments and professional colleges may require professional experience and credit for particular undergraduate courses related to the proposed program.

- A Postgraduate Diploma program consists of 30 credit units, at least 18 of which are normally required of a Master's candidate in the same field of specialization.

- Students and departments are jointly responsible for insuring that the department sends the appropriate documents to the College of Graduate Studies and Research Office when program requirements have been completed.

- Upon submission of the GSR 300.4 form, the Diploma is awarded to a student who passes all the courses of an approved program with a grade of at least 60% in each course and an average of at least 65% for all courses.

- A person with a GPA of at least 70% who has been admitted fully qualified to a Diploma program and attained a grade of 70% or higher in each of the courses acceptable for a Master's degree may be transferred at any time (upon departmental recommendation and CGSR approval) to a Master's program and obtain the degree by completing the remaining requirements, e.g., thesis, project or additional courses, provided that the time limits for a Master's

program are respected. Additional fees will apply.

- A person who has received a Postgraduate Diploma may be admitted subsequently to a Master's program. Relevant course work completed to fulfill the Diploma program requirements may be taken into account in determining the requirements for the Master's program. Regular Master's admission and minimum program requirements are applicable. Students who did not meet admission requirements for a Master's program at the time of admission to the Diploma program must complete at least 6 credit units at the graduate level, in addition to the project or thesis, as part of the Master's program. There may be additional course requirements, depending upon the pertinence, level and currency of the Diploma course work. The amount of course work required will be determined on an individual basis through recommendation of the department and approval of the College of Graduate Studies and Research.

- All requirements for a Postgraduate Diploma must be completed within a 5-year time period. This time is measured from the date of registration in the first course work which applies to the Postgraduate Diploma program.

## MASTER'S DEGREE REQUIREMENTS

### MASTER'S DEGREE WITH THESIS

A student enrolled for graduate work in a department of the Colleges of Agriculture, Engineering, Medicine and Veterinary Medicine becomes a candidate for an M.Sc. degree in the discipline designated by the name of the department. A student enrolled in a department of the College of Arts and Science usually becomes a candidate for an M.A. degree in the discipline designated by the name of the department, if the baccalaureate for admission is a B.A. degree; an M.Sc. degree, if a B.Sc. degree. Special conditions may apply for admission to the Master's program and to the course requirements in Business Administration, Continuing Education, Education and Law. These are mentioned in the sections describing the courses which are offered.

An M.A. or M.Sc. program for a fully-qualified candidate consists of at least 15 credit units for courses which are graduate in character for the field in which the student is working, a thesis on a subject permitting the student to make some contribution to knowledge, and seminars, colloquia and related activities as the student's department may require. Other Master's degrees with thesis which are available are: M.F.A., M.B.A., M.C.Ed., M.Ed., LL.M., M.Mus., M.N., and M.P.Acc. Prospective students interested in these degrees should consult the relevant section in the *Calendar* for course and program requirements. The thesis work for a Master's degree seldom takes less than one-half year, and is usually carried out in parallel with the course work.

After an applicant has been admitted to the College of Graduate Studies and Research,

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the principal department submits, on the student's behalf, a recommended program of study and research (M.B.A. excluded). This should be done as soon as possible on forms available from the Dean, and not later than twelve months, after the time of first registration.

If an applicant has been admitted as a candidate for a Master's degree, subject to the satisfactory completion of selected preparatory courses either prior to or in parallel with the required graduate courses, the preparatory courses are designated as such on the program of study. In such cases, the student should not anticipate completion of the requirements for award of the degree in less than two years of residence during regular sessions, or the equivalent. A qualifying examination on the field of specialization may be required by a department either as a means of evaluating the student's ability to proceed with work for the degree or for the award of the degree.

Research for the thesis and its preparation is usually supervised by a member of the department to which the student is attached. An Advisory Committee is appointed, consisting of at least three members, including the Department Head or designate who acts as chairperson, the research supervisor and other members as deemed appropriate. If the student's work for the degree involves other departments, the Advisory Committee includes the student's research supervisor and representatives of the departments concerned. The Committee is responsible for periodic reviews of the candidate's progress toward the degree and must meet at least annually for this purpose. The role of the Advisory Committee may be filled by a graduate committee of the department.

## MASTER'S DEGREE WITHOUT THESIS

Non-thesis programs leading to the M.Agr., M.B.A., M.C.Ed., M.Ed., M.Eng., M.Math., M.Mus., M.N., M.P.Acc., M.Vet.Sc., and to the M.A. degrees in Economics and Sociology are also available. These degrees are intended to serve the needs of students who wish to obtain advanced knowledge in a specialized field, but who do not require traditional research training. All non-thesis degree programs include as a requirement the project course 992. In most programs the project course 992 is in addition to the usual 30 credit units required. Other special conditions are mentioned within the course descriptions section.

After an applicant has been admitted to the College of Graduate Studies and Research, the principal department submits on the student's behalf a recommended program of study and research. This should be done as soon as possible on forms available from the Dean, and not later than twelve months, after the time of first registration.

## SPECIAL CASE PROGRAMS

Departments which do not have an established Master's degree program may be allowed, with the permission of the Dean and the Academic Committee of the College of Graduate Studies and Research, to accept a student for a Special Case

Master's program of studies. Rules for such programs are available from the Dean of Graduate Studies and Research and the respective departments.

## RESIDENCE

In general the residence requirement can be met by full-time residence at this university for one regular academic session, starting in September and ending in April, or by the equivalent in Intersession and Summer Session. For full residence within this or equivalent periods, candidates must carry at least the minimum number of graduate credit units for their specific program of study, in addition to registration in 990 (where required) and in 994 (Master's with thesis). A student who is notably deficient in general training, or in specific preparation required by each department as prerequisite to the graduate work for which the degree is to be awarded, should expect a longer period of residence to obtain the degree.

Students registered in a "Special Case" Master's program must complete a minimum of two academic sessions as full-time students in the department or unit to which the program is attached.

## TIME LIMIT

Candidates for Master's degrees are expected to complete their work with reasonable continuity over a period not exceeding five years. This time is measured from the date of first registration in a course credited toward the program.

## TRANSFER CREDITS

Graduate work of high quality done in a recognized graduate school elsewhere and coming within the five-year time limit may be accepted. Such credits will be transferred only after the student has established a satisfactory record in residence here for at least one-half of a regular academic session, and then only if the department concerned recommends to the Dean of Graduate Studies and Research for approval of the transfer of such credits. Normally a student should expect to complete at least 60% of the program requirements at this university. Work already applied toward another degree cannot be accepted. Transferred credit will not reduce the residence requirement at this university.

## ACADEMIC STANDARDS

Students taking courses required to remove deficiencies in their general training or for preparation prerequisite to the chosen field of graduate work must obtain a cumulative weighted average of at least 70% in these courses. A minimum of 70% is required in each undergraduate course. They must obtain 60% in each graduate course required specifically for the degree and a cumulative weighted average of 70% for all their courses in this category. Under exceptional circumstances, on recommendation of the department, and with the approval of the Dean of Graduate Studies and Research, a student may be permitted to write a supplemental examination in a course for which a grade of less than 60% was obtained. With permission of the Dean, students may repeat the course to raise their standing, or

substitute an additional course recommended by the department.

If, in the opinion of the Advisory Committee and the department concerned, a student is not making reasonable progress with any aspect of the program, a recommendation may be made to the Dean that the student be required to discontinue as a candidate for the degree. The Dean will take prompt and appropriate action.

## THESIS AND PROJECT REQUIREMENTS

A thesis or project presented in partial fulfillment of the requirements for the degree must:

- Deal with a specific topic related to the major field.
- Demonstrate ability on the part of the candidate to do independent study and investigation.
- Be written in good scholarly style and conform to the requirements of a style manual approved by the department.
- Comply in mechanical features with specifications as described in the *Guide For the Preparation of a Thesis*.

It is expected that the student will follow the department regulations and the advice of the Supervisor and the Advisory Committee in developing the thesis or project proposal and in establishing whether the thesis or project is ready for examination. In exceptional circumstances the student may request that the Dean of Graduate Studies and Research arrange for an examination without prior departmental approval. The rules for such an examination are determined by the Dean in consultation with the department.

The adequacy of the project is decided by an examining committee consisting of the Supervisor, other members of the Advisory Committee and other persons as appropriate. Departments and colleges are required to inform students in a timely fashion about the criteria to be used and the procedures to be followed in the examination of master's project work.

Every thesis must go to oral defence. The adequacy of the thesis is decided by an examining committee. The committee will consist of the Department Head or designate, who chairs the examination, the supervisor, at least one member who served on the Advisory Committee, and the external examiner from another department of the university, who has not been a member of the student's Advisory Committee. The department may recommend the appointment of additional examiners. The examining committee shall be appointed from the College Faculty by the department or departments in consultation with the Dean. The thesis supervisor may not serve as the chair of the thesis oral examination. The character of the oral examination is decided upon by the Committee, but in general the examination is limited to work done by the candidate for the thesis and to knowledge of matters directly related to it. At the conclusion of the examination, the Committee decides whether the thesis work of the candidate and the subsequent defence of it meet the requirements for the degree. The Committee's

decision is reported to the Dean on forms available from the College of Graduate Studies and Research Office.

It is the responsibility of the student who may have any disability that could interfere with his/her conduct or ability to respond to questioning at an oral defence, to reveal the extenuating circumstances in sufficient time prior to the defence to allow the Examining Committee and the College of Graduate Studies and Research to take measures to mitigate the situation at the oral exam. The student must inform his/her Supervisor or Graduate Chair, who in turn must inform the College of Graduate Studies and Research Office of any potential problems.

*The External Examiner* represents the Dean and shall provide the Dean with a written report following the conclusion of the examination. A form for this purpose is available from the College of Graduate Studies and Research Office. The External Examiner shall be appointed by the Dean prior to the thesis examination and shall not have been associated with the preparation of the thesis in any way. The Dean or designate verifies that all program requirements are met before approval of the External Examiner and permission to proceed to defence. If those voting in favour of the majority opinion do not include the External Examiner, the Dean shall investigate the circumstances and decide if another examination should be held.

The period between the submission of the examination copies of a Master's thesis and the date of the examination is left to the discretion of the student's department. Departments normally require a period of three weeks. Students are expected to make required revisions within the time period determined by the department. Final dates for oral defences, submission of documentation and bound copies of theses are found earlier in this section. No exceptions to these dates will be made.

## COPIES OF THE THESIS

Three bound copies of the thesis in final form must be supplied by the candidate to the department to which the candidate is attached. A copy must reach the College of Graduate Studies and Research Office by the appropriate deadline established for Spring or Fall Convocation. The remaining copies are placed in the department files and given to the candidate's research supervisor for reference purposes. The first copy is catalogued and placed in the University Library, if the mechanical features meet with the approval of the Dean and the Librarian. Otherwise, it is returned to the department which shall require the candidate to make recommended changes. *The Guide For the Preparation of a Thesis* is available at the University Bookstore and at [www.usask.ca/cgsr/](http://www.usask.ca/cgsr/)

## COPYRIGHT AND SUBSEQUENT USE OF THESE AND PROJECTS

The author of a thesis or project claims copyright on the title page. As a condition for the award of a degree, the student is required to sign a form giving permission to the University Library to make the thesis

available for inspection and to the supervisor of the research and to the department in which the research was done to copy and to circulate the thesis for scholarly purposes only, and to make use of material and ideas included in the thesis in the preparation of papers for publication. Where circumstances warrant, theses may be withheld from circulation for up to 12 months.

## RECOMMENDATION FOR AWARD OF DEGREE

The department or departments concerned must file a Recommendation for Award of the Degree with the Dean on forms for this purpose, available at the College of Graduate Studies and Research Office. It must show how the candidate has met the residence requirements, list the courses to be credited specifically for the degree (including transferred credits) and the exact title of the thesis. The title shown on the thesis cover must be identical to the title which appears on the recommendation form for the award of the degree. The recommendation for the award of the degree must be received in the College of Graduate Studies and Research Office on or before the date, available from the office or under the section "Graduate Academic Schedule for 1999-2000", established in relation to Convocation. If the recommendation is approved by the College of Graduate Studies and Research, the student's name will be forwarded to the Office of the Registrar for inclusion in the Convocation Program.

## DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

A student who receives this degree must have demonstrated proficiency in some broad subject of learning and ability to initiate and evaluate work in this field. Furthermore, the student must have shown the ability to work independently in the chosen field and must have made an original contribution of significance to the advancement of knowledge. The technical requirements stated or implied below are minimum requirements for all candidates for the degree.

### ADMISSION

Only an applicant who is fully qualified for admission to postgraduate work at this university and for starting on some particular field of study and research is admitted to a Ph.D. program. This normally means that the applicant will already have completed a recognized Master's program in a field which is relevant to the proposed Ph.D. program of study.

An applicant who is deficient in background training or in courses prerequisite to scholarly work in the chosen field of study and research or who holds a Master's degree whose academic level is in doubt cannot be admitted as a fully qualified candidate for a Ph.D. degree. Such an applicant may be admitted to the College of Graduate Studies and Research for the purpose of removing these deficiencies (see Classification of Admitted Students), but the time spent in doing so can seldom be counted toward the residence

requirement for the Ph.D. degree. Applicants holding a Master's degree, the equivalence of which is difficult to assess, will be permitted at the time of admission to register only as probationary students in a Ph.D. program or as a Master's student. After no less than one year and on the recommendation of the department, a student may be considered by the College of Graduate Studies and Research Office for transfer to fully-qualified status in a Ph.D. program if the qualifying examination has been successfully completed.

After an applicant has been admitted to the college, the principal department submits on the applicant's behalf a recommended program of study and research for approval by the college. This should be done as soon as possible and not later than twelve months after the time of admission. The form to be submitted by the department or college on the applicant's behalf lists the courses required to meet the academic requirements for the degree, the particular field of research, the student's research supervisor and members of the Advisory Committee (see below, Supervision), and any other requirements peculiar to the department or college in which the student will be working. At least 6 credit units at the 800 level are required for a student with a recognized Master's degree in the same field of specialization.

### SUPERVISION

The selection of a supervisor should be completed by mutual agreement among student, supervisor, Head of the Department, or the Dean in colleges without departments, and the Dean of Graduate Studies and Research. This selection should take place as quickly as possible, never later than the second annual registration. The supervisor must be a faculty member of the College of Graduate Studies and Research and should be familiar with the rules and procedures of the department, the College of Graduate Studies and Research and those of the university. Both student and supervisor are responsible for ensuring that all College of Graduate Studies and Research and departmental regulations and requirements are observed and met.

The work of each student is coordinated by an Advisory Committee. This Committee consists of the Head of the Department or designate who acts as Chair, or the Dean in colleges without departments, who acts as Chair, the student's supervisor and three or four additional members from the principal department and related departments selected because of their knowledge of the proposed research field. One member must be from a department other than the principal one. If the student's work for the degree is cross-disciplinary, the Advisory Committee should have representatives from each of the departments involved. In consultation with the Dean, persons from other universities or from non-University laboratories and groups may be invited to serve on the Committee because of their specialized knowledge of the research field. Such persons must be Adjunct Professors or have received formal approval from the Dean. The Dean of Graduate Studies and

Research is an ex officio member of the Committee.

The Advisory Committee serves to advise the student and to periodically review progress being made in preparing the thesis proposal, developing appropriate methodology, carrying out research and writing the thesis. To facilitate these reviews, the student will submit a written progress report on the research project at least once every twelve months through the research supervisor. The supervisor is responsible for distributing a copy of this report to each member of the Advisory Committee. The Committee may require the student to give an oral progress report to explain further and describe the research in progress. The Committee may recommend changes and additions to the student's program and changes to the research project. The Chair of the Advisory Committee will report to the Dean of Graduate Studies and Research at the end of each academic year on the progress of the student. A report indicating unsatisfactory progress will result in further action being taken by the Dean.

### SPECIAL CASE PROGRAMS

Departments who do not have an established Ph.D. degree program may be allowed, with the permission of the Dean of Graduate Studies and Research and the Ph.D. Committee of the college, to accept a student for a Special Case Ph.D. program of studies. Rules for such programs are available from the College of Graduate Studies and Research Office and the respective departments.

### RESIDENCE

To meet the minimum residence requirements, a candidate for the Ph.D. who holds a recognized Master's degree in a suitable field must be registered as a full-time student for two regular academic sessions, or the equivalent, while actively engaged in academic work as prescribed by the department. Such work will comprise courses, seminars and research. The program of study for which credit for residence is to be earned is recommended by each student's Advisory Committee and departmental Graduate Chair, and approved by the College of Graduate Studies and Research.

Students who transfer from a Master's program to a Ph.D. program without completing the Master's program may be allowed to count course work completed during the period of registration in the Master's program if the courses taken are deemed relevant and at a suitable level for the Ph.D. program. The minimum residence requirements for such transfer students is three regular academic sessions beyond the attainment of the Bachelor's degree. Students must be registered as full-time students, or the equivalent, during this time. Students transferring from a Master's program are required to complete a minimum of two regular academic sessions in residence as Ph.D. candidates, regardless of the time in residence completed at the Master's level.

All interpretation regarding residence credit for a student will be made by the Dean of

Graduate Studies and Research (or designate) on the advice of the Chair of the student's Advisory Committee. The place of residence during the Ph.D. program is normally the University of Saskatchewan. Written permission from the Dean is required if students plan to study or do research elsewhere during the residence period. Following the residence period students may continue their research at the place of their choice, in consultation with their supervisor and Advisory Committee. However, at any time during the program, students may be required to spend their time at the University of Saskatchewan.

### TIME LIMIT

A candidate for the Ph.D. degree is expected to complete the work with reasonable continuity over a period not exceeding six years. This time is measured from the date of first registration in the first work credited toward the program.

### TRANSFER CREDITS

Graduate work of high quality done in a recognized graduate school elsewhere may be accepted for credit at this university. Except in special circumstances, transferred credits will not reduce the minimum residence requirement, but may reduce the amount of course work to be done. In all cases at least six credit units of course work at the graduate level must be done at the University of Saskatchewan. Credits are transferred only after the student has established a satisfactory record in residence here for at least one year. Students required by their Advisory Committee to take courses at another university will receive both course credit and residence credit upon satisfactory completion of such courses.

### ACADEMIC STANDARDS

Students are expected to complete with distinction all work in the courses included in their program of studies. Any grade below 70% is unsatisfactory. The Advisory Committee will review such grades and make a recommendation to the College of Graduate Studies and Research concerning the action to be taken. The Advisory Committee will also recommend appropriate action to be taken regarding any student whose progress in the research project or any other component of the Ph.D. program is deemed unsatisfactory. Academic standards applied will be those prevailing in the national and international academic community. Upon recommendation by the Advisory Committee and with approval from the Dean of Graduate Studies and Research, a student may be required to withdraw at any time from the program for failure to achieve and maintain satisfactory progress.

### LANGUAGES

The Advisory Committee may require the candidate to demonstrate ability to read publications, related to the candidate's special field of study, in one or more languages other than English.

Successful completion of a course in a language (other than English) recommended by an Advisory Committee usually meets the minimum requirements for a reading knowledge of a foreign language. This language requirement may be met by a course, or courses, taken at

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another university, or by knowledge of the language acquired in other ways. In such cases, supporting evidence must be submitted to the appropriate language department at this university. The language department may set a special examination. The decision of the department is final in such cases.

## PRELIMINARY OR QUALIFYING EXAMINATION

Students must satisfy the department by written or oral examination, or by both, that they have the potential to obtain sufficient knowledge of their chosen general field of study to proceed toward candidacy for the Ph.D. degree. Responsibility for this examination may be assigned to the Advisory Committee in cases where several departments are involved. Normally this examination is administered within the first year, preferably within the first four months, of the student's program. The results of this examination are likely to have a significant impact on the program of study developed for the student. The standard which a student must obtain to pass the qualifying examination is at the discretion of the department or the Advisory Committee, as the case may be. A student failing an examination for the first time is permitted a second qualifying examination. A second failure automatically disqualifies the student from further work for the Ph.D. degree. This failure may be appealed to the Ph.D. Committee on substantive or procedural grounds. The results of all qualifying examinations must be reported to the College of Graduate Studies and Research Office.

The thesis examination for the award of Master's degree at this or other recognized universities, may, at the discretion of the department and the College of Graduate Studies and Research, be accepted in lieu of the Ph.D. qualifying examination.

The Ph.D. qualifying examination must already have been passed at a suitable level before consideration will be given to recommendations for transfer from a Master's to a Ph.D. program.

## COMPREHENSIVE EXAMINATION AND CANDIDACY

The comprehensive examination covers a broad aspect of the appropriate discipline and may be in written and/or oral form. This examination is usually on topics cognate to the candidate's field of research and is used as a means of judging whether the individual has a mature and substantive grasp of the discipline as a whole. A comprehensive knowledge of the subject will not only help to validate the Ph.D. student as an expert in the general field of choice but will also complement research activity in the specific area under investigation. Normally this examination is scheduled after the student has completed all requirements except the doctoral thesis.

Only upon successful completion of the Comprehensive examination at an appropriate time during the program is a student permitted to continue scholarly activity towards the Ph.D. degree. The Comprehensive may be repeated once with the permission of the Dean of Graduate

Studies and Research. The results of all Comprehensive examinations must be reported to the College of Graduate Studies and Research Office. A second failure will result in the student being required to withdraw from the program. This failure may be appealed to the Ph.D. Committee on substantive or procedural grounds.

## THESIS

The thesis, based upon original investigation, must demonstrate mature scholarship and critical judgement on the part of the candidate, as well as familiarity with tools and methods of research in the candidate's special field. To be acceptable, it must be a worthwhile contribution to knowledge, and warrant publication in whole or in part. It must comply with specifications described in the *Guide For the Preparation of a Thesis*.

Thesis preparation involves a long-term commitment through the stages of preparing a research proposal, completing a literature review, developing methodology, carrying out research and writing the results. Throughout this process the student will maintain contact with the supervisor, as well as the Advisory Committee. When, in the opinion of the student and the supervisor, the work is virtually complete and ready for defence, the student will submit a draft of the thesis, substantially in its final form, to the supervisor. The supervisor will review the thesis, making any appropriate suggestions to the student and will then submit it to the Advisory Committee. It is the student's responsibility to make available the number of copies needed by the Advisory Committee. When the Advisory Committee has agreed that the manuscript is ready for examination the candidate will receive permission to make the final copies required for the Examining Committee. The period between the submission of the examination copies of a Ph.D. thesis and the date of the examination should be at least four weeks.

The Examining Committee consists of at least six persons, as follows: the External Examiner, the supervisor, three members of the Advisory Committee (at least one of whom is from another academic unit), and the Department Head, or designate, who will chair that part of the defence devoted to questioning the candidate.

Permanent members of the candidate's department and of related departments may be invited to attend the examination. The Dean of Graduate Studies and Research or designate will chair the Examining Committee. A recommendation, which shall provide the Dean with a minimum of three suitable persons from whom the Dean may select an External Examiner, is made by the Department Head. The Dean invites the External Examiner. All program requirements are verified by the Dean or designate before the invitation is extended to the External Examiner. The External Examiner shall not have been associated with the preparation of the thesis in any way and shall have no conflict of interest regarding the student or the supervisor on any aspect of the research itself.

At least five unbound copies of the thesis in its final form must be submitted. One copy is sent by the College of Graduate Studies and Research Office to the External Examiner, one copy is provided to the Chair of the Examining Committee by the College of Graduate Studies and Research Office and the other copies are circulated by the Head of the Department to the other members of the Examining Committee and such other members of the department as time permits.

The Ph.D. thesis defence, which is an oral examination, is usually scheduled three to four weeks after the thesis has been submitted to the External Examiner. A candidate who anticipates formal award of the degree at a particular Convocation must ensure that two copies of the thesis, suitable for examination, are taken to the College of Graduate Studies and Research Office in sufficient time to permit the examination process to be completed prior to the deadlines established by the College of Graduate Studies and Research.

A Dissertation Summary is distributed to the Examining Committee at the time of the examination. It is the responsibility of the candidate in consultation with the research supervisor to prepare the Dissertation Summary and related material and to submit it to the Dean seven working days prior to the oral. Students are advised to consult with the College of Graduate Studies and Research Office on this matter at least one month prior to the exam.

It is the responsibility of the student who may have any disability that could interfere with his/her conduct or ability to respond to questioning at an oral defence, to reveal the extenuating circumstances in sufficient time prior to the defence to allow the Examining Committee and the College of Graduate Studies and Research to take measures to mitigate the situation at the oral exam. The student must inform his/her Supervisor or Graduate Chair, who in turn must inform the College of Graduate Studies and Research of any potential problem.

A brief evaluation of the Ph.D. thesis must be submitted by the External Examiner to the Dean of Graduate Studies and Research indicating that the thesis examination should take place as scheduled. This evaluation must be in the hands of the Dean or designate before the examination takes place. A form stating the Committee's decision and signed by members of the Committee, is given to the Dean, or designate, who is present at the examination.

Where the Committee's decision is not unanimous, the majority view will prevail provided that the External Examiner shares the majority view. Where the External Examiner does not share the majority view, the Dean will review the situation and establish appropriate procedures to resolve the matter. Unless the examination is adjourned for such a reason, the decision of the Examining Committee is final.

It is normal for the Examining Committee to require at the time of the examination that revisions be made to the thesis before final submission. The Examining Committee will establish procedures and name the person(s) responsible for ensuring that the

revisions are carried out completely. Candidates are expected to make the revisions promptly. Failure to do so could jeopardize successful completion of the degree.

Following the defence the External Examiner will submit a full written report. In most cases this report may be made available to candidates and departments, upon request.

The candidate must supply the College of Graduate Studies and Research Office with one bound and one unbound copy of the thesis. In addition the candidate must also supply three bound copies to be distributed as follows: one to the candidate; one for the research supervisor and one for the departmental files. The College of Graduate Studies and Research Office will arrange for the microfilming of the thesis by the National Library of Canada, for the publication of the abstract in the journal *Dissertation Abstracts*, and for the storage of the original copy of the thesis. Students are responsible to reimburse the college for microfilming costs.

The regulations concerning copyright and subsequent use of a thesis are the same as for a Master's thesis (see applicable section on Requirements for Master's Degrees).

## PUBLICATION

The university does not require the publication of doctoral theses other than in microfilm by the National Library of Canada and University Microfilms International. Each thesis is expected to include material acceptable for publication in scholarly journals of the field in which the candidate has done the research. Each candidate as a condition for award of the degree must sign two forms, one giving permission to circulate microfilm copies of the thesis; the other, permission to the University Library to make the thesis available for inspection and to the research supervisor and department to distribute copies of the thesis and to use materials and ideas therein in scholarly publications, due recognition being given in all cases to the author of the thesis and to the University of Saskatchewan.

## RECOMMENDATIONS FOR AWARD OF DEGREES

Prior to the thesis defence, the Advisory Committee is responsible for establishing that the candidate has met all other requirements for the award of the degree, as specified in department and College of Graduate Studies and Research regulations and indicated on the student's approved program of studies: residence, Qualifying examination, courses credited for the degree (including transfer credits), Comprehensive examination and any other requirements. The Advisory Committee is responsible for determining when the thesis is ready to go to defence. The written statement to this effect must contain the exact title of the thesis, as it appears on the thesis.

All necessary paperwork provided at the defence must be received in the College of Graduate Studies and Research Office on or before the date, available from the college office, or under the section "Graduate

Academic Schedule for 1999-2000", established in relation to Convocation.

## TIME LIMIT

Special permission may be granted for a four-month extension in a Postgraduate Diploma, Master's or Ph.D. program. It is the student's responsibility to make a written application to the department for a time extension stating the reason for extension and setting out a program with a timeline for completion of the degree requirements. The department will forward the student's letter with a recommendation to the College of Graduate Studies and Research Office. Students are advised in writing by the Dean of Graduate Studies and Research of acceptance or rejection of this recommendation. Only in most unusual circumstances will a further four-month extension be granted.

## DOCTORATE DEGREE FOR SCHOLARLY WORK

Members of Convocation of the University of Saskatchewan or faculty members may apply or may be nominated for the award of an earned D.Sc. or D.Litt. based on the high standard of their published works and related international stature in their particular fields of research. Persons wishing to apply or to nominate an individual for such an award should write to the Dean of Graduate Studies and Research for a copy of the regulations concerning the submission of an application and the subsequent evaluation of the applicant's scholarly work.

## REGISTRATION AND FEES

### REGISTRATION

Each student who wishes to undertake work in the College of Graduate Studies and Research must submit to the college a registration form approved by the student's Advisor or Department Head which lists the class(es) to be taken in the session. This registration form must be received in the College of Graduate Studies and Research Office prior to the first day of regular classes for the session. If it is received after this date, a late registration fee will be assessed, to a maximum of \$65.00.

Registrations and class changes will not be accepted after the deadline for class changes (See General Information section of the *Calendar*).

*Students are required to maintain continuous registration during their programs. A student failing to register to maintain regular status will be considered to have discontinued. A student who has discontinued and wishes at some future time to resume regular status as an active candidate for a degree must make formal application through the department or college. Permission to do so is given only on recommendation by the department or college and with the approval of the College of Graduate Studies and Research. The student's program will be reassessed in terms of the regulations in force at the time of re-application. Fees re-establishing continuous*

registration will be assessed on the basis of the current fee structure.

All students in degree programs with thesis, whether full-time or part-time, must maintain continuous registration by registering in their thesis during each regular academic session (September to April), beginning with the first time they register in the program. They must maintain continuous registration in the thesis each year until graduation. Students in thesis programs who remain at the University of Saskatchewan during the summer months (May to August) in order to work on or defend their thesis research project or make any use of university facilities must register for Spring and Summer Session (registration deadlines are enforced). Students must be registered in the period immediately preceding the Convocation in which the degree will be awarded (Spring and Summer Session in the case of Fall Convocation). See tuition waiver policy for exceptions to this requirement.

Students in diploma or degree without thesis programs must maintain continuous registration by registering at least once in each 12-month period. Students wishing to be classified as full-time students must meet course and project requirements as defined by the College of Graduate Studies and Research. Information on these requirements can be obtained from the College of Graduate Studies and Research Office. Students in a Master's program without thesis are required to register in the project course only during the session that they are actively working on it. Students normally complete their project course during one session. If they do not, they will be required to register in the project course during the next session and pay the appropriate fee until the project is completed. The project course will be counted as its credit value for the purpose of assessing fees and determining full or part-time status.

All students in graduate degree programs in departments or colleges listing a 990 course must register in this course until requirements have been completed according to the departmental regulations.

*Note:* Graduate courses may be taken on an audit basis where space allows and instructors grant permission.

### FULL-TIME/PART-TIME STATUS

**Full-time students** are those who declare themselves to be working full-time on their graduate program and are registered in 994 or 996 or 9 credit units of course work in the term. In cases where there is doubt about full-time status, students may choose to affirm their status using the *Blue Card* (available at the College of Graduate Studies and Research), with the written support of their Supervisor or Graduate Chair, that they are regularly working at least 40 hours per week on their graduate program. It is the shared responsibility of the student and the department or college to inform the Graduate College when these conditions change. In some cases, with department support, it may be possible to classify students registered in 6-9 credits in the

term as full-time students. Such cases will be assessed on an individual basis.

**Part-time students** are those who do not declare themselves to be full-time and/or who are registered in fewer than 9 credit units of course work in the term. Part-time students are most frequently in one of the following categories:

- 1) Students who have completed full-time residence requirements for their program and have accepted employment;
- 2) Students in a Master's without thesis or Postgraduate Diploma or MBA programs.

### MAINTENANCE OF STATUS

Students who are not working on their degree programs, not using any university facilities or services and not consulting their advisors must register for maintenance of status by paying the prescribed fee and student fees. Full-time students are those who declare themselves to be working full-time (minimum of 40 hrs/week) on their graduate program, and are registered in their thesis or 9 credit units of course work in the term.

### STUDENT RESPONSIBILITY

Students are responsible for the completeness and accuracy of their registration. Students must ensure that there is agreement between the program they are following and that entered on their registration form. Students may not attend classes for which they are not registered and may not drop or add courses without proper authorization and in accordance with published deadlines.

### CHANGES IN REGISTRATION

Students who wish to drop or add a class must have departmental authorization to do so. A class change is not valid until a class change form signed by the department has been received in the College of Graduate Studies and Research Office. The effective date will be the date this form is received in the College of Graduate Studies and Research Office. Regular university deadlines and cancellation fees will apply (see the General Information section of the *Calendar*). A student who discontinues attendance in a class without official withdrawal will be marked as having failed (ABF) the course.

### VOLUNTARY TRANSFER OF PROGRAMS

Students who choose to transfer from a Master's program with thesis to one without, from a Master's program without thesis to one with, from a Postgraduate Diploma program to a Master's program, or from a Master's program to a Postgraduate Diploma program will be charged a transfer fee.

*Note:* There will be no transfer fee charged for students transferring from a Ph.D. to a Master's program or from a Master's to a Ph.D. program.

### ADDRESS CHANGES

Students are responsible for prompt notification to the Office of the Registrar and the College of Graduate Studies and Research any changes in address, telephone number, or name. An

address/name change form, for this purpose, may be obtained from the Office of the Registrar or the College of Graduate Studies and Research Office. Only one address will be recorded as the main contact address to which university mail will be sent. The university is not responsible for delayed or misdirected mailings as a result of either the student's failure to report a change of address or the actions of an external delivery agent.

### LATE REGISTRATION

Students are required to complete their registration by the date specified in the Graduate Academic Schedule for 2000-2001. Students seeking registration after this date must receive special permission of the Department and the College of Graduate Studies and Research before they may be registered. This will be granted only in extraordinary circumstances. Late registration fees will be charged after September 7, 2000. No registration or additions/changes to classes starting in Term 1 may take place after September 19, 2000, except in extraordinary circumstances. Students who enter late may be required to register for less than a regular course load.

Students accepted for the second term only should note that late registration fees will be charged after January 4, 2001. No registration may take place after January 16, 2001, except in extraordinary circumstances.

The late fee for full time students in the Regular Session will be \$20 for the first day and \$5 each day thereafter to a maximum of \$35 for the first week, then \$10 for each additional week or part thereof to a maximum of \$65. Part-time students will be charged half these fees.

### GRADUATION

Application for graduation is required of all students who expect the award of a degree at either Spring or Fall Convocation. An Application to Graduate can be obtained at either the Office of the Registrar or the College of Graduate Studies and Research Office. Deadlines for submission, etc., are indicated under "Significant Dates" at the beginning of this section.

### TUITION AND FEES

A new tuition model has been approved by the Board of Governors and the College is working on the implementation of this policy. Updates can be obtained at the Graduate College or by visiting our website at: [www.usask.ca/cgsr/](http://www.usask.ca/cgsr/)

Tuition fees are assessed at the time of registration at the College of Graduate Studies and Research. They are subject to validation for accuracy and correctness at any time by the Office of the Registrar.

### 1999-2000 TUITION AND FEE SCHEDULE

Graduate tuition and compulsory student fees are described below. There are

# GRADUATE STUDIES & RESEARCH

different schedules for Canadian and International students.

At the time of printing the *Calendar*, the 2000-2001 Tuition and Fee Schedule was not available.

Fees are those on record at time of printing and are subject to review and revision at any time by the Board of Governors of the University.

## Central Registry of Fees

The Central Registry of Fees (CRF) is a list of fees that can be charged to students. Fees are charged in addition to tuition, and must be approved by the Board of Governors. The Central Registry of Fees is available on the web at: [www.usask.ca/registrar/current\\_fees/](http://www.usask.ca/registrar/current_fees/)

## TUITION

### Postgraduate Diploma Programs, Master's, and Master of Business Administration (non-thesis)

- each 3 credit unit course numbered 700 or above .....\$389.10
- each 6 credit unit course numbered 700 or above.....778.20
- maximum (Regular Session).....3891.00
- maintenance of status .....778.20
- transfer fee .....389.10
- first registration in project
  - 3 credit unit course.....389.10
  - 6 credit unit course.....778.20
- subsequent registration in project
  - 3 credit unit course.....194.55
  - 6 credit unit course.....389.10

### Master of Professional Accounting

- cost for the program ..... \$8000.00

### Master's Thesis Programs and Doctor of Philosophy

A new tuition fee structure for thesis programs was recently approved by the Board of Governors of the University. Beginning in 2000-2001, graduate students in thesis programs will be assessed a Fixed Graduate Program fee, payable in equal installments in the first three terms of registration (Master's level), or the first six terms of registration (Ph.D. level). Please contact the College for further details.\*

\*Students registered in a Master's program who transfer to a Ph.D program without receiving the Master's degree must pay, in addition, the cost of first registration in Master's thesis and of all course work done while a Master's student.

## STUDENT FEES

### Full-time Students

Student Union.....	6.04
Athletic and Recreation .....	53.94
Student Services Fee .....	30.00
Graduate Students' Association (G.S.A.)	
Activity Fee .....	39.95
Canadian Graduate Council .....	2.00
G.S.A. Health Insurance* .....	104.58
G.S.A. Dental Insurance	
(yearly premium) .....	100.50
<b>Total = .....</b>	<b>\$336.41</b>

\*\$69.72 for students starting their program in January; students starting in May will not be assessed or covered by the Health Insurance until they register for the Regular Session.

### Part-time Students

Athletic and Recreation .....	26.97
Student Services Fee .....	30.00
Graduate Students' Association (G.S.A.)	
Activity Fee .....	22.55

Canadian Graduate Council .....	2.00
<b>Total = .....</b>	<b>\$81.52</b>

### Maintenance of Status Students

Graduate Students' Association (G.S.A.)	
Activity Fee .....	22.55
Canadian Graduate Council .....	2.00
<b>Total = .....</b>	<b>\$24.55</b>

All Graduate Students in Canada on a Student Authorization will be assessed an annual International Student Fee of \$100.00.

Students claiming landed immigrant status must do so before September 30 (before January 31 for students registered in Term two only) for waiver of this fee. Contact the International Student Advisor's Office for more information.

## THESIS TUITION WAIVER POLICY

Students who complete all thesis requirements by the following deadlines may waive the requirement to register in the period immediately preceding their Convocation: April 30 (waive Spring and Summer Session - graduate at Fall Convocation) or September 30 (waive Regular Session - graduate at Spring Convocation)

## THESIS TUITION REDUCTION POLICY

A partial reduction of tuition fees may be requested by students completing their thesis requirements part-way through a session. For more details contact the College. Postgraduate diploma and Master's non-thesis (project) students are not eligible for this reduction.

The student must submit a written request in advance for the tuition reduction. *Late requests will not be processed.* Students who are eligible for a refund can expect to receive it approximately one month after the thesis defense.

## DEFINITION OF THESIS REQUIREMENTS

The College of Graduate Studies and Research defines thesis requirements to include the following: the student has applied to graduate, all required graduation forms and the unbound thesis for Ph.D. students have been submitted to the college, and the thesis has been submitted to the bindery for binding.

## PAYMENT OF FEES FOR REGULAR SESSION

### Payment Dates

Once a student has registered, they are then responsible for assessed fees. To determine the amount owing please consult the confirmation copy of your registration. Students should not wait to receive a statement of fees owing before making payment.

Payment deadlines are now fixed dates. When the date occurs on a Saturday or Sunday, the deadline automatically becomes 16:30 the previous Friday.

For students registered in Term 1 classes only or in both Term 1 and Term 2 classes, all fees assessed are due **September 30**. The late payment penalty for missing this

deadline is \$40. Fees which remain unpaid will be subject to a second late payment penalty of \$40 if not paid on or before **January 31**. Students who add a class after a payment deadline must pay fees immediately for that class or risk incurring a \$40 late fee.

For students registered in Term 2 classes only, all fees assessed are due **January 31**. The late payment penalty for missing this deadline is \$40.

In addition to the above, for all students, fees which remain unpaid at the end of May and at the end of all subsequent months, will be subject to a monthly overdue fee equal to 1% of the unpaid amount (12.68% per annum).

Failure to make payment by the stated deadline will result in the withholding of future services by the university and in some cases may result in the termination of student status. Students will not receive grades or transcripts, will not receive their parchments upon graduation and are not eligible for re-registration until all outstanding accounts have been cleared with Employee and Student Accounts. Non-payment of fees does not constitute an official withdrawal from the university.

### Method of Payment

The regular hours of business are 08:30 to 16:30, Monday through Friday.

Cash, Cheque, Interac Debit Card, telephone or Internet banking service are all acceptable methods of payment. Students are strongly encouraged to make payment by mail, telephone or Internet banking service in order to avoid line-ups. If mailing fees, forward cheque or money order (on which the student number is clearly written) to Employee and Student Accounts. Cash should not be sent in the mail.

If you have subscribed to your bank's telephone or Internet banking service, you can pay your tuition using this method. The account number for the University of Saskatchewan is your student number. The University is registered with the following banks: Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, Royal Bank of Canada and Toronto Dominion Bank.

*Paying by installments* - This option is only available to students who are full-time students. An installment fee of \$20 is charged for using this option.

The first installment payment is due September 30 and the balance is due January 31. A first installment payment shall be a minimum of one-half the assessed tuition PLUS all student society and athletic fees PLUS the installment fee of \$20.00, all rounded up to the nearest dollar.

If you are a graduate student on a graduate studies scholarship, fellowship or research assistantship, etc., which is paid out to you on a monthly basis, then you may elect to pay your tuition on a monthly basis through payroll deduction. To do so you must present yourself and the confirmation (pink) copy of your registration form to the Employee and Student Accounts, Student

Fees Office and make the necessary arrangements.

These arrangements must be made prior to the payment deadline in order to avoid the late payment fee of \$40. A \$20 installment fee will be assessed for this service. It should be noted that in the case of class additions and/or withdrawals, the fee assessment will be adjusted accordingly, but it is the student's responsibility to ensure that Employee and Student Accounts, Student Fees, make the appropriate adjustment to the monthly deduction. Reductions in monthly deductions can be handled routinely by Employee and Student Accounts, but increases require the student to sign a revised deduction form.

## PAYMENT OF FEES FOR SPRING AND SUMMER SESSION (UNDER REVIEW)

Graduate students registered for Spring and Summer Session will be subject to the same payment deadlines as are students attending Summer Session. For 2000, this means that fees will be deemed late if not paid in full on or before the first day of Summer Session (July 4, 2000) and a late penalty of \$40 will be assessed. Interest of 1% per month will also apply to any unpaid amount after September 30, 2000.

## DROPPING COURSES

Students who wish to drop any or all courses should report at once to the College of Graduate Studies and Research Office in order to obtain an authorized form, which must be presented first to the Department Head, then to the College of Graduate Studies and Research. A student who withdraws unofficially without completing such forms will not be eligible for any refund of fees, nor exemption from fees in the event that they were unpaid. For the purpose of refund of fees, the date of withdrawal will be the date the authorized form is received in the College of Graduate Studies and Research Office. An absent/failure (ABF) will appear on the record of a student who has not officially withdrawn from a course.

## COMPLETION OF GRADUATE CLASSES

All students registering in a graduate course in a particular term must finish the course in the same term. Any student withdrawing from a course after the drop deadlines will receive a withdraw failure (WF) on their transcript. Students who do not withdraw and do not complete course requirements by the end of the final examination period will receive a grade of INF or ABF.

## UNDERGRADUATE REGISTRATION IN GRADUATE COURSES

Graduate courses are usually available only to students admitted and registered in the College of Graduate Studies and Research. With special permission from their undergraduate program advisor and the Dean of Graduate Studies and Research, undergraduate students registered at the University of Saskatchewan may be granted permission to register in a graduate class. Contact the College of Graduate Studies and Research Office for the necessary permission forms.

**GRADING SYSTEM**

The following describes the relationship between literal descriptors and percentage scores for courses in the College of Graduate Studies and Research:

**90-100 Exceptional**

A superior performance with consistent strong evidence of

- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

**80-89 Very Good to Excellent**

A very good to excellent performance with strong evidence of

- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

**70-79 Satisfactory to Good**

A satisfactory to good performance with evidence of

- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

**60-69 Poor**

A generally weak performance, but with some evidence of

- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

**<60 Failure**

An unacceptable performance.

**Program Requirements**

- Percentage scores of at least 70% are required for a minimal pass performance in undergraduate courses taken by graduate students;
- Percentage scores of at least 70% are required for a minimal pass performance for each course which is included in a Ph.D. program;
- Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Master's program, provided that the GPA is at least 70%;
- Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Postgraduate Diploma program, provided that the GPA is at least 65%;
- Students should seek information on other program requirements in the *Calendar* and in Department and College publications.

**SCHOLARSHIPS, FELLOWSHIPS AND ASSISTANTSHIPS**

A number of scholarships and assistantships are available for full-time, fully-qualified students in Master's and Ph.D. programs. Brief descriptions of these awards are provided in a booklet entitled *Graduate Awards Guide* which is available from the College of Graduate Studies and Research free of charge or you may view this publication on the world wide web at [www.usask.ca/cgsr/](http://www.usask.ca/cgsr/)

In addition, certain colleges and departments offer scholarships, assistantships and bursaries to students pursuing particular programs of study. Consult the Office of the Dean or the Head of the Department for additional information.

The Dean of Graduate Studies and Research has approved a number of departments to allocate University Graduate Scholarships at the departmental level. Please contact the department Graduate Chair regarding Graduate Scholarships or the CGSR Awards Administrator.

**STUDENT RIGHTS, APPEALS AND ACADEMIC DISHONESTY**

Graduate students are expected to be familiar with the university's official policy on academic dishonesty and misconduct. The regulations on Student Appeals and Academic Dishonesty are on the web at [www.usask.ca/registrar/](http://www.usask.ca/registrar/).

Graduate students are also advised to obtain copies of the following publications: Guidelines for the Various Parties Involved in Graduate Student Project and Thesis Research - from the College of Graduate Studies and Research Office; Graduate Student Handbook - from the GSA Office; Guidelines for the Preparation of a Thesis -

from the University Bookstore. All of the above graduate publications and the College of Graduate Studies and Research Policy and Procedures Manual are also available for viewing on the web at [www.usask.ca/cgsr/](http://www.usask.ca/cgsr/)

An *Intellectual Properties Policy (Graduate Students)* was approved in 1996 and is on the web at [www.usask.ca/avpr/ors/mission/ip.html](http://www.usask.ca/avpr/ors/mission/ip.html)

**LEAVES OF ABSENCE**

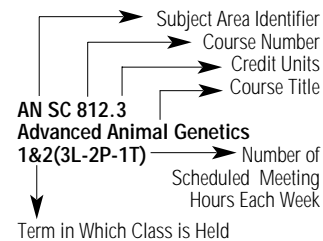
Students may request a Leave of Absence for up to 12 months. Such a Leave may be granted for medical, maternity/parenting or compassionate reasons, but not to accept employment. Student requests must be in writing, must indicate the reason for the leave with appropriate documentation, and must include a letter of support from the Graduate Chair. Students on Leave of Absence are not entitled to university services. They pay no fees and may request that the time of the Leave not count in their graduate program. Leaves of Absence are not granted retroactively.

**PROGRAMS AND COURSE DESCRIPTIONS**

Many of the courses in the *Calendar* have specifically stated prerequisites. Under exceptional circumstances, prerequisites may be waived as approved by the department.

**KEY TO COURSE DESCRIPTIONS**

Throughout the *Calendar*, the following convention may be observed in course descriptions:



The following term designations are used:

- 1—Term 1 only
- 2—Term 2 only
- 3—Term 3 only
- 1&2—Term 1 and 2
- 1/2—Either Term 1 or 2

The following instructional code designations are used:

- L—Lecture
- P—Practicum/Lab
- S—Seminar/Discussion
- C—Clinical Service
- R—Reading
- T—Tutorial

Unless otherwise specified, a course numbered 990 and described as a seminar does not involve examinations and has no credit attached to it, although a student is required to attend and to participate in the discussions. All students who are working on their thesis projects register for 994 (Master's Programs) or 996 (Ph.D. Programs). Project courses for students registered in Master's

programs without thesis are numbered 992. The times and rooms at which courses meet are posted by the department prior to the beginning of a term.

Not all courses described in the *Calendar* are given in any one academic year. For a list of courses to be offered in 2000-2001 Regular Session and timetable of these courses, please consult the Head of the Department concerned.

**PROGRAMS**

**DISCIPLINARY AREAS**

In the College of Graduate Studies and Research disciplinary areas are divided as follows:

**Humanities and Fine Arts**

- Art and Art History
- Classics
- Drama\*
- English
- French
- History
- Languages and Linguistics
- Music
- Philosophy
- Religious Studies\*

**Life Sciences**

- Anatomy
- Animal and Poultry Science
- Applied Microbiology
- Biochemistry
- Biology
- Biotechnology
- Community Health and Epidemiology
- Crop Science
- Food Science
- Herd Medicine and Theriogenology
- Horticulture
- Kinesiology
- Medicine\*
- Microbiology
- Nutrition and Dietetics
- Pathology
- Pediatrics
- Pharmacology
- Pharmacy
- Physiology
- Plant Ecology
- Psychiatry (Applied)\*
- Psychiatry (Neuro)
- Rehabilitation Medicine
- Soil Science
- Surgery
- Toxicology
- Veterinary Anatomy
- Veterinary Anesthesiology, Radiology and Surgery
- Veterinary Internal Medicine
- Veterinary Microbiology
- Veterinary Pathology
- Veterinary Physiological Sciences

**Physical & Engineering Sciences**

- Agricultural and Bioresource Engineering
- Biomedical Engineering
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science
- Electrical Engineering
- Engineering Physics
- Environmental Engineering



- Geological Sciences
- Mathematics and Statistics
- Mechanical Engineering
- Physics

**Social Sciences A**

- Agricultural Economics
- Anthropology and Archaeology
- Economics
- Geography
- Law
- Native Studies
- Nursing
- Political Studies
- Psychology
- Sociology
- Women's and Gender Studies\*

**Social Sciences B**

- Accounting
- Agricultural Extension
- Business Administration
- Adult and Continuing Education
- Curriculum Studies (Including Educational Communications and Technology)
- Education of Exceptional Children
- Educational Administration
- Educational Foundations
- Educational Psychology
- Finance and Management\*
- Indian and Northern Education Program
- Management and Marketing

\*There are students in "Special Case" programs in these departments.

**NEW PROGRAMS**

Subject to approval the following new programs may be introduced in the upcoming year. Please contact the College of Graduate Studies and Research for further updates.

- M.B.A. in Agriculture

**COURSE DESCRIPTIONS**

**990 COURSE**

Most Master's and Ph.D. programs include a requirement that students register in a 990 seminar course. There are no tuition fees for the 990 course, provided students are registered for other courses. The 990 course carries no credit unit weight, and does not reduce course requirements in the required program of study. Students must register in the 990 course at the time of first registration in any program containing a 990 component. This registration must be continuous until they have completed requirements for the course. Once credit has been received, no further registration in the 990 course will be either required or allowed. These seminar courses vary considerably in content. All include reports and discussions on current developments, research and methodology in the field, and all include requirements for student participation and presentations.

**COLLEGE OF GRADUATE STUDIES AND RESEARCH**

The following GSR courses, which are non-credit courses, are not associated with any specific department, but are available on recommendation by the student's Advisory Committee to all registered graduate students. There are no tuition fees

for these courses, provided the student is registered for other courses. Students must officially register for these courses in order to attend. These courses do not reduce the course requirements for a graduate degree.

**GSR 984  
Critical-Thinking Skills for Graduate Students: A Multi-Disciplinary Perspective  
1/2 (3L)**

Course content is based partially on perennial complaints from employers about deficiencies of students in the areas of communication, ethics, and team work, and partly from interviews with a number of people from different disciplines around campus. One aspect of this course, ethics, is receiving serious attention in many professional institutions. Some granting agencies require proof of training in ethical issues before funds will be released.

**GSR 985  
Introduction to Ethics and Integrity  
1/2(2S/L)**

Introduces principles of ethical decision-making in the contexts of research, teaching, supervision, consultation, and collegial relationships. Covers issues related to integrity in research, ownership of data, and authorship. In co-operation with the Office of Research Services, gives information needed for successful application for university ethics approval of proposed research. Discusses handling of complaints of ethical misconduct. Teaches participants to identify, formulate, and resolve ethical dilemmas following a structured process which includes consultation and reference to professional codes of ethics. The course is intended for beginning graduate students in departments or colleges which do not have their own courses in this field.

**GSR 986  
Basic Scientific Glassblowing for Graduate Students  
1/2(2L)**

Designed to introduce researchers to the basic skills of glassblowing. It will include a study of the physical and chemical properties of glass, how to present acceptable drawings and specifications to a skilled glassblower and provide the student with sufficient technical ability to construct and repair a simple glass vacuum system.

**GSR 988  
Laboratory Animal Care  
1/3(Total 16L-6P)**

Deals with the basic principles of laboratory animal care. It is designed for graduate students in the biological sciences, research scientists and support personnel. This course is mandatory for all graduate students, who in the judgement of their Advisory Committee, will use animals in their programs or future careers.

**GSR 989  
Introduction to University Teaching  
1/2(3L-1P)**

Designed for individuals who have no formal preparation in university teaching. It focuses on the core activities of teaching, examines their relevance, and illustrates how they are best accomplished. Practical application of the core activities to the

student's field of specialization is emphasized.

**ACCOUNTING**

**MASTER OF PROFESSIONAL ACCOUNTING**

The M.P.Acc. program is designed to prepare candidates for careers as professional accountants in public practice and industry. The program consists of eleven courses taken over a twelve-month period beginning in mid-August. The courses encompass advanced study in accounting, auditing and taxation sufficient to allow candidates to successfully challenge professional accounting qualifying examinations (e.g. Uniform Final Exam of the Chartered Accountants). The courses also expose candidates to the modern business environment, financial and strategic management, information systems and entrepreneurship. A research project component is also included. The program begins with two weeks of skills workshops followed by two fourteen week semesters. The two semesters are separated by a four-month work period allowing candidates to gain relevant business and accounting experience. For further information, contact: Department Head, Accounting, telephone: (306) 966-8395.

**MPACC 801.2  
The Business Environment  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Focuses on current developments in the internal and external environments of modern business and administrative organizations and their implications for the accountant of tomorrow.

**MPACC 802.3  
Corporate Financial Management  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Provides comprehensive coverage of finance theories/concepts and techniques essential to the professional accountant in his/her roles as financial information preparer, auditor and financial advisor.

**MPACC 803.4  
Financial Reporting and Accountability  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Provides an in-depth understanding of the major financial reporting issues facing professional accountants.

**MPACC 804.4  
Strategic Management Accounting  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* This is a capstone course in management accounting which serves to review previous managerial concepts, to integrate them into a wider management decision making framework, and show how cost information needs to be related to the broader, strategic context of the organization.

**MPACC 805.3  
Managing the Modern Business  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Prepares accountants to be more influential in delivering their expertise in organizational decision making and to enable them to be appropriately influenced by non-accounting organizational members.

**MPACC 806.4  
Auditing  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Examines the fundamental and current issues in auditing modern businesses, government entities, and non-for-profit organizations.

**MPACC 807.2  
Information Systems  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Focuses on the analysis, design and implementation of computer-based accounting and management information systems, using both traditional and object-oriented methods. The course also examines the impact of computer-based systems on internal control and auditing.

**MPACC 808.4  
Taxation  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Covers the tax issues, problems and planning opportunities professional accountants encounter in providing tax services. The course also reviews the legal, economic and political framework within which tax policy is developed as well as the future direction of tax policy.

**MPACC 809.3  
Entrepreneurship  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Using the viewpoint of the small business owner/manager and the small business this course examines the research, analytical, and planning processes required for the successful start-up and long run continuation of a business venture.

**MPACC 810.6  
Integration  
1&2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* This is the capstone course of the master of professional accounting program. The course focuses on application and integration of the multi-disciplinary knowledge required for the successful practice of professional accounting.

**MPACC 992.3  
Research Project  
1/2**

*Prerequisite(s): Admission to Graduate Studies and permission of the department.* Provides students an opportunity to develop research skills through completing a research project of importance to the



accounting profession. The focus of this research can be financial accounting or reporting, management accounting, auditing or taxation.

**MASTER OF SCIENCE IN ACCOUNTING**

The M.Sc. program represents an intensive analysis of the discipline. Course work and thesis are directed towards an examination of the current status and the evolution of accounting thought as well as that of various organizations and structures which the profession has developed. Candidates for admission must hold a four-year undergraduate degree with an accounting major. Professional certification in accounting may be accepted in lieu of the accounting major requirement. Enrolment will be restricted to four or five students a year.

The program contains several integrating viewpoints and approaches. First is a concern with examining and recognizing the interrelated nature of the various aspects of accounting - in effect the unity of accounting thought. The traditional managerial and financial as well as quantitative and behavioral aspects of accounting are integrated within each course. Second, the program views the discipline of accounting as being intimately related to the profession itself - its organization, role, evolution, leadership, etc. - and therefore considers these as appropriate areas for academic inquiry. Third, each course in the program is designed to produce in the student an awareness of the most recent accounting research.

**Areas of research under investigation by faculty**

The Accounting Department's faculty are interested in a number of different areas of research: financial statement analysis, accounting education, judgment in auditing, audit-management conflict, audit risk, accounting academic-practitioner interface, business valuation, disclosure strategy, international accounting, accounting information and capital markets, and management accounting and control.

*Requirements:* The M.Sc. in Accounting degree requires a candidate to take at least 15 credit units of courses which are graduate in nature for the field in which the student is working and a thesis on a subject permitting the student to make a contribution to knowledge.

Prospective applicants requiring more information about the M.Sc. Program are invited to write to the Director of the M.Sc. Program in Accounting, College of Commerce, University of Saskatchewan, 25 Campus Drive, Saskatoon SK S7N 5A7.

**ACC 814.3  
The Auditing Profession  
1(3S)**

Examines the economic, social, and professional determinants of an auditor's work environment. In addition, the auditor judgment process is examined through study of various theories and models from the psychology of information processing. Empirical applications of these models are considered in terms of auditor's judgments

regarding issues such as analytical procedures and aggressive financial reporting.

**ACC 823.3  
Management Accounting and Control  
Processes  
1(3S)**

Examines academic research in selected areas within the managerial accounting and control literature. Current research examining cost accounting systems (e.g., activity-based costing) and management control processes, including strategy, structure, performance measurement and evaluation, are discussed. Research papers discussed cover different methods (e.g., case studies, experiments, surveys).

**ACC 824.3  
Accounting Information and Capital  
Markets  
1(3S)**

Explores both traditional and contemporary theories and research in financial accounting with a focus on empirical research. Paradigms that will be studied in depth include capital markets and costly contracting research.

**ACC 825.3  
The Evolution of Accounting  
Practices  
1(3S)**

The evolution of accounting thought and practices is examined with regard to both its internal and external dimensions. Sources of influence are traced and their relationship to present practices and to the future is sought.

**ACC 827.3  
Research Methodology in Accounting  
1(S, 2 weeks)**

Introduces students to a wide range of research approaches appropriate to, and illustrative of, current accounting research. The course prepares students to effectively use these approaches in their own research and to critically evaluate research done by others.

**ACC 898.3  
Selected Readings in Accounting  
1(R)**

Selected readings will be offered in specialized areas of scholarship within the department upon approval of the Graduate Accounting Committee.

**ACC 990  
Research Seminar**

A forum in which faculty members, visiting professors and M.Sc. students will present research papers.

**ACC 994  
Research in Accounting**

Students undertaking research should register in this course each year until completion of the program.

**AGRICULTURAL ECONOMICS**

The Department of Agricultural Economics offers graduate programs leading to the Ph.D., M.Sc., and M.Ag. degrees and the Postgraduate Diploma. Research interests

in the department lie in the areas of agricultural policy, international trade, farm business management, international development, rural development, co-operatives, and natural resource and environmental economics.

Students with a recognized four year Bachelor's degree in agricultural economics, economics, or a relevant field can be admitted directly into the M.Sc. program. Background training should include training in mathematics, statistics, economic theory, and computers. Those students whose undergraduate training is in an area of specialization other than agricultural economics, economics, or a relevant field are usually required to take about one year of additional training in agricultural economics at the undergraduate level.

**AG EC 820.3  
Agricultural Production Economics  
2(3L-1P)**

*Prerequisite(s):* Permission of the instructor.

A study of the application of production economic principles with special attention to the usefulness of recent dynamic and stochastic production theory/model developments. Production economics principals are applied to both micro and macro economic problems.

**AG EC 832.3  
Rural Development  
1/2(3L)**

*Prerequisite(s):* Graduate-level standing.

The study of theories of rural development in advanced-market economies, a review of empirical studies of selected North American rural economies and a survey of national and subnational North American rural development policies.

**AG EC 835.3  
Welfare Economic Applications in  
Agricultural Policy  
1/2(3L)**

*Prerequisite(s):* AG EC 315 (or 310) or equivalent; AG EC 342 (or 340) or equivalent.

*Corequisite(s):* AG EC 820 or ECON 800.

Introduction to the fundamentals of applied welfare economics, with particular emphasis on the application of welfare economics to the analysis of agricultural problems. Techniques for measuring social costs and benefits are discussed. Focus is on agricultural policy the implications on the economy.

Students interested in a specialization in agricultural marketing should take both AG EC 840 and 842.

**AG EC 840.3  
Methods of Marketing Agricultural  
Products  
1(3L-1P)**

A study of alternative marketing systems and price discovery methods from the point of view of the agricultural economist as a researcher. Covers the relevant literature with a focus on the theoretical and research issues of market regulation (rent seeking), commodity futures markets, auction

markets, marketing boards, thin markets, vertical integration and coordination. A special section is included on international marketing and marketing in developing economies.

**AG EC 842.3  
Agricultural Market Organizations  
2(3L-1P)**

Develops a conceptual framework in which organizations, their behaviour, their interactions with other firms and their impact on an industry can be studied, compared and analyzed. The relevant literature in organizational theory, industrial organization and contract theory is reviewed, especially as it focuses on theoretical and empirical work in the areas of co-operatives, crown corporations and other forms of organizations. Examination of these types of firms is undertaken to better understand their behaviour and to develop concepts that can be put to use in analyzing other types of organizations.

**AG EC 845.3  
Transportation Economics and  
Interregional Competition  
1(3L-1P)**

*Prerequisite(s):* Permission of the instructor.

Deals primarily with the transportation economics as applicable to the transportation problems of agricultural commodities. Topics include a study of basic concepts in transportation economics, decision making in space, and an evaluation of spatial equilibrium and interregional competition models.

**AG EC 851.3  
Agricultural Policy  
1/2(3L)**

Focuses on an economic analysis of agricultural policies in Canada. In addition, general economic policy will be discussed in terms of how it impacts on farm income, economic growth and efficiency. Agricultural policies in other countries will also be discussed.

**AG EC 855.3  
International Agricultural Trade  
Policy  
1/2(3L)**

*Prerequisite(s):* Graduate-level standing in agricultural economics or economics.

The economic analysis of agricultural trade policy. Topics include introduction to international trade theory, an introduction to trade policy, methods of protection by importers and methods of protection by exporters.

**AG EC 860.3  
Econometrics for Agricultural  
Economists I  
1(3L-4P)**

*Prerequisite(s):* AG EC 461; or equivalent.

Deals with the alternative methods of estimating economic relationships. Topics include a review of single-variable statistical inference, the two-variable regression model, violations of the basic assumptions of ordinary least squares regression, the multiple-variable regression model, and models that use qualitative variables.

**AG EC 861.3  
Econometrics For Agricultural Economists II  
2(3L-4P)**

*Prerequisite(s):* AG EC 860.  
Follows up on concepts developed in AG EC 860, more appropriate to research in Agricultural Economics. Topics include multi-variate hypothesis, extensions of multiple regression, distributed lag models, problems of estimation, and simultaneous equation methods. Econometric model building, including evaluation, forecasting, and econometric simulation will also be included.

**AG EC 862.3  
Advanced Econometrics  
2(3L-4P)**

*Prerequisite(s):* AG EC 861; or equivalent.  
A study of advanced concepts in econometric theory and foundations, building it up from AG EC 861. Topics include inference and distribution theory including asymptotic distributions, statistical analysis of disturbances and generalized least squares, aggregation, non-linear estimation, Bayesian methods, and control theory.

**AG EC 866.3  
Mathematical Programming  
Applications for Agriculture and Agri-business  
2(3L-4P)**

*Prerequisite(s):* AG EC 315 (or 310); or equivalent.  
Concerned with the application of mathematical programming models for solving farm management, resource economics, international trade and policy problems. Besides a review of general linear programming principles, the course will deal with duality theory, sensitivity analysis, non-linear and quadratic programming and risk programming. Extensive use of linear and non-linear programming computer programs will be used for class assignments.

**AG EC 890.3  
Research Procedures in Agricultural Economics  
1(3L-1P)**

Topics from the areas of the philosophical basis of research in Agricultural Economics, the methods of science as applied to economic problems, current issues and problematic aspects of both the methods and substance of research in Agricultural Economics and initiating, organizing, funding and utilizing the results from research are examined.

**AG EC 898.3  
Special Topics  
1/2(3L)**

Reading essays and discussion in an approved special field.

**AG EC 990  
Seminar**

Reports and discussion on current development and research. All graduate students in Agricultural Economics are required to register. Attendance and at least one paper required of postgraduate students during the period of their candidacy, whether for one year or more.

**AG EC 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Agr.) must complete the course as part of the requirements for the degree.

**AG EC 994  
Research**

Students writing a Master's thesis must register as in the case of regular courses.

**AG EC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**AGRICULTURAL AND  
BIORESOURCE ENGINEERING**

Ph.D., M.Sc., M.Eng. and PGD programs are available in the Department of Agricultural and Bioresource Engineering to qualified students with a degree in engineering or the natural sciences. Research interests in the department lie in the areas of agricultural machinery design, tillage mechanics, sensors and instrumentation for agricultural and biological systems, agricultural building environments, soil and water management, waste management, cold-regions hydrology, postharvest and food engineering, and added-value processing of nutraceuticals and medicinal plants. Research programs may be arranged in environmental engineering in consultation with the Environmental Engineering Division. The faculty in the department work closely with engineers and scientists at PAMI, the Centre for Agricultural Medicine, the Prairie Swine Centre, the National Water Research Institute, and the Saskatchewan Irrigation Development Centre. In addition, interdisciplinary programs can be arranged in cooperation with other university departments.

Course requirements for fully qualified students consist of a minimum of 15 credit units for the Masters program, and 6 credit units beyond the Masters for the Ph.D. Students from a non-engineering background, or changing their areas of research, may be required to take additional courses at the undergraduate level. Courses are chosen in consultation with the student's advisory committee and typically include courses delivered by other university departments.

For more details about faculty, staff, research facilities and application procedures contact the Graduate Chair or the department web site at [www.engr.usask.ca/research/ag/](http://www.engr.usask.ca/research/ag/)

Students considering graduate level courses should consult with the faculty member responsible for teaching the course before registering, to determine when the course will be offered.

**A E 807.3  
Advanced Measurements  
2(3L-3P)**

Topics include an analysis of the static and dynamic response of instruments,

transducers used for measurement of temperature, pressure, strain, flow, radiation, displacement, velocity, acceleration, information transmission, signal conditioning and recording.

**A E 809.3  
Lubrication  
1/2(2L)**

Studies viscosity and flow; hydrostatic and hydrodynamic lubrication; friction and power losses in bearings; bearing materials and lubricants.

**A E 822.3  
Soil Hydrology of Semi-Arid Environments  
1/2(2L-1S)**

*Prerequisite(s):* Permission of the department.

The hydrological processes of infiltration, evapotranspiration, retention, drainage, and vadose zone flux within the Prairie semi-arid soil system will be studied. The course will cover concepts, field instrumentation and empirical and physically-based methods of analysis. Examples from field investigations will be used as basis for class discussion.

**A E 825.3  
Agricultural Ground Water Hydrology  
1/2(3L)**

A study of the fundamental theories and processes governing groundwater movement, groundwater occurrence and exploration, well construction, and aquifer evaluation. Students actively participate in this class by preparing and presenting a paper on a selected topic.

**A E 830.3  
Design of Farm Irrigation Systems  
1/2(3L-3P)**

Detailed study of the design of farm irrigation systems. Land classification and preparation. Theory and empirical methods of estimating consumptive use, hydraulics and economics of sprinkler irrigation design, fundamentals of overland flow applied to the design of surface water distribution systems.

**A E 840.3  
Building Science  
1/2(2L)**

The effect of moisture on the properties of agricultural products and building materials with special reference to heat transfer in the unsteady state. Analysis of heat and moisture problems in buildings for cold climates.

**A E 841.3  
Similitude  
1/2(2L)**

The application of dimensional analysis and similitude to the analyses of problems in Agricultural Engineering.

**A E 850.3  
Post-harvest Technology  
1/2(3L)**

Engineering principles as applied to processing of various agricultural materials. Topics include thermal environment, transfer processes, and physical properties of agricultural materials. The emphasis will be on handling, storage, and drying of agriculture grains and their products.

**A E 860.3  
Parameter Estimation in Engineering  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.  
Methods of data analysis and estimation of parameters appearing in mathematical models. Topics include parameters and model identification, sensitivity analysis, ordinary least squares, maximum likelihood, maximum a posteriori and sequential procedures. Methods of optimal experimental design in engineering applications are also reviewed.

**A E 861.3  
Soil-Machine Relations in Tillage and Traction  
1/2(3S-1.5P)**

*Prerequisite(s):* A university-level course in calculus.  
Mechanics of interactions between agricultural and forest soils and tillage and traction devices. Determination of relevant soil physical parameters. Analysis of stress and strains in soil due to machine applied loads. Effects on plant growth. Experimental and analytical methods for synthesizing characteristics of overall systems.

**A E 872.3  
Applied Stereology  
1/2(2L-3P)**

*Prerequisite(s):* A university-level course in statistics.  
Stereology is a series of efficient and unbiased methods to obtain information regarding 3-D structure from 2-D sections. Focuses on practical stereological methods for obtaining unbiased estimates of surface area, volume, connectivity of porous structures, number of objects, and spatial distribution of objects, using properly sampled information. The focus will be on stereology for non-homogenous materials.

**A E 898.3  
Special Topics  
1/2(R)**

Special problem assignments involving investigation and/or design in each of the major study areas of agricultural engineering. Each student's work will be limited to his/her own area of specialization. A technical report in a form satisfactory to the supervisor is required.

**A E 990  
Seminar**

Graduate students are required to register, to attend and to participate in the seminar course throughout their program.

**A E 992.3  
Project**

Students undertaking the non-thesis Master's degree (M.Eng.) must register in this course. It consists of independent study and investigation of a real world problem, and submission of an acceptable report on the investigation.

**A E 994  
Research**

Students writing a Master's thesis must register for this course.

**A E 996  
Research**

Students writing a Ph.D. thesis must register for this course.

## AGRICULTURAL EXTENSION

The College of Agriculture in association with the College of Education and the Extension Division is offering a M.Sc. degree in agricultural extension which will meet an increasing demand for advanced training in extension methods for agrologists. Students taking this option plan on future careers as professional agrologists relating to adult learning, sales and administration.

Students must have a B.S.A. degree and two years of field experience. The prerequisites are EDCNT 410 and 420.

Required program courses (21 credit units and thesis): AGEXT 990, 994, EDCNT 872.3, 875.3 and 882.3; one of EDCMM 804.3, 873.3, EDCNT 885.3, 878.3 or 880.3; and 9 credit units from the chosen agricultural discipline (Agricultural Economics, Animal Science, Horticulture Science, Mechanized Agriculture, Plant Science, or Soil Science). One of these courses must be the department's special topics course specifically designed to meet the needs of Agricultural Extension students.

### AGEXT 990 Seminar

A non-credit seminar on research proposals, methodology, and reports in which students enroll each term during their program.

### AGEXT 994 Research

Students must register in this course each year until the thesis is completed.

## ANATOMY AND CELL BIOLOGY

The Department of Anatomy and Cell Biology offers graduate programs leading to the M.Sc. and Ph.D. degrees. Areas of research interest include neurobiology, cell biology, developmental biology and advance anatomical image analysis. Students must have a B.Sc. 4-year degree. Program requirements for fully-qualified students are a minimum of 15 credit units of coursework and a thesis for the M.Sc. and a minimum of 21 credit units of coursework and a thesis for the Ph.D. Students must register in Anatomy 990 and Anatomy 994 (M.Sc.) or Anatomy 996 (Ph.D.). Further details are available on the web site at [www.usask.ca/anatomy](http://www.usask.ca/anatomy) or from the Graduate Program Chair of the department.

Students should note that INTDL 810 is given in alternate years to ANAT 812 and 820. ANAT 813 is given only on demand.

### ANAT 7323 Human Histology 1/2(2L&2P)

*Prerequisite(s): ANAT 200; or equivalent cell biology course.*

A survey of human tissue organization and systematic study of the normal arrangement of cells and tissues into organs and organ systems.

### ANAT 801.6 Human Gross Anatomy 1&2(2L-6P-1S)

*Prerequisite(s): ANAT 202; or equivalent.*

A practical study of the macroscopic structure of the human body by regional dissection and study of prepared specimens. Lectures are closely integrated with the laboratory sessions. Correlation of structure and function is emphasized and surface and radiological anatomy are included.

### ANAT 802.3 Advanced Cytogenetic Techniques 1/2(1L-6P)

*Prerequisite(s): BIOL 211 and ANAT 812; permission of instructor.*

This laboratory course will familiarize the students with a variety of modern cytogenetic techniques. The exercises involve tissue culture techniques and cell preparation for chromosome analysis, chromosome banding, demonstration of nucleolar organizers, differential staining of sister chromatids, cell synchronization, cell cycle analysis, somatic cell fusion and autoradiography.

### ANAT 812.6 Tissue Culture 1&2(2L-6P)

The student will study the behaviour of cells and organized tissues in vitro conditions and the principles and application of tissue culture techniques. Practical work will include short and long term culturing of various tissues, as well as the isolation of cell clones. Qualitative and quantitative procedures will be studied.

### ANAT 813.6 Experimental Medicine 1&2(8P)

Provides advanced training in experimental methods to study the normal morphology and function of tissues and their reactions to pathogenic stimuli.

### ANAT 820.3 Experimental Embryology 2(8L/P)

*Prerequisite(s): ANAT 201 and 204.*

Deals with the causal analysis of embryological development as studied by morphological, surgical, physical and chemical methods. In the main, vertebrate embryos will be studied but some invertebrate material will also be used.

### ANAT 821.3 Advanced Topics in Developmental Biology 1/2(4S)

*Prerequisite(s): ANAT 201; or equivalent and permission of the instructor.*

A review of recent advances in the study of developmental biology. Special emphasis is placed on the contributions of different experimental animal systems to research in a variety of areas in the field.

### ANAT 830.3 Advanced Topics in Cell and Molecular Biology 1/2(4S)

*Prerequisite(s): At least one senior level course in biochemistry, genetics or cell*

*biology; or permission from the instructor.* Recent developments in cell and molecular biology research will be examined. Students will present and evaluate selected publications from current literature. Among the topics of interest are: Signal Transduction, Development and Differentiation, apoptosis, gene expression/transcription, cell and organelle structure, and DNA dynamics and chromosome structures.

### ANAT 840.3 Development of the Nervous System 1/2(1L&2S)

*Prerequisite(s): Permission of the instructor.*

A comprehensive survey of the development of the vertebrate nervous system. Learning will be guided by examination of the experimental scientific literature. Topics include neurulation, cell migration, process outgrowth, trophism, differentiation, and extended consideration of the formation of synapses and refinement of patterns of connectivity.

### ANAT 898.3 Special Topics 1/2(2S/R)

*Prerequisite(s): Permission of the department.*

Study in selected areas of morphological sciences may be undertaken with the consent of the Department Graduate Committee. Involves reading assignments, lectures, and tutorials. Students will be required to participate in discussion, give oral presentations, and prepare a series of essays.

### ANAT 990 Seminar

Graduate students in Anatomy are required to attend, and to take part in the seminars throughout the course.

### ANAT 994 Research

Students writing a Master's thesis must register for this course.

### ANAT 996 Research

Students writing a Ph.D. thesis must register for this course.

## OTHER COURSES

The department also participates in the teaching of the following course:

### INTDL 810.3 Principles and Applications of Electron Microscopy 1&2(3P)

*Prerequisite(s): Permission of the instructor.*

Includes specimen preparation, ultramicrotomy, study of the principles and practice with the use of the microscope and related equipment, and evaluation and interpretation of electron micrographs.

## ANIMAL AND POULTRY SCIENCE

Programs leading to the M.Agr., M.Sc. and Ph.D. degrees are offered in all major divisions of Animal and Poultry Science; many supporting courses are available in

other departments. A minimum of 15 credit units of course work is required for the M.Sc. and a further 6 credit units is required for the Ph.D. degree. Current research includes nutritional, physiological, genetic and management studies in behaviour of farm animals.

## ANIMAL SCIENCE

### AN SC 800.3 Advanced Protein and Amino Acid Nutrition 2(3L)

Current information on digestibility, absorption and metabolism of nitrogen, proteins, amino acids and nucleic acids, as they apply to animals and man. Includes discussion on protein synthesis, protein catabolism and related regulatory mechanisms. The application of these processes in defining the dietary requirement, interaction and toxicity of essential and non-essential amino acids, including assessment of protein quality.

### AN SC 810.3 Nutrition of Grazing Ruminants 1/2(3L)

A concise overview of the sources, availability, functions, requirements, deficiencies, deleterious effects and interrelationships of nutrients affecting the productivity of free-ranging wild and domestic ruminant animals. Research techniques will be emphasized.

### AN SC 812.3 Advanced Animal Genetics 1(3L)

Special topics in genetics with emphasis on domestic animals. Approaches to testing, selection, population screening, ascertainment, and data analysis will be emphasized. Sample topics include RFLP analysis, disease associations, LOD scores, and twin studies.

### AN SC 813.3 Advanced Monogastric Nutrition 2(3L)

*Prerequisite(s): Permission of the instructor.*

Lectures, seminars and discussion on special topics related to monogastric nutrition with emphasis on swine and poultry. Methods of evaluating the nutritional characteristics of feed ingredients and establishing nutrient requirements. Advanced feed formulation.

### AN SC 815.3 Advanced Ruminant Nutrition and Metabolism 1/2(3L-1S)

*Prerequisite(s): Permission of the instructor.*

Covers the impact that nutrition has on ruminant metabolism in order to maintain optimal production throughout the animal's life. The main emphasis is on dairy and beef cattle. The role of nutrition in the metabolism of the fetus, the calf from birth to puberty, and of the pregnant and the lactating cow is covered. Advances in feed and animal biotechnology that may improve the efficiency of production and have an impact on metabolism are discussed. Students will be assigned to a local dairy farm, cow-calf operation, or feedlot so that they can apply the knowledge gained in this course to a practical situation.

**AN SC 817.3  
Advanced Mineral Nutrition  
2(3L-2P)**

*Prerequisite(s):* Permission of the instructor.  
A review of the biochemistry, physiology and application of mineral nutrition in ruminant and monogastric animals. Includes presentation of seminars and students will be acquainted with current analytical methodology.

**AN SC 820.3  
Animal Energetics  
1(3L)**

*Prerequisite(s):* BIOCH 200 (or 209); or equivalent.  
Energy flow in biology. Partition of energy. Determination of energy requirements. Factors affecting efficiency of energy utilization from the cellular to the climatic levels.

**AN SC 825.3  
Nutritional Toxicology  
1/2(3L-2S)**

*Prerequisite(s):* Undergraduate biochemistry and nutrition courses and permission of the instructor.  
Naturally occurring toxicants. Bacterial toxins and mycotoxins. Additives and residues. Contaminants. Drug nutrient interrelationships. Nutrient toxicity. Safety and regulatory aspects.

**AN SC 870.3  
Applied Animal Biotechnology  
1(3L)**

*Prerequisite(s):* Permission of the instructor; basic genetics and physiology courses are recommended.  
Covers reproductive technologies; transgenic techniques; molecular genetics in animal selection; use of recombinant proteins for growth, lactation and reproduction; immunological modulation of animal production; improvement of feeds and rumen organisms; improvement of health. In addition, ethical and safety aspects will be considered. Emphasizes the application and impact of biotechnological techniques on animal production rather than the techniques themselves.

*Note:* Students who have taken AN SC 470 will not be allowed to obtain credit for AN SC 870.

**AN SC 898.3  
Special Topics  
1&2(1.5L)**

Special offerings in topics relevant to Animal and Poultry Science. Examples would be Nutrition of Grazing Animals, Laboratory Techniques and Use of Statistics in Animal Experimentation. Interested students should contact the Head of the Department.

**AN SC 990  
Seminar**

Reports and discussion of current research. Graduate students are required to attend and participate during their candidacy.

**AN SC 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Agr.) must complete the course as part of the requirements for the degree.

**AN SC 994  
Research**

Students writing a Master's thesis must register for this course.

**AN SC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**ANTHROPOLOGY AND  
ARCHAEOLOGY**

The Department of Anthropology and Archaeology offers a graduate program leading to the degree of Master of Arts in Anthropology. Students wishing to register in the program should consult with the Head of the Department and the graduate advisor as early as possible in advance of the regular academic session.

The graduate program has been designed to provide flexibility in the choice of courses and research topics within the capacity of the department's resources. An applicant must hold a B.A. Honours or equivalent degree in anthropology or archaeology. Students with Honours degrees in other disciplines are encouraged to apply, but they will be required to do qualifying course work. The admission prerequisites are: (1) at least one course in three of the four sub-fields - cultural anthropology, physical anthropology, archaeology and linguistics; (2) substantial course work in the area of declared research interest; and (3) a course either in the history of anthropological theory or in archaeological method and theory.

Anthropology is considered the major field of study, but each applicant must declare an area of concentration in one of the sub-fields mentioned above. Applications for cultural anthropology for 1999-2000 will not be accepted. Applicants are strongly encouraged to identify the topic area in which they wish to do their thesis research so that a thesis supervisor can be assigned when the applicant is accepted. The course requirements consist of 15 credit units at the graduate level, which must include either ANTH 803.3 or ANTH 805.3. Other courses are chosen in consultation with the student's supervisory committee. Some of these courses may be taken from cognate fields outside the department.

Standing as a fully-qualified graduate student in Anthropology or permission of the department is a prerequisite for the following courses. Any additional prerequisites are stated with the course description.

**ANTH 803.3  
Core Seminar in Ethnological Theory  
1/2(3S)**

Readings, seminars and discussion periods dealing with a wide range of theoretical developments in ethnology. The nature and dynamics of various conceptual frameworks and theoretical approaches will be critically

examined, both historically and in the context of contemporary debates.

**ANTH 805.3  
Core Seminar in Archaeological  
Method and Theory  
1/2(3S)**

Seminars based on a series of readings dealing with the development of archaeological theory. Special emphasis will be given to anthropological archaeology and contemporary explanatory models.

**ANTH 820.3  
Topics in Contemporary Ethnological  
Theory  
1/2(3L)**

A survey of the principal approaches employed by present-day social/cultural anthropologists as they seek to understand society and culture.

**ANTH 821.3  
Methods in Contemporary Ethnology  
1/2(3L)**

A survey of the methods and techniques employed in present-day social/cultural anthropological research. Problems of field work and data analysis will be considered.

**ANTH 840.3  
Seminar in Linguistic Anthropology  
1/2(3L)**

A survey of selected problems in linguistics and the ethnography of language. Problems of field work and data analysis will be emphasized.

**ANTH 850.3  
Research Design  
1/2(3S)**

Covers preparation of research designs, methods of problem development, data analysis and interpretation, and also the organization and writing of theses (including stylistic and technical aspects).

**ANTH 851.3  
Seminar in Archaeological Method  
and Theory  
1/2(3S)**

A survey, through discussion and analysis, of current methods and techniques of archaeological interpretation.

**ANTH 852.3  
Seminar in Historical Archaeology  
1/2(3S)**

*Prerequisite(s):* ARCH 352 or equivalent.  
Readings and discussions of the major theoretical developments and research orientations within contemporary Historical Archaeology.

**ANTH 853.3  
Graduate Seminar in Plains  
Archaeology**

*Prerequisite(s):* ARCH 353; or equivalent.  
Deals with the prehistory of the Northern Plains with an emphasis on current issues and problem-solving.

**ANTH 855.3  
Problems in Archaeology  
1&2(3S)**

Research on a selected problem in archaeology or the prehistory of a selected geographic area with a problem orientation. The subject will be examined by the class

as a group and in detail through conferences, readings and laboratory work. A comprehensive report will be prepared by the class.

**ANTH 857.3 Seminar in Pottery  
Analysis 1 (3S)**

*Prerequisite:* Arch 457.3 or equivalent  
Readings and discussions on the pottery produced by folk artisans in traditional settings. The mineral compositions of clays will be considered as well as the physical makeup of pottery, and its archaeological classification. There will be a practicum involving analysis and reporting on an actual pottery assemblages from the northern plains region.

**ANTH 858.3  
Zoarchaeology  
1/2(3S & 2L)**

*Prerequisite(s):* ARCH 458 (Students may take this course concurrently).  
A reading course in method and theory relating to the identification and interpretation of faunal materials from archaeological sites. A practicum involving actual faunal assemblages is included.

**ANTH 870.6  
Seminar in Physical Anthropology  
1&2(3S)**

Guided reading and discussion course to permit advanced students to follow intensive research into special aspects of physical anthropology.

**ANTH 898.3/899.6  
Special Topics  
1/2(3R), 1&2(3R)**

Guided reading and discussion courses to permit advanced students to follow intensive library research into special aspects of anthropology.

**ANTH 994  
Research**

Students writing a Master's thesis must register for this course.

**ARCHAEOLOGY**

**ARCH 860.3 Advanced Cultural  
Resource Management  
1/2(3S)**

*Prerequisite:* ARCH 360.3 or equivalent.  
Readings and discussions on methodological approaches and theory related to the management and conservation of heritage sites and materials. Examines federal and provincial legislation, contract research and public involvement. A work study program will be incorporated, involving an internship with appropriate government, museum and/or private business agencies.

**ARCH 990.0 Seminar**

*Prerequisite:* Enrolment in the Department of Anthropology / Archaeology Graduate Program.

During residence, all graduate students will register in ARCH 990 and will present at least one paper based on their own research. Graduate students are required to attend and interested undergraduate students may be invited to attend.

## APPLIED MICROBIOLOGY

The Department of Applied Microbiology and Food Science offers M.Agr., M.Sc. and Ph.D. programs in Applied Microbiology. Programs may be oriented towards Biotechnology. Emphasis in course work and research is on the role and exploitation of microbial activities in agriculture, industry and the environment. Faculty research interests include food quality and safety, fermentation, yeast nutrition, microbial biotechnology, applied genetics, environmental microbiology, and microbial ecology.

The course requirements for M.Agr. programs is 30 credit units, at least 18 of which must be at the graduate (800) level, plus a seminar course (AP MC 990) and a project (AP MC 992). Candidates are required to pass a comprehensive examination and an oral defence of the project report. M.Sc. programs require a minimum of 6 credit units of graduate-level courses, annual registration in a seminar course (APMC 990), and a thesis (AP MC 994), which requires an oral defence. Ph.D. programs require a minimum of 6 credit units of graduate-level courses, a comprehensive examination, annual registration in a seminar course (AP MC 990), and a thesis (AP MC 996), which requires an oral defence. M.Sc. and Ph.D. programs may require a preliminary (qualifying) examination.

### Food Science

The Department of Applied Microbiology and Food Science offers M.Agr., M.Sc. and Ph.D. programs in Food Science. Faculty research interests include food chemistry, food analysis, detection of food adulteration, meat science, product development, food safety and quality assurance, and the processing and utilization of grain crops.

Specific requirements for graduate programs in Food Science are identical to those described for corresponding programs in Applied Microbiology, with equivalent FD SC courses substituting for the AP MC courses listed.

### AP MC 801.3 Laboratory in Fermentation Technology 1(1L-5P)

*Prerequisite(s): AP MC 212, 434, and 437 or equivalents; BIOCH 200 (or 203); laboratory experience in research and written permission of the Head of the Department.*

Designed to familiarize limited numbers of students with fermentation research techniques used at the University of Saskatchewan. Commercially available microbes will be used to transform substrates to a variety of end products. Emphasizes operational aspects of laboratory scale fermenters, computer control and measurement of parameters using modern equipment, enzymes and chemical assays.

### AP MC 803.3 Genetics of Industrial Microorganisms 2(2L-1S)

*Prerequisite(s): AP MC 437, BIOCH 220 (or 203), and MICRO 386 or equivalents; or an undergraduate degree in microbiology or biochemistry. Previous course work in genetics is desirable.*

Detailed study of the genetics of industrially important microorganisms and their relationship to the relevant practices. Seminar presentations review research literature related to the lecture topics.

### AP MC 806.3 Anaerobic Microbiology 2(3L)

*Prerequisite(s): AP MC 212 and MICRO 386 or equivalent; or permission of the instructor.*

Studies the biology and cultivation of anaerobic microorganisms and of their application to agricultural and industrial processes.

### AP MC 807.3 Microbial Biotechnology in Industry and Agriculture 2(3L-1S)

*Prerequisite(s): AP MC 212, 434 and 437, BIOCH 220 (or 203), MICRO 386 or equivalent; or permission of the instructor.*

Principles of biotechnology as they apply to useful products and processes involved in industry and agriculture, including food production and processing.

### AP MC 808.3 Brewing Microbiology 1(3L-2P)

*Prerequisite(s): AP MC 212 and 425 or equivalent; FD SC 412 or 812 is recommended.*

A comprehensive review of the status and current problems in brewing microbiology, wild yeast and bacteria in brewing; use of selective and general media for their isolation and enumeration; yeast washing; brewery quality control; yeast propagation, storage, handling and fermentation; beer pasteurization.

### AP MC 825.3 Carcinogens and Mutagens 2(2L-1S)

*Prerequisite(s): A course in biochemistry [BIOCH 220 (or 203)], knowledge of general cell biology (ANAT 201), general microbiology (AP MC 212 or MICRO 214), and permission of the instructor.*

Provides some understanding of carcinogens and mutagens, their mechanism of action at organismic, cellular and molecular levels, and of their testing and assessment. Short seminar discussions of current developments will be included.

### AP MC 830.3 Microbial Ecology 2(3L)

*Prerequisite(s): AP MC 212 or MICRO 214; CMPT 100 or AGRIC 290.*

Introduction to the diversity of microorganisms and the dynamics of microbial interactions. Microbial biogeochemistry of specific aquatic and terrestrial ecosystems. Selective microbial

enrichment and isolation. In situ quantitation of microbial activity.

### AP MC 831.3 Laboratory in Microbial Ecology 2(3L)

*Prerequisite(s): AP MC 430 or 830 (may be taken concurrently); and permission of the instructor.*

Designed to introduce modern experimental and computer modeling techniques for the study of microbial interactions. Laboratories will include the use of microbial enrichment cultures to isolate organisms of geochemical and industrial significance; in measurement of microbial proliferation and metabolic activity under in situ conditions; and in dynamics of microbial interactions and effects of environmental stress.

### AP MC 833.3 Microbial Insecticides 1/2(3L)

*Prerequisite(s): AP MC 212 or MICRO 214 or equivalent.*

Microorganisms as biological insect pest control agents is a rapidly advancing area of applied microbiology and agriculture. Examines the microbiology and molecular biology of such pest control agents.

### AP MC 836.3 Food Microbiology 1(3L)

*Prerequisite(s): AP MC 212 and 425 or equivalent, and BIOCH 220 (or 203); or permission of the instructor.*

Applications of biotechnology to food microbiology. Emphasis on genetic engineering of starter cultures used to produce fermented foods, microbial processing of food wastes, and rapid methods for detection and enumeration of microorganisms.

### AP MC 837.3 Industrial Microbiology 2(3L-3P)

*Prerequisite(s): Permission of the instructor.*

Principles of design and operation of fermentation equipment, aerobic and anaerobic fermentation processes leading to industrial chemicals, antibiotics, vitamins and amino acids with emphasis on biochemistry. Influence of biotechnology on the fermentation industry. Demonstrations, field trips and special projects are included.

### AP MC 838.3 Laboratory in Microbial Insecticides 2(1L-4P)

*Prerequisite(s): AP MC 433/833 and permission of the department.*

Experimental methods in the production, molecular analysis and use of microbial insecticides. Commercially available and experimental microbial insecticides will be used to demonstrate principles of bioassay, culturing pathogens, characterization of insecticidal molecules, mycoinsecticide action, cuticle degrading enzyme production and commercial bacterial insecticide application technology.

### AP MC 850.3 Microbiology of the Rumen 2(3L-1S)

*Prerequisite(s): Permission of the*

*instructor.*

A detailed study of the microflora and microfauna indigenous to the rumen and of the role of the rumen microbiota in nutrition of the host animal. Seminars will involve reading and discussion of recent literature in selected areas.

### AP MC 898.3/899.6 Special Topics and Techniques 1&2(R-T-P)

Reading assignments, tutorials and laboratory projects in selected areas related to the student's major field of study. A series of term papers, reviews or laboratory reports will be required.

### AP MC 990 Seminar

Seminars are held weekly throughout the year. Current literature in the field of Applied Microbiology and Biotechnology is reviewed and discussed, and papers on current research topics are presented. Graduate students are required to attend and to participate.

### AP MC 992.6 Project

Students undertaking the non-thesis Master's program (M.Agr.) must register for this course.

### AP MC 994 Research

Students writing a Master's thesis must register for this course.

### AP MC 996 Research

Students writing a Ph.D. thesis must register for this course.

## ART AND ART HISTORY

The Master of Fine Arts degree is offered in studio art. Candidates for the M.F.A. degree must have a B.F.A. degree or its equivalent with acceptable standing upon entrance to the program. When applying for admission, students must submit a statement of intent and a proposed area of research or study to the Head of the Department. Applicants are requested to present 20 slides, 3 letters of recommendation, official transcripts and a University of Saskatchewan application form. Applications for admission should be made no later than February 1 for the term beginning the fall of that year.

After admission, a program of courses and research will be arranged in consultation with the department's Graduate Committee and the candidate's supervisor. Accepted candidates may concentrate in the following studio disciplines: painting, drawing, printmaking, sculpture, photography, and extended media. Applicants should anticipate a minimum of two years to complete the program requirements. Studio facilities are available for 1st and 2nd year candidates. Upon completion of the program, the department will, in consultation with candidates, select one work from M.F.A. exhibitions for the university collection.

The requirements for the M.F.A. degree are:

- M.F.A. exhibition
- One secondary studio art course (6 credit units)
- One academic course relevant to student's program and approved by the department's Graduate Committee (6 credit units)
- Biweekly seminars in art

In addition, *one* of the two following options must be selected:

*Option A*

- Project paper (major paper)
- Oral defense of exhibition and paper

*Option B*

- Problems in Contemporary Art (6 credit units)
- Exhibition statement
- Oral defense of exhibition and statement

Both Option A and B constitute the M.F.A. with thesis. Under Option A the major paper and exhibition represents the thesis. Under Option B the exhibition statement and exhibition represents the thesis.

Admission to graduate studies is prerequisite for each of the following courses.

**ART 830.6  
Problems in Contemporary Art  
1&2(1L-2S)**

This seminar will deal with key problems in contemporary art. Primary sources, as well as subsequent interpretations and current literature all pertaining to modern art, will serve as source material for topics selected by individual students for investigation. Faculty and students will participate through ongoing presentations and discussions.

*Note:* Students receiving credit for ART 430 may not receive credit for ART 830.

**ART 838.3 and 839.3 (Formerly 835)  
Extended Media  
1/2(1L&2S)**

*Prerequisite(s): B.F.A. degree.*  
A practical and theoretical course extending the range of studio techniques beyond those of normal specialization. Projects will include alternative practices such as video, performance, installation, projection, and bookworks. Reading and discussion of related texts will accompany production of artworks.

**ART 841.3 and 842.3 (Formerly 814.6)  
Sculpture  
1/2(1L-2S)**

Research and continual identification of the concepts, materials, and means of sculpture will be pursued. Methods of construction, fabrication, and casting will be studied. Both traditional and experimental approaches will be encouraged. Wide exploration of materials and combinations such as metals, wood, plastics, fiberglass, fabric, cement, and stone will be encouraged.

**ART 851.3 and 852.3 (Formerly 813.6)  
Printmaking  
1/2(1L&2S)**

*Prerequisite(s): B.F.A. degree.*  
Studio work and exploration of the conceptual, expressive and technical means of four major print methods will be offered: Etching, Lithography, Relief Print and Serigraphy. Related photographic methods will be demonstrated. Thorough familiarity with the craft of the traditional print methods, as well as experimentation will be encouraged.

**ART 861.3 and 862.3 (Formerly 816)  
Photography  
1/2(1L&2S)**

*Prerequisite(s): B.F.A. degree.*  
Continued development in the creative language of photography, both expressive and technical. The study will include still, motion, black and white, and color photography. Theory and practical application will be approached through direct experience with the camera and with the developing and printing processes.

**ART 871.3 and 872.3 (Formerly 811.6)  
Painting Media  
1/2(1L-2S)**

Continual identification of concepts and methods as they relate to the expression, structure, media, and skills of painting. Students may experiment with any or all painting media and work from a choice of subject matter. Emphasis is on students' artistic growth and development.

**ART 881.3 and 882.3 (Formerly 812.6)  
Drawing  
1/2(1L-2S)**

Continual identification of concepts and methods as they related to visual perception and expression through drawing, compositional design, graphic media, and skills. Use of diverse media coupled with invented and observed form is encouraged.

**ART 898.3/899.6  
Special Topics  
1/2(3L), 1&2(3L)**

Offered occasionally by regular and visiting faculty and in other special situations. Students interested in this course should contact the department for more information.

**ART 922.6  
Project Paper**

This is a major paper and will require proper documentation. Based on appropriate research under Option A. One of the following approaches to the writing of the paper should be specified:

- An exhibition history, the intent of which is to allow students the opportunity to examine in detail their development as artists. This paper can use other artists or periods of art history for purposes of comparison; *or*
- A research paper. This paper more closely approximates the generally accepted notion of theses and has as its content a specific topic in the History of Art or Art Criticism.

**ART 990  
Seminar**

All graduate students are required to attend biweekly departmental seminars during the first two years of their program. Students will present their exhibition research and participate in seminar discussions. departmental faculty and visiting lecturers also contribute to the program.

**ART 995  
M.F.A. Exhibition**

This is a major studio component of the M.F.A. Degree. Students must select the best from work completed during the two years and mount an acceptable exhibition. This exhibition constitutes the major emphasis of the students' study and research. The examining committee consists of three Art Department faculty and one external examiner.

**BIOCHEMISTRY**

The Department of Biochemistry offers programs in Graduate Studies leading to the M.Sc. and Ph.D. degrees. Individual graduate student programs in Biochemistry can emphasize, antibody structure and abzymes, biotechnology, cell biochemistry, diabetes, metabolism, molecular biology, muscle function, plant biochemistry, protein structure, function and engineering, and signal transduction in metabolism and cancer. Collaborative graduate research opportunities with Agriculture Canada, the Plant Biotechnology Institute, and the Saskatoon Cancer Centre exist.

**BIOCH 800.3  
Information Transfer - DNA to Proteins  
2(3L)**

*Prerequisite(s): BIOCH 200 (or 203) and CHEM 251; or permission of the department.*  
Deals with the structure and function of nucleic acids at an advanced level. Chromosome anatomy, DNA replication, transcription of genes, and translation of mRNA in both prokaryotes and eukaryotes are covered. The various mechanisms whereby gene expression is regulated are also discussed.  
*Note:* Students cannot obtain credit for this course and BIOCH 230, 300, 334, or 834.

**BIOCH 810.3  
Proteins and Enzymes  
1(3L/4P)**

*Prerequisite(s): BIOCH 212 (or 203); permission of the department.*  
The properties of proteins and enzymes will be described including structure, kinetics, regulation and modification, antibodies, membrane proteins and glycosylation. Laboratories will provide experience with the determination of structural and functional properties including: ultracentrifugation, chromatography, electrophoresis, kinetics, phosphoamino acid identification, Western blotting, computer-based sequence analysis via the Internet.  
*Note:* Students cannot obtain credit for this course and BIOCH 310, 341, 429, 841, or 829.

**BIOCH 811.3  
Introductory Molecular Biology  
1(3L/4P)**

*Prerequisite(s): BIOCH 212 (or 203); one of BIOCH 230, 300, 334, 800, 834; BIOL 211; MICRO 216; permission of the department required. MICRO 214 or AP MC 212 recommended.*  
Basic principles and techniques of nucleic acid manipulations used in molecular biology and biotechnology are presented. Information and practical experience with plasmids, vectors, restriction endonucleases, DNA sequencing, site-directed mutagenesis, simple cloning, hybridization, promoter analysis and protein over-expression. In addition mRNA analysis, eukaryotic cloning and DNA fingerprinting will be presented.  
*Note:* Students cannot obtain credit for this course and BIOCH 311, 341 or 841 or MICRO 391 (395).

**BIOCH 812.3  
Protein Structure, Function, and Engineering  
2(3L)**

*Prerequisite(s): BIOCH 310 or 810 ; or 341 or 841 and 429 or 829; or permission of the department.*  
The details of protein structure, domains, folding, and targeting shall be presented. Modern experimental approaches to protein engineering shall be presented. The inter-relationship between structure and function in enzyme/protein mechanism and regulation shall be stressed.  
*Note:* This course will be offered in 2001-2002 and 2003-2004.

**BIOCH 820.3  
Advanced Plant Biochemistry  
2(3L)**

*Prerequisite(s): BIOCH 200 (or 203); BIOCH 220 and one of BIOCH 230, 300, 334, 800, 834, and BIOL 211; or permission of the department.*  
This advanced course presents the following topics: recent advances in metabolic control, photosynthesis, nitrogen assimilation, and secondary metabolism; the structure and function of selected proteins and the application of protein engineering; selected topics illustrating the biochemical basis of plant biotechnology.  
*Note:* Students cannot obtain credit for this course and BIOCH 433 or 833. This course should be offered in 2000-2001 and 2002-2003.

**BIOCH 830.3  
Cell Biochemistry  
2(3L)**

*Prerequisite(s): BIOCH 211 (or 203); BIOCH 334 or 834; or permission of the department.*  
The biochemical properties of eukaryotic cells will be investigated with special emphasis on signal transduction mechanisms, cell-cell extracellular matrix interactions, cell cycle control, apoptosis, neoplastic transformation and tumor progression.  
*Note:* This course will be offered in 2001-2002 and 2003-2004.

**BIOCH 832.3  
Lipid Metabolism  
1(3L)**

*Prerequisite(s): BIOCH 211 (or 203); or permission of the department.*

A review of selected aspects of the biochemistry of lipids, emphasizing their function and metabolism.

*Note:* This course will be offered in 2001-2002 and 2003-2004.

**BIOCH 835.3  
Intermediary Metabolism  
2(3L)**

*Prerequisite(s): BIOCH 211 (or 203); or permission of the department.*

The organization of metabolic pathways dealing with carbohydrates, lipids, amino acids and nucleotides with emphasis on common strategies employed in different pathways, and the overall regulation and integration of metabolite flow into cells, in tissues, and in intact organisms.

*Note:* This course will be offered in 2000-2001 and 2002-2003.

**BIOCH 836.3  
Advanced Molecular Biology  
2(3L)**

*Prerequisite(s): one of BIOCH 311, 811, MICRO 391, 395; or permission of the department.*

Modern and advanced methods and strategies of nucleic acid manipulation and characterization are presented. Topics include: uses of the polymerase chain reaction; generation and screening of libraries; cloning and expression of foreign genes; RFLPs and molecular medicine.

*Note:* This course will be offered in 2000-2001 and 2002-2004.

**BIOCH 843.3  
X-ray Crystallographic Structure  
Determination  
1(3L/3P)**

*Prerequisite(s): BIOCH 200 (or 203); or equivalent and permission of instructor; MATH 110, and 112 or 116 are also advisable.*

Describes the principles, methodology, application and limitations of the techniques in x-ray crystallographic structure elucidations. The methods employed to solve both small molecule and macromolecular crystal structures will be discussed and a small molecular structure determination will be carried out by the students.

*Note:* This course will be offered in 2000-2001 and 2002-2004.

**BIOCH 850.3  
Current Topics in Biochemistry  
1&2(L-S)**

*Prerequisite(s): Permission of the department.*

Students registered for a Master's degree should register for this course.

Based upon current biochemical literature. Papers will be assigned to students for presentation (a minimum of two) and departmental faculty will present papers and lectures and current research topics. Students will be evaluated on their presentation, participation and a term paper.

**BIOCH 851.3  
Current Topics in Biochemistry  
1&2(L-S)**

*Prerequisite(s): Permission of the department.*

Students registered for a Ph.D. degree should register for this course.

Based upon current biochemical literature. Papers will be assigned to students for presentation (a minimum of two) and departmental faculty will present papers and lectures and current research topics. Students will be evaluated on their presentation, participation and a term paper.

**BIOCH 898.3  
Special Topics**

These courses are offered occasionally by visiting faculty and in other special situations. Students interested in these courses should contact the department for more information.

**BIOCH 990  
Seminar**

All Biochemistry graduate students must register annually for this course. Seminars are held weekly throughout the year. The Biochemistry seminar series presents a wide range of topics from the life sciences. Students specializing in biochemistry are required to attend these seminars throughout their program and may be required to attend seminars in related fields given in other departments or institutions on the campus.

**BIOCH 994  
Research**

Students writing a Master's thesis must register for this course.

**BIOCH 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**BIOLOGY**

The Department of Biology offers programs leading to the M.Sc. and Ph.D. degrees in molecular, cellular, organismic, population, ecosystem and evolutionary biology. The faculty, which includes associate members and adjunct professors from other departments and institutes on campus, has particular strength in vertebrate ecology and behaviour, plant biotechnology and developmental biology. Joint graduate research programs can be arranged with other colleges of the university: Western College of Veterinary Medicine, College of Medicine, and College of Agriculture. Joint research programs can also be arranged with several government institutions on the campus: Canadian Wildlife Service; Prairie and Northern Wildlife Centre; National Research Council, Plant Biotechnology Institute; Agriculture Canada Research Station (applied entomology and plant pathology); National Hydrology Research Institute, Environmental Sciences Division; Saskatchewan Natural Resources, Fisheries and Wildlife Branches.

Course work consists of 15 credit-units for M.Sc. and 6 credit-units for Ph.D.

Graduate students are also required to register in the seminar course, BIOL 990, for two years.

**BIOL 811.3  
Cell Biology  
1&2(1.5S)**

*Prerequisite(s): Permission of the department.*

Review of the literature on selected topics including microscopic and sub-microscopic cellular organization, and cell function.

**BIOL 812.3  
Seminar in Genetics  
1&2(1.5S)**

*Prerequisite(s): Permission of the department.*

Reading and discussion of the recent literature in particular topics; the topics will change from year to year.

**BIOL 815.3  
Advanced Limnology  
1/2(3S)**

*Prerequisite(s): BIOL 315.*

Deals with limnological problems such as: planktonology, productivity, biocides, and regulation of aquatic populations.

**BIOL 825.3  
Current Topics in Plant Molecular  
Biology  
(1S-4R)**

*Prerequisite(s): BIOL 420 or PL SC 416; or permission of the instructor.*

A review of recent advances in plant molecular biology, emphasizing the use of molecular techniques in studying basic plant processes. Where appropriate, the impact of such research on plant biotechnology will be discussed.

**BIOL 827.3  
Multivariate Methods in Taxonomy  
and Ecology  
1&2(2S-4P)**

*Prerequisite(s): An introductory statistics course; a course in computer science, any two of BIOL 423, 472, 473, PL EC 431; or permission of the instructor.*

An introduction to numerical taxonomy and quantitative phytosociology, covering estimates of resemblance, classification and ordination procedures.

**BIOL 832.3  
Control of Plant Growth and  
Development  
1/2(1L-1S-4R)**

*Prerequisite(s): Satisfactory knowledge of plant structure and development, biochemistry and physiology. Permission of the instructor.*

Deals with problems of growth, differentiation and morphogenesis in plants examined at the genetic, cellular and organismic levels.

**BIOL 835.3  
Genetic Approaches to Plant  
Physiology  
1(3L)**

*Prerequisite(s): Satisfactory knowledge of plant physiology, biochemistry and*

*genetics. Permission of the instructor.* Deals with case studies to illustrate the use of genetic mutants and variants to investigate plant physiological processes.

**BIOL 841.3  
Advanced Plant Pathology  
2(2L-2S-2P)**

*Prerequisite(s): Permission of the instructor.*

Selected topics in plant pathology and related aspects of applied biology.

**BIOL 861.3  
Invertebrate Zoology  
2(1S-3R)**

*Prerequisite(s): BIOL 367, 368 or permission of the instructor.*

A study of the anatomy, physiology, ecology and phylogeny of some invertebrate animals.

**BIOL 871.3  
Advanced Insect Physiology  
1/2(4L-2T)**

*Prerequisite(s): BIOL 365, 366; or permission of the instructor.*

A review of recent advances in certain fields of insect physiology.

**BIOL 872.3  
Advanced Animal Behaviour  
1/2(3S)**

*Prerequisite(s): BIOL 472.*

Examination of current concepts and techniques in the study of animal behaviour.

**BIOL 873.6  
Modeling Techniques for Biological  
Systems  
1&2(3L-3P)**

*Prerequisite(s): MATH 110, 112; PL SC 314; BIOL 473; PL EC 412; or permission of the instructor.*

Deals with the analysis of complex biological systems using computer simulation techniques.

**BIOL 880.3  
Applied Statistics in Ecology  
1/2(3L)**

*Prerequisite(s): PL SC 314 or equivalent.*

An overview of basic statistical methods and their applications to ecological studies. Topics include descriptive statistics, frequency analyses, experimental designs and analyses of variance, trend analyses, and analyses by rank. Designed for students involved in ecological research.

**BIOL 883.3  
Ecology Seminar  
2(2S)**

Students and faculty reports on selected topics in aquatic and terrestrial ecology.

**BIOL 889.3  
Avian Wildlife Conservation and  
Management: Theory in Practice  
2(2L-1P)**

*Prerequisite(s): BIOL 458 or 473; or equivalent.*

Evaluates current problems and solutions in conservation and management of wildlife, primarily birds, with emphasis on hypothesis-testing, and identification, review and application of ecological theories and new analytical techniques. Analysis of specific case-histories dealing with management of birds.



**BIOL 898.3  
Special Topics  
1/2 or 1&2 (R/T)**

Assigned reading and tutorials, projects and/or lectures in special topics related to the student's major field of interest. Students are required to prepare three essays or term papers or their equivalent if another form of evaluation is more appropriate.

**BIOL 990  
Seminars**

A student seminar series held weekly during the Regular Session to develop scientific communication skills. Both M.Sc. and Ph.D. students are required to participate in and pass this course for two years.

**BIOL 994  
Research**

Students writing a Master's thesis must register for this course.

**BIOL 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**OTHER COURSES**

The department also participates in the teaching of the following courses:

**INTDL 810.3  
Principles and Applications of  
Electron Microscopy  
1&2(3P)**

*Prerequisite(s):* Permission of the instructor. Includes specimen preparation, ultramicrotomy, study of the principles and practice with the use of the microscope and related equipment, and evaluation and interpretation of electron micrographs.

**GRADUATE STUDENT RESEARCH  
PROJECTS**

The Department of Obstetrics and Gynecology through the auspices of its Reproductive Biology Research Unit offers graduate students the opportunity to engage in research in gamete biology and embryology using tools ranging from molecular to clinical.

**BIOMEDICAL ENGINEERING**

The Division of Biomedical Engineering offers postgraduate programs leading to M.Eng., M.Sc. and Ph.D. degrees. Research in the Division is of an interdisciplinary nature involving the application of Engineering Sciences to the solution of specific problems in Medicine, Veterinary Medicine, and related fields. The following are focal areas for the activity: biomedical signal processing, physiological system modelling, biomedical image processing, biomechanics and medical instrumentation.

Students with a Four-year Bachelor's degree in Engineering, the Natural Sciences, Applied Mathematics, Computer Sciences, Medicine, Dentistry, Veterinary Medicine or in the general Life Sciences are eligible for

admission. Candidates for the M.Eng. are required to have a Bachelor's degree in Engineering. Courses to be taken are determined on an individual basis. They will be selected from the specialized courses listed below, from graduate level courses in the student's original discipline and from introductory courses of a complementary character. This means that students with a basic degree in the Physical Sciences will be required to take introductory courses in selected disciplines of the Life Sciences and vice versa. In addition to course work, submission of a research thesis is required for M.Sc. and Ph.D. students. Candidates for M.Eng. are required to submit a final report on their project.

In addition to the following specialized courses, students may take courses offered by other colleges and departments. These courses may be selected in consultation with the Chair and the Supervisor. Descriptions of these courses may be found in the *Calendar* as well as in the bulletin of the Division.

**BIOL E 800.3  
Advanced Biomedical  
Instrumentation  
1/2(3L-1.5L)**

An introduction to some of the concepts of instrumentation and their application to measurements of biological parameters. Includes: transducers, biopotential amplifiers, electrodes, biopotential signals, electrical safety, cardiovascular and respiratory measurements, and imaging.

**BIOL E 802.3  
Fundamentals of Signals Theory for  
Life Scientists  
1/2(3L)**

Signals and spectra. Bandwidth requirements. Amplitude and phase distortion. Time delay considerations. The sampling theorem. The sampling of non-periodic wave shapes. White noise. Signal to noise ratio.

**BIOL E 804.3  
Biomaterials  
2(3L)**

An introduction to the structure and physical properties of materials of importance in bioengineering; compatibility of materials with the body; mechanisms of damage and failure of implanted materials; materials selected and fabrication.

**BIOL E 898.3  
Special Topics  
1/2(3L)**

Two 3 credit-unit courses can be taken independently. Topics will be selected according to the student's specific areas of interest. They include signal analysis for the acquisition and processing of physiological data, digital and optical picture processing for medical applications, theory of bioelectrodes, biological control theory and computer simulations of biological processes (some of these topics may be presented by faculty members specializing in that particular field).

**BIOL E 990  
Seminar**

Seminars are held periodically throughout the Regular Session or as a one-day symposium. Graduate students are required to make a presentation related to their thesis work or on a course project. In addition, graduate students may be required, from time to time, to attend seminars relevant to biomedical engineering given by faculty or visiting scientists in other departments. Students must enrol throughout their program.

**BIOL E 992.6  
Project**

Students taking the non-thesis Master's degree must register in this course.

**BIOL E 994  
Research**

Students writing a Master's thesis must register for this course.

**BIOL E 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**BIOTECHNOLOGY**

Biotechnology is a field of study which encompasses three traditional scientific areas: genetic and cellular manipulative technology, enzyme technology and fermentation technology.

Although no formal graduate program in Biotechnology has been established, programs leading to M.Agr., M.Sc., or Ph.D. degrees with specialization in Biotechnology are offered in the following disciplinary areas and departments:

Anatomy and Cell Biology, Animal and Poultry Science, Applied Microbiology and Food Science, Biochemistry, Biology, Crop Science and Plant Ecology, Microbiology and Veterinary Microbiology. Students interested in such a program should contact one of the above departments.

Relevant graduate and senior undergraduate courses that are relevant to biotechnology include:

- ANAT 300.3 Cell Biology
- ANAT 450.3 Introduction to Tissue Culture
- ANAT 802.3 Advanced Cytogenetic Techniques
- ANAT 812.6 Tissue Culture
- AN SC 313.3 Animal Breeding and Genetics
- AN SC 812.3 Advanced Animal Genetics
- AN SC 870.3 Applied Animal Biotechnology.
- AP MC 434.3 Industrial Microbiology I
- AP MC 437.3 Industrial Microbiology II
- AP MC 801.3 Laboratory in Fermentation Technology
- AP MC 803.3 Genetics of Industrial Microorganisms
- AP MC 806.3 Anaerobic Microbiology
- AP MC 807.3 Microbial Biotechnology in Industry and Agriculture
- AP MC 825.3 Carcinogens and Mutagens

- AP MC 833.3 Microbial Insecticides
- AP MC 836.3 Food Microbiology
- AP MC 838.3 Laboratory in Microbial Insecticides
- BIOCH 800.3 Information Transfer: DNA to Proteins
- BIOCH 810.3 Proteins and Enzymes (First offered September 1999)
- BIOCH 811.3 Introductory Molecular Biology
- BIOCH 812.3 Protein Structure, Function and Engineering (First offered January 2000)
- BIOCH 820.3 Advanced Plant Biochemistry. (First offered Jan 2000)
- BIOCH 830.3 Cell Biochemistry
- BIOCH 836.3 Advanced Molecular Biology
- BIOCH 843.3 X-ray Crystallographic Structure Determination
- BIOL 316.3 Intermediate Genetics
- BIOL 420.3 Molecular Biology of Plants
- BIOL 811.3 Cell Biology
- BIOL 812.3 Seminar in Genetics
- BIOL 825.3 Current Topics in Plant Molecular Biology
- BIOL 832.3 Control of Plant Growth and Development
- BIOL 835.3 Genetic Approaches to Plant Physiology
- BIOL 841.3 Advanced Plant Pathology
- BIOL 871.3 Advanced Insect Physiology
- CH E 861.3 Fundamental Biochemical Engineering
- CH E 862.3 Advanced Biochemical Engineering
- CHEM 858.3 Natural Product Chemistry
- CHEM 860.3 Proteins and Nucleic Acids
- HMT 801.3 Principles of Embryo Transfer
- MICRO 386.6 Microbial Genetic Mechanisms
- MICRO 395.6 Laboratory Aspects of Microbiology
- MICRO 812.3 Principles of Immunology
- MICRO 814.3 Microbial Physiology
- MICRO 817.3 Molecular Virology
- MICRO 827.3 Advanced Cellular and Molecular Immunology
- MICRO 860.6 Microbial Genetics
- PL SC 405.3 Evolution and Population Genetics
- PL SC 411.3 Genetics and Plant Breeding
- PL SC 416.3 Applied Plant Biotechnology
- PL SC 812.3 Population and Conservation Genetics
- PL SC 815.3 Applied Plant Cytogenetics
- PL SC 816.3 Quantitative Genetics
- PL SC 818.3 Physiology and Biochemistry of Herbicide Action
- PL SC 822.3 Biotechnology in Crop Development
- VT MC 830.3 Recent Advances in Microbiology
- VT MC 831.3 Research Techniques and Instrumentation
- VT MC 833.3 Advanced Virology



For details on the above courses, see the appropriate section of the *Calendar*.

## **BUSINESS ADMINISTRATION**

### **MASTER OF BUSINESS ADMINISTRATION**

The College of Commerce offers a graduate program leading to the degree of Master of Business Administration (M.B.A.). This program is designed to meet the needs of those students whose undergraduate education has been in academic disciplines other than business, and whose future careers are likely to involve managerial activities.

Admission to the Master of Business Administration program is open to graduates of universities approved by the College of Graduate Studies and Research in accordance with its normal admission requirements.

Graduates of a four year program from the College of Commerce, or its equivalent, can normally complete the degree requirements within one year. Students whose undergraduate degree is in a discipline other than business should plan on a two year period to complete the program.

Required courses in the first year are: MBA 710.3, 720.3, 730.3, 740.3, 750.3, 802.3, 804.3, 806.3, 808.3 and 810.3. Required courses in the second year are: MBA 828.3, 830.3, 832.3 and 992.3 for the non-thesis option and MBA 828.3, 830.3 and 832.3 for the thesis option. In addition, 18 credit units in electives at the 800 level are required in the non-thesis option while 9 credit units in electives are required in the thesis option.

All students seeking admission to the Master of Business Administration program must write the Graduate Management Admission Test (GMAT). This test is given four times each year in major centres throughout the world. Information on test centres, dates of tests, and deadlines for registration may be obtained from: Graduate Management Admissions Test, Educational Testing Services, Box 966, Princeton, NJ, 08541, U.S.A.

Prospective students requiring more information about the Master of Business Administration program at the University of Saskatchewan are invited to write the Associate Dean, College of Commerce, University of Saskatchewan, 25 Campus Drive, Saskatoon SK Canada, S7N 5A7.

#### **MBA 710.3 Financial Accounting 1(3L)**

The principles and fundamentals of accounting theory and practice. Accounting measurements and the use of accounting data. The preparation of business records and financial statements. An examination of the alternatives available in the measurement of income, assets, liabilities and owners' equity for external financial reporting.

#### **MBA 720.3 Organizational Behaviour 1(3L)**

Introductory examination of the behaviour of work organizations and the groups and

individuals within them. Topics include schools of management thought, organizational structure, work motivation, perception, decision-making, job satisfaction, work performance, group processes and leadership. Provides a knowledge base upon which advanced organizational behaviour courses are built.

#### **MBA 730.3 Industrial Relations 1(3L)**

Considers the administrative problems involved in the staffing of producing organizations. The central theoretical considerations will be the relative power relations that exist between the individual and the organization in the context of a labour market and the relative power that exists between different kinds of organizations in Western society. Involves an introductory discussion on the labour force and the labour market - basic concepts and trends; employee placement and compensation - the employment bargain; labour-management relations - the bases of conflict and conflict resolution.

#### **MBA 740.3 Quantitative Methods for Management 1(3L)**

*Prerequisite(s): Admission to the M.B.A. program; Courses in mathematics for Business Applications and Descriptive Statistics.*

Orients the students to concepts, techniques and applications of both statistical and operations research methods to problems of data analysis and managerial decision-making.

#### **MBA 750.3 Economic Environment of Business 1(3L)**

*Prerequisite(s): Introductory course in economics; Admission to the M.B.A. program.*

Examines the overall macroeconomic environment facing business firms, with some attention devoted to the feedback between business firms and the environment itself. Broadens and enhances the student's "toolkit." Pays close attention to the direct implications to business firms of particular environments and policies of the day including the interaction between business policy and the economy.

#### **MBA 802.3 Management Accounting 2(3L)**

*Prerequisite(s): MBA 710.*

The role of accounting and analysis as an aid to managerial planning and control. Basic cost concepts, cost compilations, and accounting techniques for product costing, budgetary planning and control, and special decisions.

#### **MBA 804.3 Marketing Management 1(3L)**

Designed for students with a limited background in marketing. Provides an overview of the nature and scope of marketing activities in the modern business firm. Specific topics include: consumer

behaviour, product policy, pricing, promotion, channels of distribution, and marketing research.

#### **MBA 806.3 Financial Management 2(3L)**

*Prerequisite(s): MBA 710.*

Asset selection, capital structure, and growth policies for the business firm. Some applications of these policies to government-owned institutions.

#### **MBA 808.3 Managerial Economics 2(3L)**

*Prerequisite(s): MBA 750; completion of three 700-level MBA courses.*

Coverage of tools and concepts in microeconomics relevant to managerial decision making. Emphasizes both theoretical and empirical contributions in the managerial economics literature with applications to the estimation of demand and product in functions, partial equilibrium in competitive and non-competitive markets, risk analysis and intertemporal analysis.

#### **MBA 810.3 Production and Operations Management 2(3L)**

*Prerequisite(s): MBA 740; completion of three 700-level MBA courses.*

A systems oriented view of the operations and production management, dealing with methods used for planning, organization, scheduling and controlling of operations in both industry and other institutional settings. The emphasis is on the concepts, analytical tools and techniques of specific topics such as process and product design, capacity planning, facility location, facility layout, operating scheduling, forecasting, inventory control and performance control.

#### **MBA 811.3 Corporate Financial Reporting 1/2(3L)**

*Prerequisite(s): MBA 710 and 802.*

Focuses on the process of interpretation and the uses to be made of financial statements. Approached from a user point of view - what should be known about financial statements and financial measurements which will influence user decisions. By reference to corporate financial reporting, the existing traditional model and the proposed current valuation models will be exposed - together with the various social uses to which financial statements are addressed.

#### **MBA 812.3 Accounting Aspects of Management Planning and Control Systems 1/2(3S)**

*Prerequisite(s): MBA 710 and 802.*

Focuses on the financial and behavioral implications of the management planning and control systems in business enterprises. Topics include the nature and purpose of planning and control systems; the budgetary control process; management accounting subsystems; financial performance measurement through profit, investment and cost centres.

#### **MBA 814.3 Business Law 1/2(1L-2S)**

Provides the student with an understanding and appreciation of the nature of the legal process, the role of the courts and other tribunals in the administration of justice, and the basic rights and obligations of individuals (and firms) in contract, tort and under the criminal law.

#### **MBA 815.3 Management in Contemporary Aboriginal Organizations 1/2(3L)**

*Prerequisite(s): MBA 720; or permission of the Director.*

This course will examine Aboriginal cultures to assist the student in understanding the different values and world views that survive in aboriginal communities and their relevance to the resolution of contemporary problems. Similarities, differences and ethical considerations in management structures will be compared with corporate management and public models of self-government.

#### **MBA 816.3 Contemporary Issues in Aboriginal Business 1/2(3L)**

*Prerequisite(s): Permission of the Director.*

This course will confront selected business and management issues in contemporary Aboriginal society. Students will gain an appreciation for the relationship law, business and economics play in shaping community development. Appropriate criteria for examining the themes or issues will be developed as well as methods for discussing and debating these issues.

#### **MBA 817.3 Indigenous People and Economic Development 1/2(3L)**

*Prerequisite(s): Permission of the Director.*

This course will survey the approaches to economic development by the Indigenous Peoples of the world, particularly those in Canada. These contemporary approaches, strategies and practices will be examined in relation to current and emerging theories of development and underdevelopment in the "new global economy."

#### **MBA 818.3 Aboriginal Management Systems 1/2(3L)**

*Prerequisite(s): Permission of the Director.*

Students examine various approaches to development in Aboriginal Nations' communities undertaken by economic development corporations, government agencies, research and planning groups, Aboriginal organizations and individual entrepreneurs. The focus is on management strategies but will consider the impact of various strategies on community issues such as education, health and justice.

#### **MBA 827.3 Contemporary Moral and Social Issues in Business 1/2(3S)**

Analysis of ethical and social problems in business as described in readings, cases,

and videos, and discussion of various societal trends which have an impact on business management. Topics include downsizing, excess profits, privacy, equity in pay and benefits, whistle-blowing, government regulation (e.g. banning tobacco ads), environmental protection, etc.

**MBA 828.3  
Business Policy and Strategy  
1(3S)**

*Prerequisite(s): All MBA 700-level courses and at least four courses numbered 800-825.* Attempts to develop an understanding of the processes of policy formulation and implementation in the environmental setting in which they are made; to demonstrate the relevance of certain approaches and tools to the analysis and solution of business policy problems in real life situations; and to deal with the total organization and integrate various functional areas in making business policy decisions.

**MBA 830.3  
Management Simulation  
1/2(2P-1L)**

*Prerequisite(s): All MBA 700-level courses and at least four courses numbered 800-825.* A capstone course designed to reinforce basic management skills and provide an action frame of reference for applying preceding functional and tool courses using a variety of methods.

**MBA 832.3  
Management Information Systems  
1/2(3L)**

*Prerequisite(s): All MBA 700-level courses and at least four courses numbered 800-825.* Problems in the implementation of modern computer-based management information systems. Provides an overview of the principal types of software support and concentrates on managerial problems in the selection and control of projects, and policy issues in the selection of a systems philosophy for the organization.

**MBA 840.3  
Power and Politics in Work  
Organizations  
1/2(3S)**

Familiarizes one with organizational power politics by: 1) developing an awareness of the reality and importance of the phenomena; 2) discussing a selection of power tactics; and 3) pointing out the necessity for introspection and the development of a personal system of managerial values or ethics.

**MBA 842.3  
Organizational Design and Change  
1/2(1.5L-.75P-.75S)**

Organizational structures and intra-organizational patterns of relationships provide the focus for this course, which is intended to prepare students for the exposure they will confront in their early years in most organizations. The second part of the course emphasizes tactics and strategies for introducing modifications in organizations.

**MBA 843.3  
Administrative Behaviour  
1/2(3S)**

The role of the administrator requires organizing, controlling, planning and motivating others to perform the work of an organization. However, the administrator is also a person with needs and career aspirations as well as responsibilities to a boss and subordinates. From the administrator's point of view, how does one survive the experience? Topics include leadership, evaluation, career issues, problem solving, stress and coping.

**MBA 846.3  
Innovative Forms of Work Structures  
1/2(3S)**

Critically examines a variety of non-traditional forms of work organization which are purported to address a variety of problems currently facing work organizations. These forms include job and task redesign, semi-autonomous work groups, participative management, joint consultation, joint decision-making through worker councils and board representation, and employee ownership.

**MBA 848.3  
Management of International  
Businesses  
1/2(3S)**

*Prerequisite(s): MBA 849; or written permission.* Identifies and analyzes key managerial policy issues within the context of an international corporation; discusses the means and problems of adapting to different environmental pressures. Involves overseas field study; field study fee applies. The College of Commerce places an emphasis on providing students with opportunities to study in an international setting. In the past students have been able to participate in internships and work study programs in Japan, Ukraine, and Malaysia.

**MBA 849.3  
International Business Environment  
1/2(3L)**

*Prerequisite(s): MBA 750.* A management course which analyzes the main environmental factors affecting the operation and management of international business activities of the enterprise. Economic, legal-political, and cultural factors are examined, and their impact on managerial decisions in international business.

**MBA 856.3  
Marketing In a Changing Environment  
1/2(3S)**

*Prerequisite(s): MBA 804.* Develops an understanding of the impact of changing environmental conditions upon the marketing activities of an organization. A primary focus is the development of the ability to adapt and rationalize various marketing principles, concepts and techniques.

**MBA 857.3  
Advanced Marketing Management  
1/2(3S)**

*Prerequisite(s): MBA 804.* Provides the student with the opportunity to recognize, analyze, and formulate solutions to marketing problems encountered in the

Canadian business environment. A decision-oriented approach is utilized to develop the student's ability to apply this knowledge of marketing in an integrated and logical manner.

**MBA 859.3  
Venture Management  
1/2(1.5L-1.5P)**

Venture Management is a general term used to describe the economic activity that deals with the initiation of new business endeavors. Included are such activities as the start-up of new companies or new subunits of large organizations, product development, and product-market expansion. Focuses on the processes and techniques required to convert ideas, inventions and innovation into profitable business undertakings.

**MBA 862.3  
Financial Markets and Institutions  
1/2(3L)**

*Prerequisite(s): MBA 750 and 806.* Examines in depth the role and function of financial markets and financial intermediaries in Canada. Topics include: money and capital markets; objectives, functions and investment policies of financial institutions; interrelationships among financial institutions; performance, expansion and growth of financial institutions. Topics such as government regulation and international aspects of financial institutions will also be discussed.

**MBA 863.3  
Advanced Financial Management  
1/2(2L-1S)**

*Prerequisite(s): MBA 750 and 806.* Focuses on the major and contemporary problems in corporate financial decision-making, thereby enabling the student to assume the role of decision-maker. Lectures, readings and case discussions will cover the topics dealing with financial problems of business investment decisions, liquidity management, major financial policies concerning dividends, growth and financial rehabilitation, as well as other contemporary financial issues and problems.

**MBA 866.3  
Security Analysis and Portfolio  
Management  
1/2(2L-1S)**

*Prerequisite(s): MBA 740, 750 and 806.* Deals with the determinants of investment values, investment risks and trade-offs between risk and return. It also considers securities markets, security analysis and valuation, portfolio selection, timing and management policies.

**MBA 882.3  
Human Resource Planning and  
Policies  
1/2(2L-1S)**

*Prerequisite(s): MBA 730 and 808.* Application of various theories to the allocation of human resources within an organization and within the national economy. Major topics include human capital investment, the internal labour market, wage structures, allocative structures and human resource forecasting.

**MBA 885.3  
Wage Administration  
1/2(2S-1P)**

*Prerequisite(s): MBA 730.* An introduction to the various aspects of compensation theory and practice. A brief general survey will cover such specialized fields as incentive systems, payment system associated with performance appraisal, executive compensation, and various forms of wage discrimination. However, emphasis will be placed on a detailed study, through the extensive use of case data, of the various approaches to job evaluation systems, both quantitative and non-quantitative. Consideration will be given to the relationship between the internal wage structure and the market.

**MBA 886.3  
Personnel Management  
1/2(2L-1S)**

*Prerequisite(s): MBA 720 and 730.* Beginning with a review of literature in the field of personnel administration, contemporary practice in the selection, placement and compensation of personnel will be studied.

**MBA 895.3  
Topics in Management Science  
1/2(3L)**

*Prerequisite(s): MBA 810.* Provides an intensive exposure to applications of management science (operations research) to particular problems. A combination of lectures, special readings, and execution of actual projects will give the students experience in making quantitative models operational in the decision process of an organization.

**MBA 898.3  
Independent Readings and Study in  
Business Administration Topics  
1/2(3T) or 1&2(1.5T)**

The student pursues an approved program of readings and study under the supervision of an individual faculty member. The subject should be other than those dealt with in listed MBA courses and must be approved by the relevant faculty member, the Department Head, and the program director.

**MBA 992.3  
Project in Business Research  
Methodology  
1/2(3S)**

This seminar is designed for M.B.A. students who have chosen not to write a thesis. After initial discussion of the literature on research methods, the seminar will focus on problems in areas of interest to the individual students. The emphasis will be placed on the writing of clear and suitable research proposals: format, organization of ideas, topical coverage, and appropriate survey of literature. Specific proposals in various stages of development will be the subject of discussion.

**MBA 994  
Research**

Students undertaking research should register in this course each year until the Master's thesis is completed. This applies to work done extramurally and intramurally.

**CHEMICAL ENGINEERING**

The Department of Chemical Engineering offers programs leading to the M.Eng., M.Sc. and Ph.D. degrees. Research projects in Chemical Engineering are concerned with the following areas: multiphase fluid mechanics, mass transfer, chemical thermodynamics and thermodynamic modeling, process control, crystallization, corrosion, biochemical engineering, pollution control, environmental engineering, catalytic reaction engineering, biofuels, fluidized bed reactors, heavy oil upgrading, renewable energy and chemical processes. All of these research areas are of interest in Western Canada as well as nationally and internationally. Further details are contained in a brochure available from the departmental office.

*Note:* Also see listing of courses in the Chemistry section of the *Calendar*.

Before registering in any of the following courses, students are advised to contact the Head of the Department for a list and timetable of courses to be offered in the current academic year.

**CH E 861.3**  
**Fundamental Biochemical Engineering**  
**1/2(3L-1P)**

The chemical engineer will learn the fundamentals of microorganisms and their uses in industrial situations. The elements of organism structure, biochemical molecules and biochemical reactions will be covered. Attention will be focused on batch vs continuous fermentations and the operations of aeration, mixing and sterilization. A batch biochemical experiment will be included.

*Note:* Students with credit for CH E 461 will not receive credit for this course.

**CH E 862.3**  
**Advanced Biochemical Engineering**  
**1/2(3L-1P)**

*Prerequisite(s):* CH E 461 or 861; or permission of the instructor.

Covers the most recent areas of research progress in biochemical engineering. Topics include novel bioreactors, large-scale cultivation of plant or mammalian cells, novel and optimum fermentation systems and downstream processing techniques.

**CH E 873.3**  
**Process Dynamics and Control**  
**1/2(3L)**

*Prerequisite(s):* CH E 423; or equivalent. Computer-controlled systems and mathematics of discrete-data systems will be introduced. Design of deterministic digital controllers of single-input, single-output and multi-input, multi-output processes in the z-domain and in the state-space domain will be studied. Off-line and on-line process identification techniques, using the time-series approach, will be investigated. Digital controllers for stochastic processes such as minimum-variance (MV) controllers, generalized MV controllers, and self-tuning

controllers will be discussed. Computer aided design control system software packages will be used.

**CH E 874.3**  
**Mass Transfer**  
**1/2(3L)**

Advanced topics in mass transfer: theoretical models, absorption with simultaneous chemical reaction, with design of a packed column for absorption with reaction.

**CH E 875.3**  
**Reaction Kinetics and Reactor Design**  
**1/2(3L)**

Topics will include: Heterogeneous catalysis, non-ideal flow through reactors, non-catalytic gas-solid reactors and fixed and fluidized bed catalytic reactors.

**CH E 877.3**  
**Mathematical Methods in Chemical Engineering**  
**1/2(3L)**

*Prerequisite(s):* CH E 322; or equivalent. Linear Algebra and numerical methods for the solution of systems of equations. Advanced numerical methods for the solution of non-linear ordinary and partial differential equations encountered in fluid mechanics, heat and mass transfer and chemical engineering kinetics.

**CH E 878.3**  
**Chemical Engineering Thermodynamics**  
**1/2(3L)**

*Prerequisite(s):* CH E 323; or equivalent. Deals with the principles of thermodynamics, equations of state, phase and chemical reaction equilibria, solution theory, and applications to industrial problems.

**CH E 881.3**  
**Process Engineering**  
**1/2(3L)**

Examines the methods of process engineering used to achieve the best overall processing systems and includes: synthesis of processing alternatives; structure of process system; process economics; optimization applications and methods; engineering in the presence of uncertainty; simulation approach to difficult processing situations; problem assignments; involving class discussion, with special emphasis on a knowledge of chemical processes. A term paper will be required.

**CH E 882.3**  
**Design of Industrial Waste Treatment Systems**  
**1/2(3L)**

Designed to provide the student with the fundamentals of air and water pollution problems and the control technology and legislation associated with these problems.

**CH E 884.3**  
**Corrosion Engineering**  
**1/2(3L)**

Intended for engineers and others who wish to develop an appreciation of the principles of corrosion and corrosion control and their application to the selection of materials of construction and the protection of engineering systems.

**CH E 885.3**  
**Corrosion Control in Engineering Systems**  
**1/2(3L)**

Advanced course in engineering design for the prevention and control of corrosion in a wide range of engineering systems including: chemical and petrochemical plants; conventional and nuclear power plants; transportation systems; communications; structures. Several case studies of previous corrosion problems will be included.

**CH E 898.3**  
**Special Topics**  
**1/2(3T)**

Supervised investigation into selected aspects of advanced chemical engineering topics. This may take the form of assigned readings and seminars.

**CH E 990**  
**Seminar**

Papers and discussions on recent developments in chemical engineering. Graduate students are required to attend these meetings for the duration of their program. Every graduate student is expected to present a seminar related to their research or project at some time before they receives the graduate degree.

**CH E 994**  
**Research**

Students writing a Master's thesis must register for this course.

**CH E 996**  
**Research**

Students writing a Ph.D. thesis must register for this course.

**CHEMISTRY**

The Department of Chemistry offers programs leading to the M.Sc. and Ph.D. degrees. Research activities cover modern aspects of analytical, organic, inorganic, physical, and theoretical chemistry. In addition, several interdisciplinary fields are emphasized including biological chemistry, electrochemistry, spectroscopy and photochemistry, chemical structure, and interfacial and surface phenomena.

*Analytical Chemistry:* Elucidating speciation in systems of environmental and toxicological interest; exploring the fundamental aspects of quantitative solution speciation; electrochemical analysis with ultramicroelectrodes; development of electrochemical detectors for capillary electrophoresis; and flow-injection analysis.

*Biological Chemistry:* The study of the kinetics of enzymes-catalyzed reactions in order to understand the relationship between the structure, function, mechanism and evolution of enzymes; the bio-organic chemistry of nucleic acids; the study of the molecular and structural basis for site-specific recognition, covalent modification and cleavage of DNA by small molecules and proteins; the study of the role of the chemical and biochemical mediators involved in the interaction of

ecologically important organisms, with the ultimate goal of developing environmentally safe strategies for controlling plant pests and pathogens; the study of electron transfer in modified peptidic systems to gain insights into molecular recognition related to peptide-peptide interactions; ab initio quality electron densities for proteins, quantum-chemical drug design and toxicological risk assessment.

*Chemical Structure:* The x-ray crystallography of single crystals of potential drug molecules and protein molecules; use of multidimensional NMR to determine structures of biological molecules in solution; investigation of metal-ligand speciation using NMR methods; computation of the structure of drug molecules and proteins by electron density shape analysis; chemical structure elucidation of complex organic molecules utilizing modern spectroscopic techniques.

*Electrochemistry:* Evaluation of microelectrodes for potential sensor application, together with specialized fast electrochemical techniques; development of electrochemical detection methods for electrophoretic separations, in particular, adsorption processes, including analyte adsorption at the electrode interface; altering the response of various electrodes to specific proteins or ions by modifying the electrode surface with polymer and self-assembled ultrathin films.

*Interfacial and Surface Phenomena:* The design of ultrathin films with a specific quality or behaviour that arises from the film's molecular and supramolecular structures; the study of systems that self-organize at interfaces using thermodynamic methods to elucidate information on the supramolecular architectures created by these systems and to assess their potential as models for various fundamental biological interactions; the study of the kinetics and dynamics of interfacial electron transfer and ion-transfer processes such as reduction/oxidation and electroadsorption at the metal/solution interface.

*Spectroscopy and Photochemistry:* Spectroscopy, photophysics and photochemistry, with an emphasis on measuring structures of the electronic excited states of polyatomic molecules and the dynamics of their relaxation as a function of environment using laser methods; the applications of emission spectroscopy and excited state photophysics to solving problems in biology, biochemistry and analytical chemistry; the investigation of amphiphilic systems that self-assemble or form strong complexes by means of noncovalent bonding in part by spectroscopic techniques to gain insight into the precise morphologies and mechanism of association in these systems; photochemical and photophysical processes of actinide and transition-metal complexes and photo-oxygenation of saturated hydrocarbon compounds as well as radiolysis of transition-metal complexes and of organometallic compounds.

**Synthetic Chemistry:** Developing new synthetic methods and demonstrating the utility of these methods in short syntheses of chiral natural products in optically pure form; the design, development, and demonstration of new strategies for application in syntheses of natural products and their analogues; combining peptide chemistry with organometallic chemistry aimed at providing working models for reaction centers of metallo-proteins and the study of electron transfer in proteins; rationally designing assemblies to target specific DNA sequences utilizing mechanistic organic concepts, synthetic methods; the rational design and synthesis of selective antifungal agents as well as the synthesis of agronomically important phytoalexins and phytotoxins and biologically relevant secondary metabolites; the chemical synthesis and biosynthesis of enzyme substrates, pseudosubstrates, and inhibitors, as well as chemical models of enzymatic reactions.

**Theoretical Chemistry:** Macromolecular quantum chemistry, ranging from molecular modeling and molecular shape analysis to chirality measures, new symmetry theorems, molecular reactivity, drug design and toxicological risk assessment.

**X-ray Spectroscopy and Microscopy:** X-ray absorption spectroscopy and microscopy studies of polymeric systems; elucidating core excitation and decay processes in organic material; exploring the formation of chemical nano and microstructure of polymer materials (blends, composites) by x-ray microscopy.

Before registering in any of the following courses, students are advised to contact the Head of the Department to check if and when a course is to be offered.

**CHEM 820.3**  
**Physical Methods of Molecular Structure Determination**  
1/2(3L)

**CHEM 823.3**  
**Selected Topics in Analytical Chemistry**  
1/2(3L)

**CHEM 824.3**  
**Analytical Separation Techniques**  
1/2(3L)

Basis theory and principles of separation will be discussed for modern chromatographic techniques used in qualitative and quantitative analytical chemistry. The focus will be mainly on modern liquid chromatography and capillary electrophoresis.

**CHEM 825.3**  
**Advanced Electrochemistry**  
1/2(3L)

Advanced theory of phenomena occurring at the electrode-solution interface will be discussed in relation to their application in modern electrochemical techniques of analysis. Various practical aspects of electroanalysis will be considered including its use in qualitative and quantitative

analysis and in studies of kinetics and thermodynamics.

**CHEM 829.3**  
**Applied Techniques in Analytical Chemistry**  
1/2(3L)

*Prerequisite(s): CHEM 322 (or 329); or equivalent.*

Practical aspects of modern instrumental analysis, such as statistical treatment of data, special considerations for trace analysis, sampling techniques, and automation are covered. The laboratory is designed to give the student an opportunity to apply these topics to a project focused on an instrumental technique (including computer interfacing) of their choice.

**CHEM 832.3**  
**Selected Topics in Inorganic Chemistry**  
1/2(3L)

**CHEM 834.3**  
**Selected Topics in Physical Chemistry**  
1/2(3L)

**CHEM 835.3**  
**Selected Topics in Theoretical Chemistry**  
1/2(3L)

**CHEM 836.3**  
**Special Topics in Theories of Solutions**  
1/2(3L)

A brief but critical study of the theories and concepts of the liquid state followed by a discussion of selected topics illustrating the importance of solvent effects in the study of solutions.

**CHEM 837.3**  
**EPR Spectroscopy**  
1/2(3L)

The basic theory of EPR spectroscopy, general features and analysis of spectra, experimental methods and applications to chemical problems.

**CHEM 838.3**  
**Chemistry of the Excited State**  
1/2(3L)

The structure and reactions of atoms and molecules in electronically excited states will be discussed. Particular attention will be paid to the processes by which excited states may be produced and deactivated. Examples from recent literature will be considered.

**CHEM 840.3**  
**Photochemistry**  
1/2(3L)

An introduction to the theory and techniques of photochemistry and its applications.

**CHEM 841.3**  
**NMR Spectroscopy**  
1/2(3L)

The basic theory of NMR spectroscopy, general features and analysis of spectra, experimental methods and applications to chemical problems.

**CHEM 842.3**  
**Chemical Thermodynamics**  
1/2(3L)

Selected topics in chemical thermodynamics.

**CHEM 845.3**  
**Chemical Kinetics**  
1/2(3L)

Kinetic theories, techniques and methods of their application to reactions in the gas and liquid phase.

**CHEM 848.3**  
**Theoretical Chemistry**  
1/2(3L)

*Prerequisite(s): CHEM 346; or equivalent.*

The application of the principles of quantum mechanics to the study of molecular structure.

**CHEM 849.3**  
**Radiation Chemistry**  
1/2(3L)

The action of ionizing radiations on chemical systems is described.

**CHEM 850.3**  
**Principles of Organic Synthesis**  
1/2(3L)

The advantages and limitation of new and general methods of synthesis.

**CHEM 851.3**  
**Stereochemistry and Asymmetric Synthesis**  
1/2(3L)

The fundamental principles of stereochemistry and stereoisomerism in organic compounds will be described. Various strategies and methods for the synthesis of enantiomerically pure compounds will be discussed.

**CHEM 852.3**  
**Selected Topics in Organic Chemistry**  
1/2(3L)

**CHEM 855.3**  
**Organic Reactions**  
1/2(3L)

A survey of organic reactions and reagents including reaction mechanisms and synthetic applications.

**CHEM 858.3**  
**Natural Products Chemistry**  
1/2(3L)

Provides a basic knowledge of natural products chemistry with emphasis on secondary metabolism. Topics covered include an overview of primary and secondary metabolism, modern techniques for studying secondary metabolism, biological reactions, chemical interactions between living organisms, and classes of bioactive compounds grouped according to building blocks and biogenesis.

**CHEM 859.3**  
**The Organic Chemistry of Transition Elements**  
1/2(3L)

Topics include the chemistry of  $d$  and  $f$  ligands of transition metals, the 18 electron rule, the iron group metallocenes, transition metal acetylene and carbon complexes, alkene, allyl and ethyl complexes, the use of transition metal complexes in organic synthesis.

**CHEM 860.3**  
**Proteins and Nucleic Acids**  
1/2(3L)

The structure and conformation of proteins and nucleic acids and the properties of these biopolymers in aqueous solution, methods of separation and molecular weight determination including chromatography, electrophoresis, sedimentation and diffusion are discussed. The biosynthesis of these polymers is examined in detail.

**CHEM 990**  
**Seminar**

Papers and discussion on recent developments in Chemistry. Graduate students are required to attend these meetings for the duration of their program, and during this period, are expected to present a seminar.

**CHEM 994**  
**Research**

Students writing a Master's thesis must register for this course.

**CHEM 996**  
**Research**

Students writing a Ph.D. thesis must register for this course.

## CIVIL ENGINEERING

The Department of Civil Engineering offers programs leading to the Postgraduate Diploma, M.Eng., M.Sc. and Ph.D. degrees.

Graduate courses in Civil Engineering are offered in three broad areas: Transportation and Geotechnical Engineering, Structures and Materials Science, and Water Sciences.

Studies in Transportation, Geotechnical Engineering and Geo-environmental Engineering include topics on terrain evaluation, transportation systems, pavement management, geometric design, traffic engineering, physio-chemical properties of soils, frozen soils, unsaturated and swelling soils, volume change and shear strength, slope stability, saturated-unsaturated seepage, contaminant transports, solid waste management, foundation and retaining wall design.

Studies in Structures and Materials Science include topics on structural analysis, dynamics of structures, theory of elasticity, theory of plates and shells, plastic design, structural steel design, advanced reinforced concrete, prestressed concrete and concrete technology.

Studies in Water Sciences include topics on: environmental engineering, water quality, advanced water and waste treatment, water resources development, river and canal engineering, open channel flow, hydraulic structures and machinery, wave mechanics, surface hydrology, statistical hydrology.

Active research programs are conducted in several major areas: geotechnical, geo-environmental, engineering geology, waste management in the resource industry, domestic and industrial waste management, environmental, hydrology and soil

salinization, transportation and transportation economics, hydraulic structures, concrete materials, reinforced and masonry concrete, and steel composite structures.

**C E 801.3  
Indeterminate Structural Analysis  
1/2(3L)**

Reviews approximate methods for analyzing the effect of lateral forces on tall buildings. The analysis of arches. The slope deflection method. Matrix techniques as used in the force and displacement methods of analysis for application with digital computers.

**C E 802.3  
Theory of Elasticity I  
1(3L)**

Introduction; plane stress and plane strain; two dimensional problems in rectangular and polar co-ordinates; analysis of stress and strain in three dimensions, elementary problems of elasticity in three dimensions.

**C E 804.3  
Advanced Dynamics of Structures  
2(3L)**

*Prerequisite(s): MATH 338 or equivalent.*

Behaviour of materials and structures under dynamic loading; simplified analysis and design principles of structures subjected to wind, earthquake and other dynamic loading.

**C E 807.3  
Numerical Methods in Structural  
Engineering  
1/2(3L)**

The nature of complex problems in structural engineering and the numerical methods available for obtaining practical solutions, with emphasis on finite difference, series and energy methods for boundary value problems, and numerical integration procedures for initial value problems.

**C E 808.3  
Elastic Stability  
2(3L)**

Structural stability problems; stability of equilibrium; exact and approximate solutions of elastic stability of columns including Newmark's Methods of numerical integration; study of beam-columns; local and lateral buckling of beams.

**C E 809.3  
Plastic Analysis and Design  
1(3L)**

The elastic and plastic properties of structural metals; fundamental principles of ultimate load analysis of structural members and rigid frames; designed procedure for rigid frame structures.

**C E 810.3  
Structural Steel Design  
1(3L)**

An advanced study of the design of structural steel members with emphasis on recent changes in design specifications, covering tension members, compression members, local and torsional buckling, beams, and beam-columns.

**C E 815.3  
Advanced Reinforced Concrete  
1/2(3L)**

Behaviour of reinforced concrete beams under bending moment and shear. Analysis and design of reinforced concrete two-way slabs.

**C E 816.3  
Prestressed Concrete  
1(3L)**

Material, prestressing systems and loss of prestress. Analysis and design of determinate structures: working stresses, ultimate design, shear, bond, bearing and deflection. Indeterminate structures: continuous beams, floor slabs and frames.

**C E 818.3  
Concrete Technology I  
1/2(3L)**

Types of cements, compounds of cements, structure of cement paste, theory and practice of aggregate grading, fresh concrete, mix design of concrete.

**C E 819.3  
Concrete Technology II  
1/2(3L)**

Nature of strength of concrete, elasticity, shrinkage and creep, chemical and physical durability, testing of concrete, light weight and high density concretes.

**C E 821.3  
Surface Water Quality  
1/2(3L-1.5P)**

Water quality aspects of rivers and lakes and implications of waste water input are discussed. Topics include surface water quality parameters, point and non point source input characteristics, water quality measurements, mixing and self-purification processes, water quality modelling methods.

**C E 822.3  
Sanitary Engineering I  
1/2(3L-1.5P)**

Water chemistry fundamentals underlying water and waste water treatment methods and groundwater chemistry are discussed. Principles covered include kinetics, chemical equilibrium, acid-base systems, complexation, precipitation-dissolution and oxidation reduction.

**C E 823.3  
Sanitary Engineering II  
1/2(3L-3P)**

Application of physical, chemical and microbiological principles in water and waste water treatment operations processes, design and control.

**C E 824.3  
Advanced Physical Chemical  
Treatment  
1/2(3L)**

Detailed study of the theory and design of physical and chemical unit processes utilized in water and wastewater treatment. Equalization, sedimentation, flotation, adsorption, gas stripping, membrane process, neutralization, disinfection, water softening, chemical oxidation, ion exchange are discussed.

**C E 825.3  
Biological Waste Water Treatment  
1/2(3L)**

Detailed study of the theory and design of biological suspended-culture and attached-culture systems utilized in domestic wastewater treatment. Activated sludge processes, aerated lagoons, trickling filters, rotating biological contactors, submerged biofilm process, sequencing batch reactors, sludge digestion are discussed.

**C E 826.3  
Solid and Hazardous Waste  
Management  
1/2(3L)**

Problems in solid and hazardous waste management are covered with respect to long term closure and containment. Principles of soil cover design are reviewed. Other topics include nuclear waste disposal, disposal of mining tailings and the design of municipal landfills.

**C E 830.3  
Advanced Open Channel Flow  
1/2(3L)**

Hydraulics of open channel flow. Basic principles; specific energy; specific force; uniform flow; water surface profiles; hydraulic jump; slope-area and contracted area method; transitions for subcritical and supercritical flow; flood routing; spatially varied flow. Laboratory work includes practical design problems and some experiments in the fluid mechanics laboratory.

**C E 831.3  
Wave Mechanics (Free Liquid  
Surfaces)  
1/2(2L-3P)**

The theory of long and short waves on open water with practical applications to regional conditions and problems. Topics include: long wave theory; applications to natural channels and canals; oscillations in chambers; tides; numerical methods of solving long wave equations - finite differences - method of characteristics - computer application; short wave theory; generation by wind, wave patterns at obstructions; shallow water effects; practical applications - wave resistant structures; sediment transport.

**C E 832.3  
Sediment Transport and River  
Engineering  
1/2(2L)**

Analysis, design and control of channels, canals, and rivers, with erodible boundaries. Topics include initiation of sediment movement, transport processes, sediment transport equations, scour and deposition. Regime Theory for canals and rivers, other river development equations, channel roughness, control of rivers and effects of these controls, movable bed models. Term papers on a topic chosen by the student may be required.

**C E 833.3  
Water Resources Development  
1/2(3L)**

Water availability and demand; basic data requirements; procedures for economic analysis, benefit-cost studies, and cost allocation; components and operating features of multi-purpose projects for flood

control, navigation, water power, irrigation, water supply, and recreation.

**C E 835.3  
Pumps and Hydraulic Transients  
1/2(3L)**

Theory of turbomachinery; design and selection of pumps; affinity laws; pumping plant layout; water hammer in pipelines; penstocks, and pumping systems; pressure relief, surge and surge tanks. Laboratory work includes tests on pumps, water hammer and surge apparatus.

**C E 840.3  
Surface Hydrology  
1/2(3L)**

Hillslope hydrologic processes are studied with particular emphasis placed on runoff producing mechanisms under both snowmelt and rainfall conditions. The influence of soil moisture conditions is of prime concern. The relationship between soil moisture and soil is studied in detail. The influence of evapotranspiration on soil moisture movement and runoff is also discussed.

**C E 851.3  
New Developments in Geotechnical  
Engineering  
1/2(3L)**

An introduction to the use of vertical and horizontal barriers in controlling contaminant migration. The factors and processes controlling the initial and long-term performance of soil cover, liners and cutoff walls are examined and illustrated with case histories. The use of geomembranes, geotextiles, chemical grouting, cement based grouting and other recent developments in barrier technology are also explored.

**C E 852.3  
Advanced Soil Mechanics Laboratory  
1/2(1L-3P)**

Laboratory investigation of advanced aspects of soil behaviour and testing, including consolidation, shear strength, compaction, index, grain size, permeability and specific gravity tests. Course requirements will include critical review and discussion of test methods, test results, and background literature.

**C E 854.3  
Unsaturated Soil Technology  
1(3L)**

Physico-chemical properties of clay soils, rheological properties of soils, behaviour of unsaturated soils, description of their stress state, measurement of soil suction, flow of water through unsaturated soils, shear strength of unsaturated soils, volume change behaviour of unsaturated soils, application of flow, shear strength and volume changes to practical engineering problems, theory of consolidation of moisture movement for unsaturated soils, pore pressure parameters and their estimation, measurement of soil properties such as the Soil-Water Characteristic curve.

**C E 855.3  
Volume Change and Strength  
Characteristics of Soils  
1(3L)**

Deformation of saturated soils; theories of primary and secondary consolidation;

settlement analysis; swelling properties of clays; shear strength theory for cohesionless and cohesive soils; pore pressure parameters. An introduction to critical state soil mechanics is also provided.

### **C E 856.3 Advanced Earth Structures 2(3L)**

Aspects of earth embankment design; seepage in composite sections and anisotropic materials by graphical and numerical methods; methods of stability analysis and their application to natural and artificial slopes; field observations and instrumentation.

### **C E 858.3 Foundation Design 2(3L)**

Advanced topics in soil mechanics: active and passive pressure; flexible bulkhead design; bearing capacity theories; dynamic and vibratory loads; design of piles and pile groups; load tests and their interpretation; theoretical, empirical and numerical solutions for foundation settlements including the selection of soil parameters.

### **C E 859.3 Site Exploration 2(3L)**

Principles of field exploration and monitoring for bridges, dams, building foundations, highways, slope stability problems, groundwater studies, industrial and urban site development. The application of basic principles of stratigraphy, structural geology, soil mapping, drilling technology, geophysics, survey control and instrumentation. Planning, execution and interpretation of data.

### **C E 861.3 Transportation Planning 1/2(3L)**

Transportation administration, planning goals, the design and the methodology of a land-use transportation study, continuation of the study and implementation of proposals. Problems and issues in the co-ordination of transport systems and agencies.

### **C E 862.3 Transportation Systems Engineering 1/2(3L)**

An introduction to the systems approach and probabilistic modelling discussion of the uses and limitations of systems in planning, and designing transportation facilities as well as analyzing the operation of existing transportation facilities.

### **C E 864.3 Terrain Evaluation 1/2(3L-3P)**

Air photo interpretation is used to evaluate the physical environment for engineering and environmental planning purposes. The emphasis is on the engineering significance of landforms and their materials.

### **C E 866.3 Pavement Management System I 1/2(3L)**

Stress analysis, theory and design of flexible and rigid pavements, aggregates, soil cement, asphalt aggregate mixtures, salt, lime and other methods of stabilization, study of road tests.

### **C E 867.3 Pavement Management System II 1/2(2L-3P)**

Properties and tests of bituminous materials; rheology of asphalt; asphalt mix design; construction practices and control; performance of asphalt pavements.

### **C E 889.3 Finite Element Method 2(3L)**

Review of stiffness matrix method, two dimensional finite element analysis, plate bending formulations and non-linear problems; field problems, seepage, settlement, etc.; analysis of shells, vibration and stability problems; introduction to finite element methods followed by a separate group studies of specific field problems related to structures, geotechnical and transportation problems, engineering mechanics, etc.

### **C E 898.3/899.6 Special Topics 1/2(L/S/P), 1&2(L/S/P)**

May consist of assigned reading, lectures by staff members, discussion periods and laboratory exercises with reports. Depending on the interests of the student and his supervisor, the topics are selected from one of the research fields of Civil Engineering, including: Structural, Soil, or Fluid Mechanics; Sanitary Engineering; Transportation Engineering and related subjects.

### **C E 990 Seminar**

A seminar is held periodically throughout the regular session. The current literature is reviewed and discussed. Graduate students are required to attend these meetings for the duration of their program.

### **C E 992.6 Project**

Students undertaking the non-thesis Master's degree (M.Eng.) must register in this course. It consists of independent study and investigation of a real world problem, and submission of an acceptable report on the investigation.

### **C E 994 Research**

Students writing a Master's thesis must register for this course.

### **C E 996 Research**

Students writing a Ph.D. thesis must register for this course.

## **CLASSICS**

Graduate programs leading to the M.A. in Classics are available only to exceptional students on a special case basis. Prospective students, who must have an Honours degree in Latin or Greek or in a cognate discipline combined with Latin or Greek, should consult the Head of the Department.

## **COMMUNITY HEALTH AND EPIDEMIOLOGY**

The Department of Community Health and Epidemiology offers a program leading to the degree of Master of Science. Applicants must hold a four-year Bachelor's degree in a discipline related to one of the Health Sciences, Basic Sciences, or Social Sciences, or from another relevant field, such as Health Care Administration. Fully qualified students are required to complete a minimum of 18 credit units of coursework, plus a thesis. The following courses are required of all students: CH&EP 800.3, 803.3, 804.3, and 805.3. Through their elective courses and thesis, students may concentrate on epidemiology and biostatistics, or on community health and health promotion.

Current research interests in the department include the epidemiology and control of cardiovascular disease, cancer, and respiratory diseases; health promotion; perinatal epidemiology; northern and Native health issues; psychosocial factors in health and health behaviour; biostatistics; and use of large administrative data files.

Please contact the Graduate Program Chair of the department for further information on the program and application procedures.

### **CH&EP 800.3 Epidemiology I 1/2(1.5L-1.5S)**

Introduces the basic epidemiologic methods used to evaluate the distribution and determinants of disease. Includes both lectures and interactive seminars to provide students with practical experience in epidemiologic problem-solving. Examples will be drawn from the fields of both communicable and non-communicable disease.

### **CH&EP 801.3 Epidemiology II 1/2(1.5L-1.5S)**

*Prerequisite(s): CH&EP 800; or equivalent and 3 credit units in statistics.* Advanced concepts of epidemiologic theory and methods. Advanced biostatistical techniques will be applied to a series of epidemiologic problems from the fields of communicable and non-communicable disease.

### **CH&EP 802.3 Community Health & Epidemiology Research Seminar 1/2(1L-2S)**

*Prerequisite(s): CH&EP 800; or equivalent.* Provides experience in the practical application of epidemiology and biostatistical principles to a specific research question.

Students develop a detailed research protocol on a subject of their choice.

### **CH&EP 803.3 Health Promotion 1/2(3S)**

*Prerequisite(s): Registered graduate student in Community Health and Epidemiology; or permission of the instructor.*

An introduction to theory, research, and practice in health promotion. Topics include: empowerment, constructivist and naturalist approaches, change in individuals, small group development, community development, healthy public policy, coalition-building and advocacy, linking research and action.

### **CH&EP 804.3 Community Health Issues 1/2(1-2L)(1-2S)**

Provides an overview of the field of community health, including health care organization and community-based approaches to health promotion and disease prevention.

### **CH&EP 805.3 Biostatistics 1/2(3L)**

*Prerequisite(s): STATS 244, 245; or equivalent.*

Designed for life sciences students who wish to understand and apply commonly used advanced statistical methods which they are likely to encounter in their career. The emphasis is on the appropriate application of these research methods and the correct interpretation of their results.

### **CH&EP 898.3 Special Topics**

These courses are offered occasionally by visiting faculty and in other special situations. Students interested in these courses should contact the department for more information.

### **CH&EP 990 Seminar**

A seminar is held periodically throughout the regular session during which current issues in research and practice are discussed. Graduate students are required to attend the seminars.

### **CH&EP 994 Research**

Students writing a Master's thesis must register for this course.

## **COMPUTER SCIENCE**

The Department of Computer Science offers programs leading to the M.Sc. and Ph.D. degrees. The department publishes a Graduate Handbook, which describes in greater detail the graduate programs offered, the requirements and prerequisites for these programs, and potential financial assistance for students. It is available upon request from the Department of Computer Science.

Enrolment in a graduate program for Computer Science, or permission of the department, is required for admission to any of the following courses. Interested students should consult the department for the list of courses to be offered in any given year.

**CMPT 810.3  
Algorithms  
1/2(3L)**

Advanced design and analysis of algorithms. Includes pattern matching in strings, augmenting algorithms on graphs (including network flows, connectivity, and matching), computational geometry (including convex hulls, Voronoi diagrams, intersection problems, and planar point location), parallel algorithms for shared memory and interconnection network models, and distributed algorithms.

**CMPT 812.3  
Knowledge Representation and Reasoning  
1/2(3L)**

Representation of knowledge in formal languages. Inference, logic programming, efficient automated theorem proving, search techniques. Nonmonotonic logic, diagnosis explanation and other patterns of plausible inference. Probabilistic approaches including stochastic search techniques, probabilistic nets, diagnosis, inferring structure from data, belief functions, and an overview of uncertainty formalisms.

**CMPT 813.3  
Programming Language Semantics  
1/2(3L)**

Introduces the principal ways in which programming languages are defined. The primary focus is on denotational semantics and the underlying domain theory; model theoretic semantics and computational proof theories may also be covered. Other topics considered include operational semantics, axiomatic semantics, algebraic specifications, and category theory.

**CMPT 814.3  
Introduction to VLSI Systems Design  
1/2(3L-3P)**

Emphasizes the design and related issues of VLSI-based systems, analysis of subsystems design approaches, specialized VLSI chips design, and VLSI impact on architectures. Includes MOS technology, CMOS circuits and logic design, array structures, subsystem design, system design aspects, and new trends in VLSI systems design.

**CMPT 815.3  
Computer Systems and Performance Evaluation  
1/2(3L)**

Provides a comprehensive overview of the quantitative aspects of computer systems with a particular focus on performance evaluation. Topics include performance measurement, the analysis and interpretation of measurement data, workload characterization and modeling, the design and evaluation of performance experiments, and the design and application of analytical techniques. A variety of application domains will be considered.

**CMPT 816.3  
Software Engineering  
1/2(3L)**

Concerns the major practical and theoretical concepts used in building large-scale software systems. Emphasizes current software development methodologies and tool support that accompanies the methodologies. The areas of software

development that will be emphasized are: requirements definition and analysis; system design; and implementation and testing.

**CMPT 818.3  
Queueing Theory and Modeling Applications  
1/2(3L)**

Markov and queueing processes in maintenance, inventory and traffic problems. The analysis of queues. Transient and steady state solutions.

**CMPT 819.3  
Image Processing and Computer Vision  
1/2(3L)**

An introduction to image processing and computer vision, including coverage of topics such as the basics of image representation and manipulation, edge detection, image segmentation, photometric stereo and shape from shading, optical flow, and pattern recognition.

**CMPT 823.3  
Compilers  
1/2(3L)**

The definition and classification of formal grammars. A discussion of regular and context-free grammars with their relationships to automata. Precedence, operator precedence, LR(k) and LALR(k) grammars with their associated syntactic analyzers, symbol table techniques, intermediate forms of source programs, run-time organization, code generation and optimization. Interpreters and their relation to the compilation process. Introduces translator writing systems and compiler-compilers.

**CMPT 826.3  
Data and Process Modeling  
1/2(3L-2P)**

Data and process modeling applied to the storage and manipulation of large amounts of data. Topics include conceptual database design, transformations for database schema, high level logical design with the ER model and the relational model, and database design tools. Applications and problems with object-oriented, knowledge, hypermedia and multimedia databases are covered.

**CMPT 829.3  
Computer Graphics  
1/2(3L)**

Introduction to computer graphics. An overview of passive and interactive graphics hardware. Software systems for graphics. Design philosophy for interactive systems. Data structure for graphics. Design of raster graphics algorithms. Rendering of realistic images using ray tracing and radiosity techniques.

**CMPT 850.3  
Topics in Computational Geometry  
1/2(3L)**

*Prerequisite(s): CMPT 810; or equivalent.*  
The study of geometric problems in a computational setting. May cover such topics as convex hulls, voronoi diagrams, proximity problems, linear programming, polygon decomposition, planar point location, multidimensional trees, range search, and visibility computations.

**CMPT 852.3  
Topics in Formal Artificial Intelligence  
1/2(3L)**

*Prerequisite(s): CMPT 812; or equivalent.*  
The representation of knowledge in formal languages and the technical problems arising in such representations. May include the comparative study of formalisms for reasoning with uncertain information, nonmonotonic reasoning, truth maintenance, constraint satisfaction, probabilistic causal nets, and belief revision.

**CMPT 853.3  
Topics in Logic Programming  
1/2(3L)**

*Prerequisite(s): CMPT 812 or 813; or equivalent.*  
An in-depth exploration into logic programming, its foundations, methods, architectures, applications, and extensions. Includes model- and proof-theoretic semantics and operational semantics. Other topics will vary according to instructor and class interest and may include: negation, implementation techniques, meta-programming, grammars, abstract interpretation, partial evaluation, constraint logic programming, extensions for parallelism, deductive databases, and amalgamating of logic programming with other declarative paradigms.

**CMPT 854.3  
Topics in Hardware, Architecture and VLSI  
1/2(3L)**

*Prerequisite(s): CMPT 814; or equivalent.*  
Emphasizes VLSI methodology and impact on computer architectures. Includes parallel architectures, VLSI testability and fault-tolerant computing. Particular attention will be in the design of fault-tolerant array processors, parallel architectures, neural computing, and multiple-valued logic. Various architectural and implementation issues will be addressed.

**CMPT 855.3  
Topics in Computer Networks  
1/2(3L)**

*Prerequisite(s): Previous course in Networks.*  
Includes low-level protocols (e.g., channel access protocols), routing, flow control, congestion control, transport layer protocols, protocol performance, and network measurement and workload characterization. Of particular interest are high-speed networks, B-ISDN and ATM, fast-packet switching, and gigabit networking.

**CMPT 856.3  
Topics in Software and Knowledge Engineering  
1/2(1.5L-1.5S-1.5P)**

*Prerequisite(s): CMPT 816 or 826; or equivalent.*  
Concerned with tools, methods, methodologies, and standards in the software engineering of conventional information systems, hypermedia and multimedia systems, and knowledge-based systems. Topics are to be selected from the following: requirements specification methodologies, object oriented design; process modeling; CASE environments and standards; software testing, validation,

metrics and quality assurance; reverse engineering; shells for knowledge-based systems; second generation expert systems; knowledge acquisition; and human-computer interfaces.

**CMPT 857.3 Bioinformatics and Computational Biology  
1/2(3L&3+S)**

*Prerequisite: Open to graduate students in computer science, life sciences, and natural sciences, but subject to permission of the instructors. Advanced undergraduate students may also take the course, subject to approval of the instructors and having 60 senior credit hours in any of computer science, life sciences, or natural sciences.*

An applications-based approach to major concepts and techniques in bioinformatics; characterization of bioinformatics and computational biology; application of various computer science concepts and techniques from areas such as artificial intelligence, databases, computational linguistics, simulation, networks; collaborative work in multi-disciplinary teams.

**CMPT 858.3  
Topics in Modeling and Operations Research  
1/2(3L)**

*Prerequisite(s): CMPT 818; or equivalent.*  
In-depth coverage of recent research areas from Operations Research, and applications to system modeling. Advanced topics from mathematical programming, queueing theory, inventory control, simulation, Markov modeling, and simulation.

**CMPT 859.3  
Topics in Computer Vision  
1/2(3L)**

*Prerequisite(s): CMPT 819; or equivalent.*  
Advanced topics in Computer Vision. Topics may be selected from the areas of image segmentation, shape-from-shading, stereo vision, shape representation and recognition, image tracking, and active vision.

**CMPT 860.3  
Topics in Algorithms  
1/2(3L)**

*Prerequisite(s): CMPT 810; or equivalent.*  
Advanced topics in algorithms. Areas covered may include parallel algorithms, distributed algorithms, on-line algorithms, graph algorithms (e.g., algorithms for special classes of graphs), advanced geometric algorithms, new algorithmic techniques, new algorithmic directions, complexity analysis, and computationally hard problems.

**CMPT 862.3  
Topics in Applied Artificial Intelligence  
1/2(3L)**

*Prerequisite(s): CMPT 812; or equivalent.*  
Topics in artificial intelligence focusing on intelligent systems and software. Topics will be selected from areas such as expert systems, intelligent tutoring systems, knowledge acquisition, machine learning, planning, natural language processing, qualitative reasoning, neural networks, and cognitive science.

**CMPT 863.3  
Topics in Functional Programming  
1/2(3L)**

*Prerequisite(s): CMPT 813; or equivalent.*  
Functional programming languages permit a wide variety of semantic definitions and a wide variety of implementation approaches. Explores selected topics in the semantics and/or implementation of these languages. May include: algebraic semantics, type theory, polymorphic type deduction, inheritance, graph reduction, data flow, systolic/wavefront arrays, and a variety of semantically sound optimization techniques.

**CMPT 865.3  
Topics in Parallel and Distributed  
Systems  
1/2(3L)**

*Prerequisite(s): Previous course in operating systems; CMPT 815; or equivalent.*  
Concerns selected design issues in distributed and parallel computer systems, particularly those most relevant to the goal of achieving high performance. In the parallel systems areas, such design issues arise in operating systems, run-time support software, compilers, and architecture. Topics concerning distributed systems may include interprocess communications, file systems, and load sharing, with emphasis on support for advanced parallel or multimedia applications.

**CMPT 866.3  
Topics in Human-Computer  
Interaction  
1/2(3L)**

*Prerequisite(s): CMPT 816 or 826; or equivalent.*  
Topics studied may include the analysis and design of human-computer interaction, user interface objects and tool kits, intelligent user interfaces and user modeling, adaptive system design, human-computer interaction standards, and computers in society.

**CMPT 880.3  
Research Methods and Topics I  
1&2(1.5L)**

*Prerequisite(s): Admission to the M.Sc. program in computer science.*  
An introduction to research methods and research topics in computer science. Selected topics are researched under the direct supervision of faculty members, and reports on the outcome of this research are given in both oral presentations and in written papers. Required of all students in the M.Sc. program.

**CMPT 890.3  
Research Methods and Topics II  
1&2(1.5L)**

*Prerequisite(s): Admission to the Ph.D. program in computer science.*  
A follow-up to CMPT 880 and is required of all Ph.D. students in Computer Science. The student focuses on two selected research areas, one oriented towards experimental aspects of computer science and the other towards theoretical aspects. Presentation of results of project work is given both orally and as written papers.

**CMPT 898.3  
Special Topics**

These courses are offered occasionally by visiting faculty and in other special situations. Students interested in these courses should contact the department for more information.

**CMPT 990  
Seminar**

All graduate students are required to register and regularly attend and participate in the department seminar series throughout their period of residence. Ph.D. students are required to present a seminar based on their own research.

**CMPT 994  
Research**

Students writing a Master's thesis must register for this course.

**CMPT 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**CONTINUING EDUCATION**

See Education in this section of the *Calendar*.

**CROP SCIENCE AND PLANT  
ECOLOGY**

See Plant Sciences in this section of the *Calendar*.

**CURRICULUM STUDIES**

See Education in this section of the *Calendar*.

**DRAMA**

Graduate programs leading to the M.A. in Drama are available only to exceptional students on a special case basis. Prospective students should consult with the Head of the Department.

**DRAMA 990  
Seminar**

**ECONOMICS**

The Department of Economics has a graduate program leading to the M.A. degree. Candidates for the Ph.D. will be accepted only under special circumstances when the Department can offer a program suited to the candidate's background and wishes. The intention is that with the M.A. degree students may proceed to doctoral work or be better prepared for private employment or the public service.

The department issues a separate brochure, which is available upon request, describing in detail the nature and requirements of the graduate. Information about the graduate program is also available on the web at [www.usask.ca/economics/index1.html](http://www.usask.ca/economics/index1.html). The department encourages students to use the email and submit their inquiries about the graduate program. The email address is [grad.econ@sask.usask.ca](mailto:grad.econ@sask.usask.ca)

**Master of Arts in Economics (Thesis  
Option)**

The degree requires 15 graduate-level credit units (5 graduate courses) plus a thesis after the honours degree or its equivalent. Candidates normally require 12 months to complete the degree program provided an early selection is made of the thesis topic. Candidates whose academic background is not equivalent to an honours degree will normally require 24 months to complete the degree. All applicants are expected to have an adequate preparation in statistics. All graduate students in the program must include ECON 800, ECON 801, and a graduate course in econometrics in their degree program.

**Postgraduate Diploma Requirements  
in Economics**

The Department of Economics offers a program leading to a Postgraduate Diploma. This program is designed particularly for people who have been away from university for some time and wish to broaden their knowledge at the graduate level on subjects peculiar to their professional interests. Full-time attendance for a regular academic session (September to April inclusive), or its equivalent, is not required by the department. Research is not a basic part of such programs, although candidates may be given the opportunity to become acquainted with research techniques.

The general regulations applicable to Postgraduate Diploma Programs are:

For admission to a Postgraduate Diploma program, students must have a Bachelor's degree from a professional college or a Bachelor of Arts degree with specialization in some subject or discipline comparable to that required for a B.A. (Honours) degree from this university, and a cumulative weighted average of at least 65% in each of the final two years of their undergraduate program.

A Postgraduate Diploma program consists of 30 credit units, at least 18 of which are normally required of a Master's candidate in the same field of specialization.

A person who has received a Postgraduate Diploma may be admitted subsequently to a Master's program. Relevant course work completed to fulfill the Diploma program requirements may be taken into account in determining the requirements for the Master's program. Regular Master's admission and minimum program requirements are applicable. Students who did not meet admission requirements for a Master's program at the time of admission to the Diploma program must complete at least 6 credit units at the graduate level, in addition to the project or thesis, as part of the Master's program. There may be additional course requirements, depending upon the pertinence, level and currency of the Diploma course work. The amount of course work required will be determined on an individual basis through recommendation of the department and approval of the College of Graduate Studies and Research. All requirements for a Postgraduate Diploma must be completed within a 5-year time period. This time is measured from the date of registration in

the first course work which applies to the Postgraduate Diploma program.

For further information on the Postgraduate Diploma please contact the Department of Economics.

**Master of Arts in Economics (Non-  
Thesis Option)**

The degree requires 24 graduate-level credit units (8 graduate courses) plus a research paper after the honours degree or its equivalent. Candidates normally require 12 months to complete the degree program provided an early selection is made of the topic for the research paper. Candidates whose academic background is not equivalent to an honours degree will normally require 24 months to complete the degree. All applicants are expected to have an adequate preparation in statistics. All graduate students in the program must include ECON 800, ECON 801, and a graduate course in econometrics in their degree program.

*Financial Assistance:* All applications received before January 31 are considered for financial assistance. The value of the scholarships and teaching fellowships are currently \$ 12,000 for twelve months.

**ECON 800.3  
Microeconomic Theory  
1(3L)**

Studies theories of exchange, consumer demand, production and cost, and pricing.

**ECON 801.3  
Macro-Economic Theory  
1(3L)**

A survey of macro-economic theory, and includes theories of the consumption function, theories of investment, money and interest rates, monetary and fiscal policy, and general equilibrium theory.

**ECON 802.3  
History of Economic Theory  
2(3L)**

Examines major developments in the history of economic theory.

**ECON 803.6  
Contemporary Economic Theory  
1&2(3L)**

Examines recent developments in theories of consumer demand and production

**ECON 805.3  
Mathematical Analysis in Economics  
1/2(3L)**

A study of the mathematical formulation and investigation of economic relationships. Topics include the theory of consumer demand, theory of the individual firm, input-output analysis, models of aggregate economic activity and economic growth.

**ECON 806.3  
Monetary Theory  
2(3L)**

Examines the relationships between the stock of money and income, employment, and price levels.



**ECON 807.3  
Advanced Analysis of Economic  
Development  
1/2(3L)**

Studies of the economic developments of Canada and the United States are undertaken to apply modern methods, theories, and approaches to understanding Canadian and American economic development. Emphasizes understanding particularly Canadian economic and institutional trends.

**ECON 808.3  
Applied Econometrics Model  
Building and Estimation  
1(3L)**

Deals with Econometric techniques, construction of appropriate econometric models, development of data sets, and estimation and interpretation of results, as they apply to economic problems.

**ECON 809.3  
Advanced Techniques in Econometrics  
2(3L)**

Considers advanced topics in econometric techniques and examines recent developments in the field as they pertain to economic science.

**ECON 811.3  
International Trade Theory  
1/2(3L)**

Studies recent developments in the pure theory of trade. Topics include current explanations of patterns of trade and factor movements, the formation of regional free trade areas, commercial policies and international cartels.

**ECON 812.3  
International Monetary Economics  
1/2(3L)**

The nature of adjustment in open economics, under various international monetary systems, to real and monetary disturbances. The systems investigated will include fixed exchange rates, both with and without sterilization, flexible exchange rates and managed floating.

**ECON 814.3  
Economic Growth  
1/2(3L)**

The theory of economic growth with topics selected from: the role of technical progress in the growth process, vintage production functions, putty-clay and clay-clay models, Harrod-Domar, Neoclassical and Cambridge growth models.

**ECON 815.3  
Economic History of Europe: 1815 to  
Present  
1/2(3L)**

Industrialization of England and the continent, related to developments in world trade, labour markets, business and labour organization, economic policies, and social institutions. Interwar stagnation, post-World War II recovery and the common market will be considered. The economic relationships between North America and Europe will be taken into account.

**ECON 816.3  
North American Economic History  
1(3L)**

Examination of economic development in North America since 1800 with particular reference to the role of government.

**ECON 817.3  
Economics of Developing Countries  
1/2(3L)**

Deals with the theories and policies of economic development primarily in developing countries of the Third World since 1945. Topics include agricultural development, industrial development, international trade, the financing of economic development, and income distribution.

**ECON 820.3  
Agricultural Policy  
1(3L)**

A study of recent developments in agricultural policy. Particular attention will be paid to the role of agriculture in programs to promote economic growth and development. Major differences in national approaches to the problems of agriculture will also be emphasized.

**ECON 821.3  
Industrial Organization and Public  
Policy  
2(3L)**

An analysis of the functioning of the price system in the market economy with different structures and conduct in order to assess market performance and economic welfare. The analysis will also include an examination of public policies and institutional constraints imposed on the Canadian market economy.

**ECON 823.3  
Labour Economics  
1/2(3L)**

*Prerequisite(s): Graduate standing in economics; or permission of the instructor.*

The functioning of labour markets including labour supply, labour demand, accumulation of skills, contracts, and unemployment.

**ECON 827.3  
Public Utilities Economics  
2(3L)**

Analyzes the conduct and performance of telecommunications, airline, electric, pipeline, gas and railway utilities. It will focus on the economics of pricing practices, costing procedures, capitalization, depreciation policy, product strategy, peak loading, technological evolution, rate base definitions, and vertical and horizontal integration in the context of public utilities.

**ECON 830.3  
Topics in Public Finance  
2(3L)**

A study of modern theoretical constructs and some of their applications. Topics include cost-benefit analysis, fiscal policy, the public debt, analysis of taxes and intergovernmental fiscal relations.

**ECON 831.3  
Economics of Natural Resources  
1/2(3L)**

Examines the economic theories of natural resource use. Topics include: static and

dynamic models of resource use; the problems arising from resource scarcities; criteria for intertemporal resource use; and public resource policies.

**ECON 840.6  
Canada-United States Economics and  
Political Relations  
1&2(3L)**

Recent trends in the economic and political relations between Canada and the United States will be arranged with particular reference to agricultural policies: capital investment; economic fluctuations; energy resources; foreign trade; trade union links; transportation; defence; and institutional arrangements for dealing with joint problems.

**ECON 845.3  
Regional and Urban Development  
Theory  
2(3L)**

Topics include selected aspects of regional and urban development theory and a critical review of recent regional planning programs in advanced countries.

**ECON 898.3  
Special Topics  
1/2(3L)**

Reading, essays and discussions in an approved special field. This course will be offered only in special circumstances.

**ECON 990  
Seminar**

Reports and discussion on current development and research. All graduate students in economics are required to register. Attendance and at least one paper is required for all postgraduate students during their time as a postgraduate student, whether for one year or more.

**ECON 992.6  
Project**

A required course for students following the non-thesis M.A. option. A research paper on an approved topic must be submitted. The topic may be empirical in nature, or a critical review of the literature, or a critical analysis of some theoretical problem. The paper will be examined by a supervisor and two other members of the department.

**ECON 994  
Research**

Students writing a Master's thesis must register for this course.

## EDUCATION

A student may be admitted for graduate work in Education if the student holds a B.Ed. degree with the necessary standing, or a four-year degree or equivalent in a disciplinary area appropriate to the graduate field of study along with a professional component of at least 30 credit units in the study of Education leading to a teaching certificate. Where the graduate program of the candidate is of such a nature that it neither requires nor leads to a teaching certificate, the student may be admitted on the basis of 18 credit units in Education rather than 30. If this requirement has not already been met in the student's undergraduate program, courses shall be prescribed by the

department. At least 12 of these prerequisite credit units will be in departments other than the department supervising the graduate work. However, if the degree for which the student is seeking candidature is the Master of Continuing Education, these 18 credit units may all be taken in the Department of Educational Foundations. The Master of Continuing Education degree requires a prerequisite of 12 credit units in the humanities and/or social sciences and 6 undergraduate credit units in Continuing Education which may be taken concurrently with the graduate program.

The following departments and programs offer programs leading to the degree of Master of Education, and some make available Postgraduate Diploma programs. Master's degrees may be obtained by the completion of an acceptable thesis or by the substitution of prescribed courses for the thesis. Interested students may acquire information about the various programs by writing to the *Associate Dean, College of Education, or to the Head of the appropriate department:*

- Curriculum Studies
- Educational Administration
- Educational Foundations
- Educational Psychology and Special Education
- Music Education

The Department of Educational Administration has a regular Ph.D. program. Programs leading to the Ph.D. degree in other departments are available only to exceptional students on a special case basis. Prospective students should consult with the Head of the Department.

Students' programs in Educational Foundations and Continuing Education can be arranged to permit access to the courses and faculty in both areas of study. Such programs may be designed to meet the requirements for the following:

- Master of Continuing Education
- Master of Education
- Postgraduate Diploma

The programs in Continuing Education meet the needs of those students whose primary interests are in Continuing, Adult, or Extension Education or Community Development. The programs in Educational Foundations are principally for students who wish to explore the anthropological, comparative/international, historical, philosophical, and sociological aspects of educational theory and practice. Special interests include moral education, critical theory, gender issues, analysis of educational policies, and multicultural education.

Each area of study has slightly different entrance requirements. For specific information, students should contact the respective graduate advisor.

## GENERAL COLLEGE

The following courses are offered under the aegis of the general college in order to supplement departmental program offerings. Registration is achieved through the sponsoring department.

**EDRES 800.3**  
**Research Methods: Introductory Level**  
**1/2(2L-2P)**

Introduction to research methods, with special reference to research in Education. The basic principles of research, both quantitative and qualitative, are discussed. Skills necessary for the production of research proposals are developed, e.g. techniques for surveying the research literature, and the collection and analysis of data.

**EDRES 840.3**  
**Statistical Methods: Intermediate Level**  
**1/2(3L-1P)**

*Prerequisite(s): Permission of the instructor.*

Selected parametric and non-parametric inferential tests. Analysis of variance, one-way and factorial designs, planned and post-hoc comparisons. Computer applications of these techniques with real and/or artificial educational and social science data will be an essential component.

**EDRES 841.3**  
**Statistical Methods: Advanced Level**  
**2(3L-1P)**

*Prerequisite(s): EDRES 840.*

Selected experimental and quasi-experimental designs relevant for research in education and behavioral sciences. Multiple and step-wise regression. Introduction to selected multivariate techniques. The use of the various techniques in actual and simulated data in education and behavioral sciences will be an essential component.

**EDRES 845.3**  
**Research Methods: Naturalistic (Intermediate)**  
**(3S)**

*Prerequisite(s): EDRES 800.*

Offers the opportunity to learn and practice inquiry processes for conducting naturalistic (qualitative) research. Within selected theoretical frameworks, the following techniques will be studied: framing the study, participant observation, interviewing, analytic induction and constant comparison, reporting.

**EDRES 898.3**  
**Special Topics**  
**1/2**

**EDUC 899.6**  
**Reading Course: Individual Reading and Study**  
**1&2(1T-8R)**

Provides an opportunity for students to pursue a topic of an interdisciplinary nature or multi-departmental concern. The topic must fall outside the scope of courses offered, although this provision may be waived with the consent of the departments involved. The student is responsible for defining the area of interest and the approval of the project by the sponsoring and cooperating departments must be gained prior to registration. The student undertakes intensive reading under the guidance of a staff supervisor and advisory committee and submits a major paper for assessment.

**EDUC 992.6**  
**Project**

The research or developmental project, required on the non-thesis option for the M.Ed., where the nature of the research or developmental project is inter-disciplinary or multi-departmental. The project must be accepted by a committee consisting of members from the sponsoring and co-operating departments and evaluated by this committee plus an external member.

**COMMUNICATIONS, CONTINUING AND VOCATIONAL EDUCATION**

The Department of Communications, Continuing and Vocational Education was dissolved effective July 1, 1993, and the programs and courses are offered by other departments. Programs of study and research leading to a Master of Continuing Education, Master of Education in Continuing Education, or Postgraduate Diploma in Continuing Education are offered by the Department of Educational Foundations. Programs of study and research leading to a Master of Education in Instructional Technology or Postgraduate Diploma in Instructional Technology are offered by the Department of Curriculum Studies.

**CURRICULUM STUDIES**

The Department of Curriculum Studies offers courses leading to the Postgraduate Diploma, M.Ed. degree with thesis, M.Ed. degree without thesis, and a special case Ph.D. program.

Courses within these programs are grouped around four major foci or themes of study: Leadership in Curriculum, Leadership in Teaching, Leadership in Core Areas of Study, and Leadership in Educational Communications and Technology. The Curriculum focus addresses curriculum design, development, implementation and evaluation. The Teaching focus concentrates on the study and analysis of teaching and professional growth and development. The Core Areas of Study focus allows students to pursue studies in the core subject and Global Education areas. The Educational Communications and Technology focus allows students to study and develop expertise in distance education, instructional development, library science and multimedia-based learning.

The Department of Curriculum Studies, College of Education and the College of Kinesiology have introduced a new graduate studies strand for physical education pedagogy. This new strand in the Department of Curriculum Studies is directed toward those who wish to develop a sound theoretical and practical knowledge base in physical education pedagogy in combination with a variety of curriculum, physical education and administration classes.

The Physical Education Pedagogy strand can be undertaken as a Master's degree

with thesis or Master's degree non-thesis (project). Each student's program will be individually designed based on a core of four required courses and a seminar. The Master's thesis program requires 24 credit units of course work, plus a thesis. The Master's non-thesis requires 30 credit units of course work, plus the project.

Prerequisites for graduate admission in Curriculum Studies normally includes a four year B.Ed. degree and a minimum of one year's successful teaching experience. However, in certain programs such as the Educational Communications and Technology focus, and the Physical Education subject area option, an undergraduate degree in an appropriate discipline along with successful professional experience is acceptable.

Postgraduate Diploma candidates will elect sufficient courses to complete a 30 credit unit program. M.Ed. thesis candidates complete a thesis (EDCUR 994) and a minimum of 24 credit units including EDRES 800.3 and EDCUR 801.6 or EDCMM 802.6. Candidates for the M.Ed. non-thesis option complete a project (EDCUR 992) and 30 credit units of coursework including EDRES 800.3 and EDCUR 801.6 or EDCMM 802.6.

For courses with prefix EDCUR, the middle digit of the three digit course number designates the subject area. Courses are grouped as follows:

- 000 General Curriculum and Instruction
- 010 Mathematics Education
- 020 Science Education
- 030 Teaching Effectiveness
- 040/070 Language Education
- 060 Second Language Education
- 080 Social Studies
- 090 Curriculum Research and Development

Educational Communications and Technology courses (EDCUR 891 and courses with prefixes EDCMM and EDIND) are found between the 080 and 090 EDCUR groupings.

Information about programs and the current research interests of faculty can be obtained by contacting the Department of Curriculum Studies.

**GENERAL CURRICULUM AND INSTRUCTION**

**EDCUR 801.6**  
**Principles and Practices of Curriculum Construction**  
**1&2(3L)**

A basic general curriculum theory course. Students investigate the complexities of the procedures, plans, personnel, processes, and problems in curriculum organization. Master's and Diploma candidates in Curriculum Studies are encouraged to complete this course prior to their intramural year.

**EDCUR 802.3**  
**Curriculum Development in Education**  
**1/2(3L)**

*Prerequisite(s): EDCUR 801.*

Provides a background for development of curricula in any of the disciplines of the elementary and secondary school and/or upon the total program or a division thereof. Current procedures, innovations, issues and problems are discussed. A study is made of research bearing upon school curricula and current trends.

**EDCUR 804.3**  
**Techniques and Practice of Curriculum Development**  
**1/2(3L)**

Offers the student an opportunity to develop in a practical setting the skills needed for critically ascertaining educational goals, assessing needs and developing curriculum materials with a team. Focus is upon schema for curriculum change in each student's own area of specialization.

**EDCUR 805.3**  
**Trends and Issues in Educational Research and Development**  
**1/2(3L)**

*Prerequisite(s): Teaching certificate.*

Contemporary school curriculum issues will be examined in the context of catalyst of change and strategies of change in the schools. Attention will be devoted to problems of the design and implementation of thesis proposal in the College of Education.

**EDCUR 807.3**  
**Language Communication and Curriculum**  
**1/2(3L)**

Examines the role of languaging processes and communication upon learning in content areas. Specifically, this course will explore the relationship between the structure of language used by students as they learn in specific subject areas and verbal interaction in the classroom.

**EDCUR 809.3**  
**Models and Methods for the Evaluation of Educational Programs**  
**1(3L-1P)**

*Prerequisite(s): EDCUR 801; or permission of the instructor.*

Examines current models for the evaluation of educational programs. The emphasis is on exploring the range of options which is available to the program evaluator and on developing an awareness of the strengths and limitations of the models. Problems in carrying out educational evaluations are also studied; examples of such problems are the utilization of evaluation results and the ethics of evaluation.

**EDCUR 810.3**  
**Design and Practice of the Evaluation of Educational Programs**  
**2(2L-4P)**

*Prerequisite(s): EDCUR 809.*

Takes the methods of evaluating educational programs and applies them to practical situations in classrooms, schools and school units. Particular attention will be paid to developing an awareness of the breadth of available techniques and to

understanding the practical problems which arise in the conduct of evaluations.

## MATHEMATICS EDUCATION

### EDCUR 816.3 Theory and Practice of Teaching Mathematics 1/2(3L)

*Prerequisite(s): 3 credit units in psychology of learning; 3 credit units in methods of teaching mathematics; 12 credit units in mathematics.*

Current practices used in the classroom will be related to the various theories of how children learn mathematics. Emphasis will be placed upon the mathematical implications and recent works of prominent individuals such as Piaget, Ausubel, Bruner, Davis, Dienes, Gagne, Skemp, Suppes, and others. Alternate classroom techniques in the teaching of mathematics will be examined in the light of basic research done by these theorists.

### EDCUR 817.3 Design and Use of the Mathematics Laboratory 1/2(3L)

*Prerequisite(s): 3 credit units in teaching of mathematics; 12 credit units in mathematics.*

Emphasizes the role of the laboratory in the elementary school mathematics program. Organizing and supervising the laboratory approach, planning laboratory investigations, facilities for and assessing the effectiveness of the laboratory approach will be topics examined in this course. A further consideration will be an examination of the value of the laboratory in the teaching of mathematics to the low achiever. This course is a sequel to EDCUR 816.

### EDCUR 818.6 Special Problems in the Teaching of Mathematics in the Secondary School 1&2(3L)

*Prerequisite(s): 3 credit units in teaching of mathematics in the secondary school; 24 credit units in mathematics.*

Emphasizes the problems surrounding the teaching of secondary school mathematics courses. Problem areas in the teaching of general mathematics, elementary algebra, geometry, and trigonometry will be identified and alternate approaches discussed. Curricula recommendations in these subject matter areas will also be discussed. An examination of various proposals for the twelfth grade mathematics program will be included.

### EDCUR 819.3 Trends and Issues in Mathematics Education 1/2(3L)

*Prerequisite(s): 12 credit units in mathematics and 6 senior credit units in mathematics education.*

Designed to acquaint advanced students with recent literature in the field of mathematics education. It will focus upon current problems and contemporary research in elementary and secondary school mathematics.

## SCIENCE EDUCATION

### EDCUR 820.3 Introduction to Graduate Studies in Science Education 1/2(3L)

*Prerequisite(s): 6 credit units of undergraduate-level science methods courses; 24 credit units of natural science courses (as defined by the Arts and Science section of the Calendar); or permission of the department.*

A survey of advanced studies in science education, prerequisite to all other graduate courses in science education. Topics include: the nature of the scientific enterprise; the interactions of science with society, stressing the implications to science education; new curriculum developments; objectives; and current issues and trends. Special emphasis will be placed on the philosophy and methodology inherent in these topics.

### EDCUR 821.3 Advanced Studies in Science Education 1/2(3L)

*Prerequisite(s): EDCUR 820.*

A continuation of EDCUR 820, but with more emphasis on individual and group projects. The major topic will be a survey of research in science education. Additional topics will be supplementary to EDCUR 820 and dependent on the interest and needs of the students.

### EDCUR 827.3 Colloquium in Science Education I 1/2(3S)

A seminar in which students will be encouraged to examine and present materials and ideas at the frontier level of science education. Contributions will be made by faculty members from science education and other departments.

### EDCUR 828.3 Colloquium in Science Education II 1/2(3S)

*Prerequisite(s): EDCUR 827.*

An advanced seminar in science education. Contributions will be made by students and faculty.

## TEACHING EFFECTIVENESS

### EDCUR 830.3 Research in Teaching Effectiveness 1/2(3L)

*Prerequisite(s): A valid teaching certificate; 3 years of successful teaching experience; an undergraduate degree in Education.*

Designed to provide students the opportunity to learn the magnitude of research in teaching and to become familiar with the knowledge of effective teaching resulting from the research. Content will be organized by areas of concentration of research and the contributions of major researchers. Regular observations in classrooms will provide an opportunity to identify teaching behaviours discussed in the research. Students will be required to demonstrate their effectiveness in teaching in the classroom.

### EDCUR 831.3 Analysis of Teaching 1/2(3L)

*Prerequisite(s): Research in Teacher Effectiveness; three years of successful teaching experience; an undergraduate degree in Education.*

Provides knowledge of models and methods of teaching which provide the parameters for analyzing micro teaching behaviours. Students will be expected to be competent in identifying and demonstrating models as well as analyzing the model itself.

### EDCUR 832.3 Practicum 1/2(3P)

Requires students to apply in schools the knowledge of teaching and/or supervision studied in course work. The specific in-school activities will include working in a classroom, with a teacher or intern and with a group of teachers conducting an in-service program.

## FRENCH EDUCATION

### EDCUR 860.6 Methods of Teaching French (Advanced) 1&2(3L)

*Prerequisite(s): Permission of the instructor.*

Methods of teaching French as a second language with concentration on current issues in French Education.

## LANGUAGE EDUCATION

### EDCUR 843.3 Reading: Process and Practice 1/2(3L)

Provides a theoretical and research basis for understanding reading as a socio-psycholinguistic process. The aim is to seek instructional implications of theory and research as they impact on issues of reading and constructing meaning from written discourse.

### EDCUR 846.3 Advanced Study of Reading Programs 1/2(3P)

*Prerequisite(s): EDCUR 843; or written permission of the instructor.*

Provides practical experience in the planning, supervision, and evaluation of reading programs by an analysis of the theoretical and real roles of the teacher, principal, consultant, and administrator.

### EDCUR 870.3 Literacy Education and Curriculum: Research and Scholarship 1/2(3L)

*Prerequisite(s): 12 credit units in English and 6 senior credit units in Language Arts Education; or permission of the instructor.*

Examines the field of language education, emphasizing developments at the elementary, middle years and secondary school levels. Topics include language and thought, language and learning, language arts, curricula, resources, writing and the writing process, literature and the response process, and research in language education.

### EDCUR 871.3 Trends and Issues in the Teaching and Study of Language 1/2(3L)

*Prerequisite(s): 12 credit units in English and 6 senior credit units in English Education; or permission of the department.*

Includes the study of those aspects of linguistics, including sociolinguistics, psycholinguistics, pragmatics, applied linguistics, and other topics of language and language study, such as syntax and grammar, which have a direct relationship to classroom practice.

### EDCUR 872.3 Trends and Issues in the Teaching and Study of Writing 1/2(3L)

*Prerequisite(s): 12 credit units in English and 6 senior credit units in English Education; or permission of the department.*

Covers theories and processes of writing and composing, the teaching of writing, and evaluation and assessment of writing.

### EDCUR 874.3 Trends and Issues in the Teaching and Study of Literature and Response to Literature 1/2(3L)

*Prerequisite(s): 12 credit units in English and 6 senior credit units in English Education; or permission of the instructor.*

Includes theory and research on response to literature, the teaching of literature, and literary criticism. Also deals with selection of literature, censorship, and literature-based programs.

### EDCUR 875.3 Ethnographic Studies in Literacy and Language in Educational Settings 1/2(3L)

*Prerequisite(s): EDRES 800.*

Enables participants to plan and carry out field-based research in literacy and language. Participants will study and apply ethnographic techniques, including observation, document and artifact collection and interviews, to gather data on literacy and language in classroom settings.

## SOCIAL STUDIES EDUCATION

### EDCUR 887.3 Issues and Trends in Social Studies Education I 1/2(3L)

*Prerequisite(s): At least 3 credit units in the methods of teaching social studies plus at least 12 senior Arts and Science credit units in the social sciences.*

A variety of issues and trends across the whole field of Social Studies Education. Issues to be identified and analyzed are: the place of the social science disciplines in social studies education; the objectives of social studies education; the various patterns for organizing curricula; the various types of methods, the use of various types of materials, and methods of evaluation.

### EDCUR 888.3 Issues and Trends in Social Studies Education II 1/2(3L)

*Prerequisite(s): At least 3 credit units in the methods of teaching social studies plus at*

least 12 senior Arts and Science credit units in the social sciences.

Extends beyond the identification and understanding of theories related to Social Studies Education as explored in EDCUR 887 to an evaluation of theoretical issues as they are applied to actual programs and materials. Focus is on research and development. Included are analyses of Social Studies curricula; the evaluation of materials and programs in terms of value development, skill processes, and cognitive orientations; viewing curricular and methodological strategies in Social Studies from the perspectives of evaluation and research; opportunities to develop and critique instructional materials and associated teaching methodologies.

**EDCUR 889.3  
Canadian Social Studies Education  
1/2(3L)**

*Prerequisite(s): At least 3 credit units in the methods of teaching social studies plus at least 12 senior Arts and Science credit units in the social sciences.*

Designed for senior or graduate students wishing to specialize in Social Studies Education. The present status and structure of Social Studies Education in Canada will be examined through its philosophical and historical development. Canadian Social Studies curricula will be surveyed in order to determine the contributions made by the various Social Science disciplines. Special attention will be given to strategies, materials and processes developed in Canadian Studies Projects and their implications for Canadian Social Studies Education.

**EDUCATIONAL COMMUNICATIONS  
AND TECHNOLOGY**

**EDCMM 802.6  
Historical and Theoretical  
Foundations of Educational  
Technology  
1&2(3L)**

Examines the historical, philosophical and theoretical foundations of the field of educational technology. Focuses on the maturation of theory and research in this area of study, and the impact of educational technology on educational institutions and practice.

**EDCMM 803.3  
Principles & Practices of Authoring  
Interactive Instruction  
1/2(3L)**

*Prerequisite(s): EDCMM 370 or equivalent computer applications course and EDCMM 873; or an equivalent course in instructional design.*

Presents procedures and principles for planning, producing and evaluating computer-based instruction, and how to develop the necessary print-based support materials required for its implementation.

**EDCMM 804.3  
Distance Education: Theory and  
Practice  
1/2(3L)**

The historical and theoretical foundations of distance education from a provincial, national and international perspective. Surveys the development, organization, and

practice of distance education for various educational endeavours. Focuses specifically on distance education in Saskatchewan and compares the Saskatchewan situation with similar systems across Canada.

**EDCMM 873.3  
Designing Materials for  
Individualized Instruction  
1/2(3L)**

*Prerequisite(s): EDCMM 472; or permission of the department.*

An applied course in which principles of instructional design are used to produce self-instructional materials. Students do a major project in which they plan and implement a self-instructional module in a medium of their choice.

**EDCMM 876.3  
Organization and Administration of  
Media Centres  
1/2(2L-1S)**

*Prerequisite(s): EDCMM 472; or experience and permission of the department. It is recommended that students enrol in EDCMM 473.*

An examination of the operation of audiovisual programs in elementary and secondary schools and school units. The course considers the facilities, materials, equipment and services required in an audio-visual program and the budgeting, personnel and staff relations required for its operation.

**EDCMM 877.3  
Advanced Cinematography in  
Education  
1/2(2L-1S)**

*Prerequisite(s): EDCMM 476; or experience and permission of the department.*

Designed to allow students to continue film-making experiences encountered during EDCMM 476. The student will have the opportunity to script, direct, produce, and edit an individual medium length motion picture film. The highly individualized course gives the student wide latitude and flexibility in content, technique and production time.

*Note:* The student should be prepared to spend approximately \$25.00 on film stock and somewhat more time than is normally required for a 3 credit unit course.

**EDCMM 879.6  
Television in Education  
1&2(2L-1P)**

*Prerequisite(s): EDCMM 476, or experience and permission of the department.*

Investigates development of open and closed circuit television in educational institutions and integration of television into formal and informal learning situations. Development of knowledge and skills in television production, direction and script writing will be stressed in practical laboratory situation. Students will undertake major projects simulating those now utilized in educational TV.

**EDCMM 898.3  
Special Topics**

These courses are offered occasionally by visiting faculty and in other special situations. Students interested in these courses should contact the department for more information.

**EDIND 865.3  
Use of Media as an Aid to  
Cross-Cultural Communication  
1/2(1L-2P)**

An activity-oriented course concerned with a study of the use and impact of mass media on communication across cultures. Opportunity will be provided for students to become familiar with producing audio-visual material for use in cross-cultural teaching situations.

**EDCUR 891.6  
Adult Basic Education  
1&2(2S)**

Deals with the upgrading of skills of adults who are termed functionally illiterate. Examines research in adult basic education, types of programs, selection of candidates, methods and materials of instruction and evaluation of progress.

**CURRICULUM RESEARCH AND  
DEVELOPMENT**

**EDCUR 898.3/899.6  
Individual Reading - Special  
Problems in School Subjects  
1/2(3R), 1&2(3R)**

In order to provide an opportunity for individual study in an area of the student's own interest, a number of individual studies are offered. Each calls for intensive reading or a curriculum project under the guidance of a faculty supervisor. A paper is required. A proposal, representing a contract for the extent and nature of the work to be done, must be approved by a committee consisting of three members of faculty and other professionals of recognized experience and authority in the area. An oral defense of the completed work will be processed by that committee.

**EDCUR 990  
Seminar in Curriculum Research**

A required seminar for Master's and Ph.D. graduate students in Curriculum Studies, taken by all full-time students throughout the academic year. Ongoing research and development projects of faculty and students form the focus of first term seminars, while readings and student-identified issues form the basis for second term seminars. This seminar also provides students with information and guidance to help them profit from their program of studies, and to utilize computer technology effectively. Separate seminars are arranged for Master's and Ph.D. students. Registration in EDCUR 990 seminar is required for one year only.

**EDCUR 992.6  
Project**

Research or curriculum project which is required on the non-thesis option for the M.Ed. Each project calls for intensive reading, under the guidance of a staff supervisor. A minor thesis may be required. Alternate requirement may be a curriculum project. The proposal for the

minor thesis or for the project, and the oral defense, will be processed by a committee constituted in the same fashion as for a thesis committee.

**EDCUR 994  
Research**

A student undertaking research leading to a Master's thesis must register in this course each year until the thesis is completed.

**EDUCATIONAL ADMINISTRATION**

The Department of Educational Administration offers programs leading to a Postgraduate Diploma, and the Master's and Ph.D. degrees. In addition to the general regulations in the College of Graduate Studies and Research, those applying for admission to the Postgraduate Diploma and Master's programs should have completed a B.Ed or equivalent, and have a minimum of two years' related professional experience. Applicants must have a minimum average of 70% in the last 2 years of study (10 full classes or 60 credit units) for admission to the M.Ed. Applicants must have a minimum average of 65% for admission to the Postgraduate Diploma. Ph.D. applicants must complete a Miller Analogies Test or GRE.

The minimum credit units for fully qualified students are as follows:

**Postgraduate Diploma Course  
Requirements: 30 credit units**

EDADM 811 is a required course. In addition, the program must include at least five educational administration courses from the following list: EDADM 810, 812, 813, 816, 817, 820, 821, 823, 824, 825, 826, 829, 834, 835, 836, 841, 861; EDIND 820, EDIND 825.

The remaining four courses are open electives(1) and may be chosen from the above, other departments, or EDADM 892, 894 or 898. PGD students planning to complete an M.Ed. program should choose EDRES 800 as one of the open electives.

**Master of Education (non-thesis)  
Course Requirements: 36 credit units**

The required courses are EDADM 811, 990, 992 and EDRES 800. One additional research or statistics course may be taken. The program must include at least five half courses from the following list: EDADM 810, 812, 813, 816, 817, 820, 821, 823, 824, 825, 826, 829, 834, 835, 836, 841, 861; EDIND 820, EDIND 825. The remaining courses are open electives and may be chosen from the above, other departments, or EDADM 892, 894 or 898.

**Master of Education (thesis) Course  
Requirements: 24 credit units**

The required courses are EDADM 811, 990, 994, and EDRES 800 (and at least one further half course in research is highly recommended). In addition, the program must include at least four half courses from the following list: EDADM 810, 812, 813, 816, 817, 820, 821, 824, 825, 826, 829, 834, 835, 836, 841, 861; EDIND 820, EDIND 825.

**Ph.D. Requirements**

Ph.D. candidates who have an acceptable Master's degree in Educational Administration are required to complete 21 credit units plus the thesis. Applicants whose Master's degrees are not in Educational Administration must complete at least 6 credit units of qualifying courses and then 27 credit units plus the thesis.

*Year 1 Required Courses\**: EDADM 881, 884, 885, 990, 996, EDRES 840

The remaining courses shall enhance the student's substantive background in Educational Administration and support the research focus of the dissertation.

\*Exceptions may be made if warranted by the student's background and/or research focus. Any exceptions require the approval of the departmental members of the Advisory Committee.

*Year 2*: Year 2 will be devoted to completion of the compulsory Comprehensive Examination and commencement of work on the dissertation.

**Course Listings**

Except for core courses not all of the courses listed below are offered in any one year. Additional information about the requirements for each of the programs is available from the department office.

*Current areas of departmental research include*: studies in leadership, administrator preparation, ethics, supervision, school effectiveness, rural education, the principalship, school and system governance, educational finance, organizational change and policy, planning and legal issues.

**EDADM 810.3  
Change Theory and Innovation in Education  
1/2(3S)**

*Prerequisite(s)*: EDADM 811.

Includes presentation of theories regarding changes in education. Forces affecting change in education are studied in detail through a case study approach. Special attention is given to the role of administrators and to methods for improving the process of change in education.

**EDADM 811.3  
History and Development of Organizational Theory  
1(3S)**

Traces major theories through the evolution of organizational thought, and examines recent trends in the study of organizations. A variety of schools of thought are investigated and utilized as perspectives from which to view educational organizations. The content is designed to provide a basis for further in-depth study of concepts and processes in educational settings.

**EDADM 812.3  
Educational Finance  
1/2(3S)**

Financing public education; educational revenues and expenditures; principles underlying grants systems for education; alternative models for financing public education; taxation and principles of taxation; financial administration in local school systems; cost-quality relations in

education; trends in educational finance; financial planning in times of retrenchment.

**EDADM 813.3  
Educational Planning  
1/2(3S)**

Designed to provide individuals with a knowledge of educational planning at the Board of Education level. Includes such theoretical aspects as the nature of educational planning, planning concepts, and approaches and models. Investigates applied aspects such as data collection, demographic analysis and enrolment forecasting, school facilities, master plans, and new planning techniques.

**EDADM 816.3  
Instructional Leadership and School Management  
1(3S)**

*Prerequisite(s)*: EDADM 811.

Focuses on the formal and informal organization of the school. The leadership styles of principals and vice-principals, as they affect curriculum development, implementation and evaluation, will be studied. Emphasis will be placed on organizational development strategies.

**EDADM 817.3  
Supervision for the Improvement of Classroom Instruction  
2(3L)**

Deals with the development of supervisory skills through the process of clinical supervision. Attention will be given to the role expectations of personnel involved in the supervisory process and the nature of the supervisory process as it involves classroom teachers and principals.

**EDADM 820.3  
Administrative Roles in School Systems  
1/2(3S)**

*Prerequisite(s)*: EDADM 811.

Examines the roles of various educational administrators: vice-principal, principal, assistant director and director. The relationships and functions associated with each of these roles will be examined from several perspectives - legislation, theoretical models, role theory, and research findings. The specific content will address means by which these roles can lead to effective administrative practice.

**EDADM 821.3  
Perspectives of Organizational Behaviour  
2(3S)**

*Prerequisite(s)*: EDADM 811.

Focuses on behaviour within the formal and informal contexts of the educational system. It includes such topics as motivation, group processes, communication, decision making, conflict management, leadership, power and authority.

**EDADM 822.3  
Economics of Education  
1/2(3S)**

Concepts fundamental to an analysis of education from an economic perspective; relationships between education and the economy, and education and personal income; human capital; cost-benefit

analysis in education; the planning of human resources development.

**EDADM 823.3  
Planning and Management of Educational Facilities  
1/2(3S)**

*Prerequisite(s)*: EDADM 813; or permission of the department.

An intensive course in the planning and management of the physical and functional aspects of elementary and secondary schools. Both theory and applications are studied. Topics include the purpose and nature of educational facilities, determining program needs, emerging awareness of facility requirements, specific facility planning activities and procedures, operationalizing new and altered facilities, evaluating completed projects, strategies for effective and efficient operation and maintenance, terminating obsolete and redundant facilities and developing an overall facility program for the school system.

**EDADM 824.3  
Structure and Organization of Education in Canada  
1/2(3S)**

Traces the historical basis and development for the present forms of education in the various provinces in Canada. It explores the current structure and organization of education in different provinces. Finally, it studies the issues and problems germane to the Canadian educational scene.

**EDADM 825.3  
Educational Administration and the Law  
1/2(3S)**

Deals with constitutional law as applied to education and language, intentional wrong and defenses, the various aspects of negligence and its defenses, occupier's liability, employer's liability, administrative law, defamation, and human rights. Wherever relevant, a parallel tie-in will be made with statute law.

**EDADM 826.3  
Personnel Administration  
1/2(3S)**

*Prerequisite(s)*: EDADM 811.

Designed to provide a review of the literature in personnel administration in education and exposure to applications in human resources management. The topics addressed include manpower planning, recruitment of personnel, selection of personnel, placement and induction of personnel, staff development, appraisal of personnel, administration of collective agreements, legal aspects of personnel administration and supervisory practices.

**EDADM 827.3  
Administration in Continuing Education  
1/2(2S)**

Assessments of various approaches to administration related particularly to public educational programs directed at social and technological change; case studies useful in administering continuing education programs.

**EDADM 829.3  
School Improvement  
1/2(3S)**

Focuses on organization development as a planned and sustained effort to apply behavioral science and school effectiveness research to school and system improvement. Strategies which involve school and system members themselves in the assessment, diagnosis and transformation of their own school organization will be studied in detail.

**EDADM 834.3  
Case Studies in Leadership Ethics  
1/2(3L/S)**

*Prerequisite(s)*: EDADM 811.

Considers issues and dilemmas arising from a wide variety of educational leadership cases. Classical and contemporary moral philosophies as well as professional ethics will be utilized to examine these problematic cases. The challenges associated with developing ethical frameworks for decision-making and with promoting ethical consciousness and competencies in particular education settings will be explored.

**EDADM 835.3  
Governance and Decision Making in Education  
1/2(3S)**

*Prerequisite(s)*: EDADM 811.

Deals with the use of political, jurisprudential and organizational theories to better understand and analyse educational governance at state, system, and site-based levels. The course includes the application and assessment of various models and mechanisms of educational policy and decision making. Consideration will be given to the evolving roles and relationships of interest groups, interagency personnel, professional educators, legislators, executives, the judiciary and citizens.

**EDADM 836.3  
Leading Community Relations in Education  
1/2(3L)**

*Prerequisite(s)*: EDADM 811.

Deals with issues, principles and strategies used to develop and maintain learning communities and effective community relations. Topics include: community-participation theory; contemporary leadership and followership theory; stakeholder collaboration; communication and conciliation strategies; the politics of diversity and inclusion; as well as approaches taken to community and capacity building in education.

**EDADM 841.3  
Administration of Special Programs  
1/2(3S)**

Designed to make use of specialists from other departments. Focuses on the administration of special education programs in the schools.

**EDADM 861.3  
Administration of Higher Education  
1/2(3S)**

Designed to explore the administration of institutions of higher education; namely technical institutes and vocational centres, colleges and universities.

**EDADM 881.3  
Organizational Paradigms and  
Analysis  
1/2(3S)**

*Prerequisite(s): EDADM 811.*  
Analyzes a number of organizational paradigms based upon different sets of metatheoretical assumptions about the nature of social science and the nature of society. Emphasis will be placed on the paradigmatic shifts that are occurring in educational administration.

**EDADM 883.3  
Advanced Theory of Organizational  
Behaviour  
1/2(3L/S)**

*Prerequisite(s): EDADM 881.*  
An advanced review of concepts in organizational behaviour. Utilizing basic tenets of philosophical thought, it will provide in-depth examination of behavioral theories of organization and will surface related research needs and applications in the context of educational organizations.

**EDADM 884.3  
Policy-making in Education: A  
Critical Perspective  
1/2(3S)**

An advanced doctoral level course in educational administration dealing with policy-making in education. Focuses on three main aspects of educational policy-making: building consent for educational policy; promoting deliberation, understanding, and informed action in policy-making; and synthesizing basic considerations for formulating and implementing educational policy.

**EDADM 885.3  
Research Methods  
1/2(3S)**

Designed to explore the various methods of research, and the problems related to research design. Special emphasis will be placed on research methods related to Educational Administration.

**EDADM 891.6/892.3  
Trends and Issues in Educational  
Administration  
1&2(3L), 1/2(3L)**

Selected current trends and issues in educational administration will be analyzed in detail. Literature, research and related developments in other areas will be examined. These courses will normally be taught during summer sessions by visiting professors with particular expertise.

*Note:* May be taken more than once on the recommendation of the Department Head.

**EDADM 893.6/894.3  
Advanced Laboratory in Educational  
Administration  
1&2(P), 1(P)**

Each provides opportunities for students to apply theory to practice in undertaking field research projects which differ from thesis and project topics. Preparation of a scholarly report and regular consultation with faculty members are key course requirements.

**EDADM 898.3  
Reading Course: Individual Reading  
and Study  
1/2(R/T)**

Provides an opportunity for a student to pursue a topic of personal interest. The topic studied must fall outside the scope of educational administration courses offered, although this provision may be waived with the consent of the department. The student is responsible for defining the area of interest and approval of the project must be gained prior to registration. The student undertakes intensive reading under the guidance of a staff supervisor, and submits a major paper for assessment on or before a date agreed upon in writing with his/her supervisor. An oral examination is also required.

**EDADM 990  
Seminar**

A required non-credit seminar for graduate students in the Master's and Ph.D. programs. Provides students with information, guidance, and some skills needed to succeed in and profit from their program of studies. Enhances skills in seminar participation, scholarly writing, library use, and computer applications. Discussions of educational issues, research opportunities, research protocols, and research funding sources are also included. Separate seminars are arranged for full- and part-time Master's students and Ph.D. students.

**EDADM 992.6  
Project**

This practicum consists of either a field project or an administrative internship planned through a process of consultation among the student, an advisor, the Department Head, and an educational administrator in the field. It is designed to provide the student with a practical experience with administrative tasks and processes in education. The student is required to file a written report on the practicum with the department.

*Note:* Required for the non-thesis M.Ed. program; not available as an elective in the Postgraduate Diploma program.

**EDADM 994  
Research**

A student undertaking research leading to a Master's thesis must register in this course each year until the thesis is completed. This applies to thesis work done extramurally as well as intramurally.

**EDADM 996  
Research**

Students writing a Ph.D. thesis must register in this course.

**EDIND 820.3  
Administrative Systems of Indian and  
Northern Education  
1/2(3S)**

Examines the various administrative systems and structures through which schooling is offered to Indian, Metis and Inuit people. Systems of concern include the Department of Indian and Northern Affairs, Governments of the Yukon and Northwest Territories, the Department of Northern Saskatchewan, provincial and band

controlled school boards and committees. Legal, financial and jurisdictional aspects of the structures are discussed.

**EDIND 825.3  
Role of the Administrator in Indian  
and Northern Education  
1/2(3S)**

A study of the duties, responsibilities and leadership qualities required of a school administrator in the various structures within which schooling is available to Indian, Inuit and Metis people. Changing expectations of local people (i.e. band controlled schools) and the role of the school principal are examined.

**EDUCATIONAL FOUNDATIONS**

The Department of Educational Foundations offers programs leading to the following: Master of Continuing Education, Master of Education and Postgraduate Diploma in Continuing Education; Master of Education and Postgraduate Diploma in Educational Foundations; Master of Education and Postgraduate Diploma in Indian and Northern Education.

**CONTINUING EDUCATION**

The Continuing Education Department has been incorporated into the Department of Educational Foundations. The EDCNT prefix signifies the distinctive content of these courses.

The programs in Continuing Education are organized to meet the needs of those whose primary responsibilities are in Continuing, Adult, or Extension Education, or Community Development. For admission to the M.C.Ed. program an applicant must have a Bachelor's degree from a professional college or the equivalent of a four-year degree in Arts and Science, 6 credit units in Continuing Education to be selected from EDCNT 453, EDCNT 410, EDCNT 420 or their equivalents which may be taken concurrently with the graduate program, and at least two years of successful experience in the field of Continuing Education. Knowledge of the concept and terminology involved in Continuing Education is necessary for the graduate student. Much of this background is derived from the social sciences and humanities. Therefore a minimum of 12 credit units is required in fields closely related to Continuing Education such as: agricultural economics, anthropology or archaeology, economics, geography, history, philosophy, political studies, psychology, sociology and theology. If the student's education background is judged to be inadequate, additional courses and/or reading may be required. For admission to the M.Ed. program an applicant must meet the general requirements of that degree.

**EDUCATIONAL FOUNDATIONS**

The Master of Education and Postgraduate Diploma in Educational Foundations may be in the following areas of specialization:

- Anthropology of Education

- Comparative/International/Development Education
- History of Education
- Philosophy of Education
- Sociology of Education

Special interest Areas include moral education, critical theory, gender issues, multicultural education and analysis of educational policies.

**Master of Education (with thesis)**

Students are required to take at least 24 credit units, write a thesis, and spend at least one year in residence.

**Master of Education (without thesis)**

Students are required to take at least 36 credit units, including a project course (EDFDT 992), and spend at least a year in residence.

**Postgraduate Diploma**

Students are required to take at least 30 credit units, some of which may be undergraduate level. The course work should centre around a theme.

**INDIAN AND NORTHERN EDUCATION**

The Indian and Northern Education Department has been incorporated into the Department of Educational Foundations. The EDIND prefix signifies the distinctive content of these courses.

Students who wish to follow a graduate program in Indian and Northern Education should arrange for an interview through the Department of Educational Foundations. The non-thesis option may be approved for the Master of Education Degree. A Postgraduate Diploma program is also available.

Current research centres on classroom problems and teaching/learning styles, selection and development of curricular resources, intercultural attitudes and communication patterns, cultural personality development and socio-economic adjustment to the larger society.

Refer to individual departments within the Education section for additional EDIND course listings.

**CONTINUING EDUCATION COURSES**

**EDCNT 810.3 Learning for Life:  
Practice and Theory in Adult  
Education  
1/2(3L)**

*Prerequisite:* Admission to the College of Graduate Studies and Research.

Introduces graduate students from various backgrounds to the scope and aims of modern adult education in all its diversity. The content is significantly shaped by recent studies in Canadian adult education practice and theory and these developments are viewed from international perspectives.

**EDCNT 830.3  
Historical and Philosophical  
Foundations of Continuing Education  
1/2(3S)**

Enables participants to gain an understanding of the history of continuing (adult) education, with emphasis on the twentieth century North American experience. Discusses key movers and shapers of the field of practice. Provides

opportunity for conducting historical-philosophical analysis and for identifying perennial ethical, social, and political problems facing adult educators.

**EDCNT 840.3  
Issues in Continuing Education  
1/2(3S)**

*Prerequisite(s): EDCNT 830 or permission of the instructor.*

Builds upon the content of EDCNT 830. In-depth study and analysis of a selected topic or topics related to the history and/or philosophy of continuing (adult) education. Examples: seminal figures in the history of the field; the early literature base of continuing (adult) education; the advocates and opponents of the professionalization of the field of continuing (adult) education; the issue of mandatory continuing education; currently emerging controversial issues which affect decision making in the practice of continuing (adult) education.

**EDCNT 872.3  
Program Planning of Continuing  
Education  
1/2(2S)**

Program development is examined within the context of Continuing Education. Specific elements of the program development process which will be discussed include the planning context, need identification, educational objectives, and learning experiences. Issues related to these concepts will be viewed from a theoretical framework. Participants will have an opportunity to apply or test some of this theory in an educational setting.

**EDCNT 875.3  
Adult Learning and Development  
1/2(2S)**

Draws on research and theory in several social sciences to provide an understanding of the changing needs and capacities of adults for learning throughout the life span; optimal learning environments for adults; teacher-learner interaction in adult education; social facilitation of learning.

**EDCNT 878.3  
Comparative Continuing Education  
1/2(2S)**

Provides participants with international perspective on the field of adult education. Critical analysis of various approaches to adult education and "development" is encouraged. Ethical questions confronting the individual practitioner will be explored. Previous offerings have included discussion of alternative approaches to research and practice in adult education and have analyzed the work of such adult educators as Myles Horton and Malcolm Knowles, Ivan Illich and Julius Nyerere, John Sewell and Paul Bergevin, Paulo Freire and John Lowe, John Ohliger and Ned Corbett.

**EDCNT 880.3  
The Community Development Process  
1/2(2S)**

Community development as a process in effecting social change is examined from historical and philosophical perspectives. Theory and research from the social sciences is utilized as a means for developing analytical and developmental

models from which community, change and the community development process might be analyzed. Canadian programs and experiences in community development serve as basic data for the course.

**EDCNT 882.3  
Evaluation of Continuing Education  
1/2(2S)**

Selected approaches and models of evaluation are compared and contrasted as they apply to programs of Continuing Education. Students are expected to gain experience in designing evaluation studies and in using the results of evaluation.

**EDCNT 885.3  
Application of Learning Principles in  
the Practice of Adult Education  
1/2(2P)**

*Prerequisite(s): EDCNT 875; or permission of the instructor.*

Requires participants to undertake the role of facilitator in arranging a learning experience for an adult group, using any of a variety of adult education procedures. The role of the project will be primarily to help the students gain increased understanding of themselves in facilitating adult learning.

**EDCNT 889.3  
Selected Topics in Comparative  
Continuing Education  
1/2(2S)**

*Prerequisite(s): EDCNT 878; or permission of the instructor.*

Participants are encouraged to deepen their knowledge and skills in an area of their choice in adult education. In the past, mainstream adult education has been an important area for selection of such topics. Alternative adult education enterprises have also been a valuable source of subject matter for analysis and discussion: environmentalism, de-schooling, pacifism, and various freedom movements around the world.

**EDCNT 890.3  
Community Development Practices  
1/2(2S)**

Using classroom and field community experiences as a means for generating information, the learner examines various community development practices on the Prairies. In so doing learners may assess their own level of competence in putting into practice community development theory, principles, and methods.

**EDCNT 891.3  
Trends and Issues in Continuing  
Education  
1&2(2S)**

Some currently important aspects of the field of adult education are reviewed and analyzed.

**EDCNT 892.3 Workplace Learning  
(Internship)  
1/2(100S)**

*Prerequisite: Admission to graduate program in Adult and Continuing Education, Educational Foundation, or Indian and Northern Education.*

Provides a hands-on workplace learning experience in adult and continuing education. The learning experience is monitored throughout by a faculty advisor and a field-based supervisor. Placements

are made with organizations that best suit students' academic interests and career aspirations.

**EDCNT 897.3  
Research Methods in Continuing  
Education  
1/2(2S)**

The first part provides background and experiences in the conduct of literary-humanistic historical research in education. The second part deals with the conduct of empirical social science research in education.

**EDCNT 898.3  
Special Topics**

These courses are offered occasionally by visiting faculty and in other special situations. Students interested in these courses should contact the department for more information.

**EDUCATIONAL FOUNDATIONS  
COURSES**

**EDFDT 820.3  
Early Educational Classics  
1/2(3S)**

Selected educational classics from antiquity to 1850 in the light of the contributions they have made to educational theory and practice.

**EDFDT 821.3  
Modern Educational Classics  
1/2(3S)**

Selected educational classics from 1850 to the present in the light of the contributions they have made to educational theory and practice.

**EDFDT 822.3  
Seminar in History of Canadian  
Education  
1/2(3S)**

Selected topics in Canadian educational history since 1867.

**EDFDT 823.3  
Education and Canadian Minorities  
1/2(3S)**

The history of education of selected Canadian minority groups.

**EDFDT 830.3  
Philosophy of Education: Methods of  
Investigation  
1/2(3S)**

An introduction to basic methods of engaging in philosophy of education focusing on such modes as conceptual analysis, phenomenology, existentialism, critical theory, and pragmatism.

**EDFDT 831.3  
Existentialism and Education  
1/2(3S)**

Highlights critical issues raised by existentialists which in turn serve as the starting point for thinking about the individual and education.

**EDFDT 832.3  
Phenomenology and Education  
1/2(3S)**

Inquiry into the value for education of phenomenological theory and methodology. Major works of selected phenomenologists will be examined.

**EDFDT 833.3  
Conceptual Analysis and Education  
1/2(3S)**

An analysis of educational concepts using the techniques of modern conceptual analysis to illuminate ethical, epistemological and other educational problems.

**EDFDT 835.3  
Problems in Philosophy and  
Education  
1/2(3S)**

Topics selected by the instructor and students.

**EDFDT 836.3  
Contemporary Education in Theory  
and Practice  
1/2(3S)**

A critical analysis of contemporary educational practice in the light of recent literature on educational theory.

**EDFDT 837.3  
Educational Philosophies and the  
Curriculum  
1/2(3S)**

Deals with the philosophical foundations of curriculum theory and will clarify the basis from which educational programs can be analyzed. Contemporary philosophical issues related to the curriculum and school programs will be examined. The writings of selected educational philosophers will be studied.

**EDFDT 840.3  
Research Design in Sociology of  
Education  
1/2(3S)**

*Prerequisite(s): EDRES 800.*

Gives students the opportunity to apply research methods to specific problems in sociology of education. Whenever possible, students will participate in ongoing research in the department.

**EDFDT 841.3  
Sociological Theories of Education  
1/2(3S)**

*Prerequisite(s): EDFDT 440; or permission of the department.*

Examines the contributions made by functionalism, conflict theory, and interactionism to educational theories. Furthermore, the status of the 'new' sociology of education will be critically assessed.

**EDFDT 850.3  
Comparative Studies in Education  
1/2(3S)**

*Prerequisite(s): Permission of the department.*

Focuses on methodological issues in comparative education and introduce the student to landmarks in cross-national research.

**EDFDT 851.3  
International Education and  
Modernization  
1/2(3S)**

Focuses on educational issues in development and modernization, and the role of education in international understanding and cooperation.

**EDFDT 854.3  
International Education Study Tour  
1/2(3S)**

Predeparture readings and seminars will introduce students to the culture of the designated country and to the history and structure of its education system. Lectures,



seminars, observation, and journals will be used to develop an analysis of the relationships between cultural tradition, economic and political structures, and education.

**EDFDT 860.3  
Seminar in Anthropology and Education  
1/2(3S)**

Investigation of selected problems in anthropology and education.

**EDFDT 870.3  
Interdisciplinary Seminar in Foundations of Education  
1/2(3S)**

A consideration of important educational issues from the anthropological, comparative, historical, philosophical and sociological points of view and the possible implications for a comprehensive theory of education.

**EDFDT 871.3  
Student Seminar  
1/2(3S)**

Under appropriate faculty supervision, students will assume major responsibility for initiating and developing the content and form of the course.

**EDFDT 872.3  
The Experience of Women in Canadian Education  
1/2(3S)**

*Prerequisite(s): EDFDT 482 and 483; or their equivalents.*

Provides a philosophical analysis of the conceptualization of the position of women in traditional educational theory and traces historically the provision of education for women in Canada. A sociological analysis of the school is undertaken to determine the extent to which it may be contributing to sexist attitudes and practices. Special attention is paid to the education of Saskatchewan native women.

**EDFDT 873.3  
Feminist Thought and Its Implications for Canadian Education  
1/2(3S)**

*Prerequisite(s): EDFDT 872.*

A theoretical, feminist framework is developed in order to analyze research, theory and practice in Canadian education. Feminist thought and its implications for education are analyzed philosophically. A feminist critique of the basis of women's socio-economic position in Canadian society is developed both historically and sociologically. Feminist thought as a mode of analysis is used to make a comparative study of women and education in selected countries.

**EDFDT 881.3  
Education, Wisdom and Nature  
1(3S)**

Traces the concept of wisdom from earliest times through a decline in interest during the Enlightenment to its present-day resurgence among feminist theologians, deep ecologists, and First Nations peoples. Conceptions of wisdom and their emotional and cognitive preconditions are explored. Educational implications are considered.

**EDFDT 882.3  
Education and Moral Development  
1/2(3S)**

*Prerequisite(s): PHIL 230 or 233; or equivalent.*

The theoretical aspects of moral education. The possibility of reasoning morally, the case for the developmental hypothesis, the cultivation of moral sentiments, the role of conscience in moral experience and the fostering of moral character are the major areas investigated.

**EDFDT 883.3  
Moral Education in Practice  
1/2(2S-1P)**

An introduction to a variety of materials and strategies used for the purposes of moral education and apply these in simulated classroom and school settings.

**EDFDT 898.3/899.6  
Individual Reading in Educational Foundations  
1/2(3R), 1&2(3R)**

Provides students with an opportunity to study in areas of their own interest. Under the direction of a staff advisor, they plan and follow a reading program and prepare a major paper.

*Note:* Students may take up to 12 credit units of individual reading in their graduate program.

**EDFDT 990  
Seminar**

This is a non-credit seminar designed for students in residence. Students and faculty explore issues in the general field of educational foundations using literature that is both challenging and current.

**EDFDT 992.6  
Project**

For students registered in a non-thesis Master's degree. Its a compulsory course for the non-thesis Master's route. The project must be accepted by a committee of the department and evaluated by the committee plus an external member.

**EDFDT 994  
Research**

Students undertaking research leading to a Master's thesis must register in this course each year until the thesis is completed (applies to thesis work done extramurally as well as intramurally).

**INDIAN AND NORTHERN EDUCATION COURSES**

**EDIND 800.3  
History of Indian and Native Education in Central and Atlantic Canada  
1/2(3L)**

The nature of history as it pertains to Indian and Inuit people. Describes and analyzes the chronological development of schooling for the indigenous people in Central and Atlantic Canada. Historical origins of contemporary issues in education are examined.

**EDIND 810.3  
History of Indian and Native Education in Western and Northern Canada  
1/2(3L)**

A review and examination of educational practices of Indian and Inuit people of Western and Northern Canada both before and after the arrival of Europeans. The course outlines the involvement in schooling of the Hudson's Bay Company, missionaries and governments. Contemporary developments in education for Indian, Metis and Inuit people are discussed.

**EDIND 830.3  
The Environment of the Schooling Process for Indian and Native Students in Northern Areas  
1/2(3S)**

Focuses on the educational environment of Indian, Metis and Inuit students with emphasis on cultural, political, economic change in northern and isolated communities. Data is drawn from ethnography and other anthropological research.

**EDIND 840.3  
The Environment of the Schooling Process for Indian and Native Students in Integrated and Urban Systems  
1/2(3S)**

A seminar centering on the societal environment of the schooling process experienced by Indian and native students in small integrated schools and those in large urban centres. Implications of economics, housing, politics, mobility, teaching/learning approaches and curriculum are discussed.

**EDIND 851.3  
Decolonizing Aboriginal Education  
1(3S)**

This course is intended to address colonization and imperialism among Aboriginal peoples, focusing specifically on the role education has played in achieving cognitive imperialism, critique the tenets of cognitive imperialism in English language and education policy, politics, and practice, and evaluate international options for restoring Aboriginal communities.

**EDIND 855.3  
Cross-Cultural Research Methodology  
1/2(2L-1P)**

A methodology course dealing with the adaptation of various research approaches to the study of variables across cultures. Students are expected to become involved in the design and conduct of a cross-cultural research study.

**EDIND 860.3  
Cross-Cultural Education Within Circumpolar Countries  
1/2(3S)**

A survey of systems, programs, teaching approaches and the development of curriculum materials for the education of minority groups resident in circumpolar countries and areas. The focus is on Greenland, the Scandinavian countries, northern Russia, Alaska and northern Canada.

**EDIND 870.3  
Cross-Cultural Education Within Third World Countries  
1/2(3S)**

A survey of the development of schooling for indigenous and minority cultures within

a sample of third world countries. Focus will be on the aborigines of Australia, the Maoris of New Zealand, the Indians of Latin and South America, and the original people of African countries.

**EDIND 898.3/899.6  
Special Study - Individual Reading Course  
1/2(R), 1&2(R)**

Students select a specific area of interest within the field of Indian and Northern education. In consultation with a faculty advisor the student delineates the subject of study, research methodology, bibliography and working arrangements. A completed report or mini-project is evaluated by a committee of faculty within the Program in consultation with the student.

**EDIND 992.6  
Project**

This project is for students registered in a non-thesis Master's degree. It is a compulsory course for the non-thesis Master's route. The project must be accepted by a committee of the department and evaluated by the committee plus an external member.

**EDIND 994  
Research**

A student undertaking research leading to a Master's thesis must register in this course each year until the thesis is completed. This applies to thesis work done extramurally as well as intramurally.

**EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION**

The Department for the Education of Exceptional Children and the Department of Educational Psychology amalgamated on July 1, 1998. Graduate programs and courses are currently undergoing review. While the review is under way, the departments will continue to list and administer their programs and courses separately.

**EDUCATIONAL PSYCHOLOGY**

Permission of the Department Head is required for admission to all graduate courses in the department.

Three areas of study (concentrations) are available in the Department of Educational Psychology:

*Area One:* Counselling and Guidance

*Area Two:* Measurement and Evaluation

*Area Three:* School Psychology

**Counselling**

Students are required to complete 21 credit units in Psychology/Educational Psychology/Education of Exceptional Children, including EDPSY 411, 412 and 441, or equivalent courses.

**Measurement and Evaluation**

Students are required to complete 21 credit units in Psychology/Educational Psychology/Education of Exceptional



Children, including EDPSY 441, or equivalent courses.

### School Psychology

Students are required to complete 21 credit units in Psychology/Educational Psychology/Education of Exceptional Children, including EDPSY 441, or equivalent courses.

### PROGRAMS OFFERED

In each area of study, three types of programs are available. For Master's programs, *one year in residence* as a full-time student is required. In each Master's program, a student is required to take a practicum course and complete an extended practicum.

#### Master of Education with Thesis

- Completion of 33 credit units of course work and a thesis.

#### Master of Education with Project

- Completion of 42 credit units of course work and a project are required.

#### Post-Graduate Diploma (PGD)

- Completion of 30 credit units of course work only. May be completed on a part-time basis within 5 years of first enrolment. The practicum course is not permitted for the Diploma.

The department has adopted an apprenticeship model to engage students in the richness and rigours of scholarly and professional life beyond course work. Early in the program each student will be assigned a faculty member as a mentor and will work closely with this professor. Students will have an opportunity to engage in research, teaching, clinical practice and other professional activities with their assigned professor. Students will have a choice of the kind of professional activities they wish to pursue. Further details are available from the Graduate Studies Chair.

### SPECIAL CASE PH.D.

In each area of study, outstanding candidates who hold a recognized Master's degree with thesis are considered for admission. It is a research degree and requires 24 months in residence. Each candidate's program is designed to meet the specific needs of the candidate while maintaining the integrity and coherence of the program consistent with the requirements of the College of Graduate Studies and Research.

#### EDPSY 811.3 The Organization and Administration of the Guidance Program 1/2(3L-1S)

A seminar dealing with the organization of the school guidance program; its relation to the total school organization, the counselor as program administrator; guidance in relation to the curriculum and needs of society; the counselling program and staff relationships.

#### EDPSY 812.3 Theories of Counselling and Psychotherapy 1(3L)

Historical overview of the major schools of counselling and psychotherapy and considers

these within the framework of a constructive-developmental orientation. Representative theories within each school are examined in terms of their philosophical roots and their impact upon contemporary therapeutic models and approaches. Emphasis is placed upon meeting the counselling needs of individuals in education/school contexts. Students are encouraged to develop an integrated personal theory of counselling and to adopt a reflective practitioner orientation to the provision of counselling services.

#### EDPSY 813.3 Counselling: Therapeutic Approaches and Techniques 2(1L-1S-1P)

*Prerequisite(s): EDPSY 812; or permission of department.*

Introduces students to specific therapeutic approaches and techniques of counselling children, adolescents, and adults and provides a theoretical foundation for the practice of a variety of counselling skills. Particular emphasis is placed upon meeting the educational/school contexts. Students are encouraged to continue to move in the direction of developing an integrated personal theory of counselling and to adopt a reflective practitioner orientation to the provision of counselling services.

#### EDPSY 814.3 Group Counselling 1/2(1S-2P)

Students are provided with an opportunity to develop an understanding of group interaction, dynamics, and interpersonal relationships, through active involvement in a group experience designed to enhance participants' self-awareness and self-insight. These understandings are reinforced by an examination of group theory and processes, with special attention to group counselling in the context of the internship and extended practicum in the Counselling program.

#### EDPSY 815.3 Child Counselling 1/2(1L-2S)

Familiarizes students with the depth study method, identification of vulnerable children, children's rights, and services available for children. Intervention strategies considered include environmental approaches and classroom management; consultation with parents, teachers and other agencies; and individual and group counselling with children. A practical component is built into the course.

#### EDPSY 816.3 Family Counselling 1/2(1L-2P)

Provides an orientation to the counselling of family units and related services available to the community. Techniques of family counselling are demonstrated, and discussed. A practical component for the practice of specific skills is built into the course. Problems are examined within a systemic context which includes the interactions between families and the school system.

#### EDPSY 819.6 Practicum in Educational Psychology 1&2(4S-4P-4C)

Provides a supervised practical experience in counselling/school psychology/measurement and evaluation. The primary objective is to facilitate the development of appropriate skills in the designated area. The practicum is divided into three major segments: a three month pre-practicum during September to December; a four month practicum during December through April; and a two month full-time practicum during May and June.

#### EDPSY 825.3 An Advanced Seminar on Career Education 1/2(1L-1S-1P)

An opportunity for students to examine in depth, integrate, and apply theories, principles, and interventions relevant to career development. Students will critically analyze and evaluate a variety of interventions, including career education, work experience, workshops and support groups for focus populations (e.g., youth, midlife career changers, minority groups, women, persons with disabilities, retirees), employee assistance programs, etc. The goal is for students to develop competencies in selecting, creating, implementing, and evaluating career interventions.

#### EDPSY 827.3 Career Counselling: Theory 1(3S)

Based on the concept of career as a dynamic, holistic, life-long enterprise. Students examine the theoretical, research, assessment and practice literature related to career development as well as individual and group career counselling.

#### EDPSY 829.3 Career Counselling: Practicum 2(3P)

*Prerequisite(s): EDPSY 827.*

Emphasizes the application of the theoretical, research, assessment and practice literature related to career development and career counselling in a variety of settings (elementary, middle years, senior high school, post-secondary school, adult counselling centres, etc.). Students will work with a limited number of clients.

#### EDPSY 831.3 Theory and Practice of School and Applied Psychology 1(1L-1S-1P)

Focuses on the conceptual, theoretical and applied framework of school psychology; service roles in diagnosis, treatment, prevention and consultation; ethics and professionalism; and a survey of the research literature on special populations of students. It is intended to introduce students to the field of school and applied psychology.

#### EDPSY 832.3 Theory and Methods of Behaviour Analysis and Therapy 1/2(1L-2P)

Designed specifically for graduate students who intend to work in educational and education-related health settings, this course examines the principles and practices of behavioral analysis and

therapy. A major focus will be on the application of behavioral strategies to the needs and problems of individuals and groups in school, family, and community environments.

#### EDPSY 835.3 Assessment in Educational Psychology: Introduction 1(2L-1P)

Introduces the theory and practices of psychological and educational assessment, including the history of assessment, techniques of assessment, theory of test construction, psychometric properties of tests, case management from referral through intervention, collaborative consultation, report writing and ethics. Practice includes screening in the academic, cognitive and behavioural domains.

#### EDPSY 836.3 Assessment in Educational Psychology: Intermediate 2(2L-1P)

*Prerequisite(s): EDPSY 835*

Consists of the theory and practice of cognitive, social, emotional and behavioural assessment. Students administer and interpret assessment batteries consisting of interviews, behavioral observation and individual tests of cognition and personality, with provision for the inclusion of some measures of specific interest for students.

#### EDPSY 837.3 Advanced Clinical Assessment in Educational Psychology 1/2(1L-1P)

*Prerequisite(s): EDPSY 835, 836 and permission of the instructor.*

Designed for doctoral and advanced masters level students, this course includes cognitive, neurological, social, behavioural, and personality assessment for the purpose of conceptualizing and evaluating interventions. Students review current research literature, construct integrated batteries, and assess the functioning of clients with a variety of disorders.

#### EDPSY 843.3 Theory of Educational and Psychological Measurement 1(1L-1S-1P)

A theoretical examination of the basic problems of psychological measurement, together with the statistical procedures relevant to the understanding and evaluation of tests. Both classical test theories and item response theory models are examined.

#### EDPSY 844.3 Advanced Test Theory and Instrument Construction 2(1L-2P)

*Prerequisite(s): EDPSY 843.*

A detailed examination of test theory within an instrument development context. Both classical test and item response theories are examined from the perspective of designing various measuring instruments. Educational and psychological tests, questionnaires, interview schedules, and program evaluation instruments are among the information gathering devices which may be considered depending upon the professional interests and needs of the

students. A practical skill development component is built in.

**EDPSY 851.3  
Advanced Educational Psychology:  
Human Development and Personality  
1/2(2L-1S)**

Examines various theoretical perspectives and research in the areas of human development and personality with a view to assisting students in the Educational Psychology sub-specialties to identify and meet the needs of clients in a variety of educational settings.

**EDPSY 855.3  
Advanced Educational Psychology:  
Learning  
1/2(2L-1S)**

The major approaches to the study of human learning are examined from the points of view of theory, research, and application. Students are encouraged to critique research in the field of human learning and to relate current findings to educational situations such as counselling, teaching, program design, and curriculum development.

**EDPSY 881.3  
Group Processes and Communication  
1/2(3S)**

*Prerequisite(s):* Permission of the instructor.

Designed to facilitate personal learning in interpersonal relations and small group functioning. The development of both conceptual frameworks and behavioral skills will be stressed. Emphasis will be placed on the experiential approach to learning with video taped feedback being available. A variety of time blocks will be employed which will include lectures, weekend workshops and individual consultation with the instructor.

**EDPSY 884.6  
Adult Counseling in Continuing  
Education**

*Prerequisite(s):* Consultation with the instructor.

Theories and techniques of personal and group counseling in work with adults. Opportunity to observe professional counselors, and to obtain experience in counseling under skilled supervision.

**EDPSY 898.3/899.6  
Special Problems in Educational  
Psychology: Reading Course  
1/2(3R), 1&2(3R)**

Topics for individual study are selected by the student in consultation with a faculty advisor. The study may take the form of an extensive report or a project which is both accepted and evaluated by a committee of three. A copy of the final project must be left with the Department Head. The area must be one which is not covered by an existing course. Permission of the Department Head is required.

**EDPSY 990  
Seminar**

A non-credit course for graduate students in residence. Current issues in educational psychology will be discussed. It will also provide a forum for discussing current faculty and student research.

**EDPSY 992.6  
Project**

For students registered in a non-thesis Master's degree. It is a compulsory course for the non-thesis Master's route. The project must be accepted by a committee of the department and evaluated by the committee plus an external member.

**EDPSY 994  
Research**

A student undertaking research leading to a Master's thesis must register in this course each year until the thesis is completed (applies to thesis work done extramurally as well as intramurally).

**EDIND 845.3  
Cross-Cultural Communication in  
Theory and Practice  
1/2(2L-1P)**

A study of the theories of interpersonal communication and of the barriers posed by variables within the cultural learnings of speaker and listener. Explores the use of role-plays, simulations and cross-cultural interaction to increase understanding and communication effectiveness.

**EDIND 850.3  
Cross-Cultural Psychological  
Research and Its Implications for  
Teaching Indian, Metis and Inuit  
Students  
1/2(3S)**

An examination of the development of the field of cross-cultural research in psychology and the importance of findings to the design of teaching material and techniques. Examines the problems and ethics involved in conducting cross-cultural studies as well as the applicability of research conclusions across cultures.

**SPECIAL EDUCATION**

Entrance requirements for the graduate program in Special Education vary from those established by the College of Graduate Studies and Research. Applicants must have at least one year of teaching experience, have a minimum cumulative weighted average of 70% on the last 60 credit units of university study, have completed at least 9 credit units of the EDEXC undergraduate minor or equivalent, and must meet a one academic year residency requirement if applying for the M.Ed. thesis program. To receive a detailed brochure outlining department programs, contact the Graduate Program Advisor, Education of Exceptional Children.

**Postgraduate Diploma**

A minimum of 30 credit units is required for the award of a Postgraduate Diploma with all credits being at the 800 level. The Postgraduate Diploma is the main vehicle for the preparation of cross categorical/resource teachers and requires the completion of 8 courses numbered 801 through 816 plus two courses from those numbered 821 through 833.

**M.Ed. Degree**

Both thesis and non-thesis options are available for the M.Ed. degree. The M.Ed. (thesis) program requires at least 24 credit units at the 800 level (including 6 credit units of Research methods) in addition to the

writing of a thesis and one academic year of residency. The M.Ed. (non-thesis) program requires at least 36 credit units at the 800 level (including 3 credit units of Research methods and 6 credit units of an approved project) and does not require a residency. In addition to other course requirements, an M.Ed. degree program needs to include a complete sequence of courses in at least one of the six specialization areas.

Students may elect to complete a Master's degree program that combines the cross categorical program with an in-depth emphasis on one selected specialization area, ensuring both breadth and depth in special education training.

Graduate programs are offered in the following areas:

*Cross Categorical*

- Resource Teaching

*Categorical*

- Behaviour Disorders
- Language and Communication Skills
- Learning Disabilities
- Mental Retardation
- Specialist Teaching

There are three broad research interests in the department. The first area includes oral communication, developmental dyslexia, and disorders of written expression. The second relates to the development and delivery of special education services to exceptional students at the individual and community level and in teacher preparation programs. Finally, research in the area of early intervention among school age special-needs students to minimize the effects of the various handicapping conditions is also being conducted.

**EDEXC 801.3  
Assessment in Special Education  
1(3L)**

Provides preparation in theory and practice of assessment methods and strategies necessary for success in the integrated practicum (EDEXC 805). Emphasizes the organizational and procedural aspects of assessment, and is directed toward providing a framework of instructional decision-making.

**EDEXC 803.3  
Theory of Service Delivery in  
Exceptionality  
1/2(3L)**

Presents models and practices of service delivery in special education. A range of service alternatives, from mainstream support to segregated settings, is outlined. Emphasis is placed upon collaboration and team decision making in selecting and implementing patterns of service options.

**EDEXC 805.3  
Integrated Practicum in Special  
Education I  
1(3L-2C)**

*Prerequisite(s):* EDEXC 801 and 803.

Provides students with practicum experience intended to consolidate and apply the concepts presented in the related theory classes within the program. Experience will be provided across a range of ages and exceptionalities. The practicum

begins in both campus and school settings and becomes progressively school-based. Collaboration and team decision-making are emphasized.

**EDEXC 807.3  
Instruction in Special Education  
1(3S-2C)**

*Prerequisite(s):* EDEXC 801, 803.

The intent of this class is to provide preparation in theory of instructional methods and strategies necessary for success in the integrated practicum. The emphasis in this class is upon the organizational and procedural aspects of instruction, and is directed toward providing a framework for instructional decision-making. The instructional content is delivered in the related needs classes.

**EDEXC 810.3  
Language and Communication Skills  
1/2(3L)**

*Prerequisite(s):* EDEXC 410; or equivalent.

Information concerning mild and moderate degrees of language and communication difficulties is presented. Relationships to academic success are discussed. Primary emphasis is placed on improving listening and speaking skills. Reading and writing skills are stressed as they contribute toward the development of communicative competence. Assessment and intervention issues are also addressed.

**EDEXC 812.3  
Teaching Behaviour and Social Skills  
1/2(2L-1S)**

Presents generic strategies for assessment and educational intervention with children/youth who have behaviour and social problems. While relevant theory and research are reviewed, major emphasis is placed on practical strategies for improving behaviour in the school setting.

**EDEXC 814.3  
Cognitive and Academic Skills of  
Exceptional Persons  
1/2(3L)**

Provides students with knowledge of theory, research, and practice related to the understanding and teaching of exceptional children who have specific instructional needs in the cognitive and academic domains. Central topics include: application of models of cognitive processes, history and methods of cognitive strategy instruction, metacognition, and cognitive processes underpinning academic instruction for exceptional students.

**EDEXC 816.3  
Transitional Needs in Special  
Education  
1/2(3L)**

Examines critical issues surrounding the transition of students with learning and behaviour disorders to less restrictive educational settings, post-secondary school, and work environments. Current models for transitional services, assessment practices, formalized transitional plans, and strategies for plan implementation and evaluation will be critiqued.

**EDEXC 821.3**  
**The Study of Intellectual Disabilities: Theory 1&2(3L)**

Examines intellectual disabilities with reference to identification, assessment and diagnosis, classification schemes, etiologies, behavioural manifestations, societal attitudes and societal responsibilities. While this course addresses practical solutions to the problems that persons with intellectual disabilities face, the emphasis of the course is theoretical.

**EDEXC 824.3**  
**Teaching Language and Communication Skills 1/2(3L)**

*Prerequisite(s): EDEXC 810; or equivalent.*

Provides an in-depth study of the theoretical basis of language and communication development and disorders. An integrated approach to assessment and intervention will provide relevant information on theoretical issues that have both direct and practical implications in working with individuals having communication difficulties.

**EDEXC 831.3**  
**Behaviour Disorders of Children and Youth: Introduction to Theory and Practice 1/2(3L)**

*Prerequisite(s): EDEXC 812.*

Provides an introduction to the interdisciplinary nature of behaviour disorders in children and youth and the broad functions that support pedagogical and clinical practice. Focus will be directed towards presenting research, theory and practice grounded in replicable experimental data. Students in special education, educational psychology and psychology may find this course useful.

**EDEXC 833.3**  
**Theoretical Foundations of Learning Disability 1/2(3L)**

Provides a comprehensive overview of the field of learning disabilities, its diverse theoretical issues, historical roots and emerging directions. Methods of recognition at different life stages will be covered as well as appropriate intervention strategies.

**EDEXC 853.3**  
**Seminar in Teaching Language and Communications Skills 1/2(1L-2S)**

*Prerequisite(s): EDEXC 810 and 824.*

A deeper examination of the theory of language and communication difficulty. Intensive review and critique of current research on the psychological, psycholinguistic, and cognitive aspects of language and communication dysfunction.

**EDEXC 859.3**  
**Seminar in Learning Disabilities 1/2(1L-2S)**

*Prerequisite(s): EDEXC 833.*

An in-depth study of the most recent theories in the field of learning disabilities. Each student will undertake a major search

of the literature and present one aspect of basic skills, the models of processing and the way learning disabilities interfere with normal acquisition of this basic skill.

**EDEXC 862.3 (Formerly 861)**  
**Special Problems: Intellectual Disabilities 1&2(3S)**

*Prerequisite(s) or Corequisite(s): EDEXC 821.*

This is a seminar class which examines topics of major interest associated with intellectual disabilities. Topics are chosen each year on the basis of student interest and critical need as determined by the instructor. Students participate in all seminars and must provide a minor graduate-level paper on a chosen topic.

**EDEXC 868.3 (Formerly 867)**  
**Behaviour Disorders of Children and Youth: Advanced Theory and Practice 1(3S)**

*Prerequisite(s): EDEXC 831.*

Focuses on the empirically-based education and clinical management of behaviour disorders in children and adolescents. Critical issues related to theory, assessment practices, and treatment approaches are examined

**EDEXC 886.1/887.2/888.3**  
**Trends and Issues in the Education of Children and Youth with Special Needs 1/2(1S), 1/2(2S), 1/2(3S)**

*Prerequisite(s): Permission of the instructor.*

Reviews the theoretical and practical bases of emerging trends in the education of children and youth with special education needs. Regular faculty with specific expertise or visiting scholars on sabbatical leave will offer the course periodically. The course is adaptable for intensive, short-term offerings by outstanding visiting scholars.

**EDEXC 898.3/899.6**  
**Individual Study 1/2(3P), 1&2(3P)**

These courses consist of the writing of a minor thesis based on extensive readings or on experimental study. The project must be planned, carried out and reported by the student under the supervision of a faculty supervisor.

**EDEXC 990**  
**Seminar on Exceptionality**

Non-credit course for graduate students in Education of Exceptional Children. On-going research and development projects of faculty and students form the focus of a series of seminars.

**EDEXC 992.6**  
**Project**

The project for students registered in a non-thesis Master's degree. It is a compulsory course for the non-thesis Master's route. The project must be accepted by a committee of the department and evaluated by the committee.

**EDEXC 994**  
**Research**

A student undertaking research leading to a Master's thesis must register in this course

each year until the thesis is completed. This applies to thesis work done extramurally as well as intramurally.

**INDIAN AND NORTHERN EDUCATION**

See Department of Educational Foundations for program description and individual department sections for course listings.

**MUSIC EDUCATION**

The Department of Music Education offers the Postgraduate Diploma and Master of Education in Music Education. Prerequisites for admission to a program leading to a Master of Education degree in Music Education are as follows: 1) A Bachelor of Education with a Music major or a Bachelor of Music; 2) at least 36 credit units in music at the undergraduate level; 3) demonstrated proficiency in music theory, music literature and history, choral or instrumental conducting techniques, performance, and music education methods and 4) at least one year of teaching experience. The program will consist of 21-27 credit units plus the thesis, a written comprehensive after the completion of the courses, and an oral defense of the thesis. A non-thesis option is available. It consists of a research methods class plus 36 credit units in the areas of music education, performance, composition and conducting. Required courses in the Master of Education degree in Music Education are EDMUS 869 and MUSIC 841. The Postgraduate Diploma program consists of 30 credit units with at least 18 on the graduate level. Applicants should consult with the Head of the Department of Music concerning prerequisites and requirements for all graduate programs in Music Education.

Areas of research in Music Education may include Administration of School Music Programs, Curriculum Development, Methodology, Instrumental or Vocal Pedagogy, Philosophy of Music Education or Technology in Education.

Graduate students in music education have the opportunity, upon application, to serve as assistants in choral and instrumental music, history and literature, theory and music methods, and applied music. For further details, contact the Department of Music.

**EDMUS 860.3**  
**Psychology of Music 1/2(3L)**

Functions of the musical mind and factors involved in the development of musical skills and maturity.

**EDMUS 861.3**  
**Tests and Measurements in Music 1/2(3S)**

Study and research into standardized aptitude and achievement testing in Music.

**EDMUS 863.6**  
**A History of Music Education 1&2(3L)**

The study of the development of music education in North America and Europe with special emphasis on the Canadian scene. A feature of the course will be the

comparative study of music education systems as they exist today.

**EDMUS 864.6**  
**Seminar in Conducting 1&2(3L/S)**

Advanced techniques in choral and instrumental conducting. A major portion of the course will be devoted to laboratory experiences with campus and community instrumental and choral organizations.

**EDMUS 865.6**  
**Seminar in Applied Music 1&2(3L/S)**

Investigates the literature, pedagogy, and performance characteristics of selected instruments (keyboard, wind, string, voice). The performance and pedagogy components will be geared to the individual needs and requirements of the student.

**EDMUS 869.6**  
**Seminar in Music Education 1&2(3L/S)**

Investigation into current trends in music education; teaching techniques, administrative and supervisory techniques, research methods, research problems and projects.

**EDMUS 994**  
**Research**

A student undertaking research leading to a thesis must register in this course each year until the thesis is completed. This applies to thesis work done extramurally as well as intramurally.

**OTHER COURSES**

Other courses may be selected from EDMUS or MUSIC offerings with permission of the Department Graduate Committee.

**ELECTRICAL ENGINEERING**

Postgraduate Diploma, M.Eng., M.Sc. and Ph.D. programs in Electrical Engineering are offered. The specific areas of active research are: Power system analysis, protection and control; reliability evaluation; electrical machines and power magnetics; image processing; pattern recognition and remote sensing; communication systems; instrumentation and microprocessor applications; VLSI and computer aided design; and biomedical engineering.

An applicant for a doctoral degree must have a M.Sc. from a North American university with exceptional academic standing and demonstrated research potential. Applicants with M.Sc. degrees from overseas are accepted for M.Sc. programs and are considered for proceeding towards Ph.D. degrees on successful completion of the M.Sc. Postgraduate Diploma students are considered for acceptance in Master's programs on the completion of the diploma program.

Applicants for advanced degrees in Electrical Engineering are advised to start graduate programs at the beginning of the Regular Session in September. Courses given in the second term are generally in continuation of those given in the first term.

The M.Sc. program consists of at least 15 credit units of graduate level courses plus a thesis. The Ph.D. program consists of at

least 6 credit units plus a thesis. Some of the courses listed are specialized in nature and are only given when there is sufficient demand. All graduate students are required to take E E 990 - Seminar in which each student is required to 1) make a presentation from his research to students and faculty and 2) participate in the discussions that follow each presentation.

**COURSES FOR STUDENTS NOT MAJORING IN ELECTRICAL ENGINEERING**

**E E 701.3  
Introductory Circuits and Electronics  
1(3L-3P)**

A lecture/laboratory course designed for students who have little or no background experience in electronics but who wish to obtain a working knowledge of electronic devices and techniques. Fundamentals of electricity and basic laws governing voltage and current in circuit elements with direct and alternating current excitation; charge carriers in vacuum and semiconductor materials; the diode and diode circuits; the junction transistor, equivalent circuit at low frequency, the basic amplifier circuit, biasing, and digital electronics. It is expected that students will follow up with E E 702 to achieve a useful level of experience in the application of electronic devices.

**E E 702.3  
Electronic Instrumentation  
2(3L-3P)**

*Prerequisite(s): PHYS 227 or G E 212; or equivalent experience approved by the Head of Department.*

A lecture/laboratory course for students whose main interest is in fields other than electrical engineering but have a background knowledge of elementary electric circuits and principles of electronics. Deals with electronic instruments and their application, in measurement, automatic control, computation, and other areas related to the interests of the students.

**COURSES FOR STUDENTS MAJORING IN ELECTRICAL ENGINEERING**

**E E 740.3  
Introduction to Real-Time Computing  
1(3L-3P)**

The main purpose of this course is to become familiar with the capabilities and use of the computers in the College of Engineering. Topics include capabilities of the operating systems, system utilities, real-time capabilities and their use. Main emphasis will be placed on an awareness of system capabilities and hands-on use of the system.

**E E 800.3  
Circuit Elements in Digital  
Computations  
1(3L-3P)**

The electrical circuit aspects of digital systems. Includes: logic devices, data bus design, processor architecture, input-output techniques, input-output devices, magnetic and electronic storage devices, computer communication techniques and devices.

**E E 801.3  
Advanced Non-Linear Circuits  
2(3L)**

General principles of design of pulse circuits from the milli-second to nano-second regions. Semiconductor two and three terminal devices will be discussed with reference to pulse generation, wave shaping, etc. The operation and limitations of digital integrated circuits will be dealt with. Devices and techniques will be highlighted by investigating a number of selected applications. Some laboratory sessions may be included.

**E E 802.3  
Advanced VLSI Design and Analysis  
2(3L-3P)**

A study of semiconductor devices with special emphasis placed on device operation in VLSI circuits. Topics include device physics, electrical characteristics, computer simulation of circuits, speed-power-area considerations, and MOS integrated circuit design. Laboratory sessions will examine device measurement and simulation. A design project is also required.

**E E 804.3  
Passive and Active Linear Network  
Synthesis  
2(3L)**

Positive real functions, realization of lossless one ports, RLC Driving point function synthesis, passive two port synthesis; an introduction to the synthesis of active networks.

**E E 805.3  
Real-time Data Acquisition and  
Control  
1/2(3L-3P)**

*Prerequisite(s): E E 740 and CMPT 122; or equivalent.*

Advanced data acquisition and control in an engineering environment. Real time control using analog and digital inputs and outputs. Processing delays associated with data acquisition software. Hardware and software techniques for noise reduction and signal conditioning.

**E E 809.3  
Selected Topics in Electronic and  
Digital Systems  
1/2(3L)**

Consists of regular lectures, assigned reading, reports, and laboratory exercises. Topics selected from the following areas: development of microprocessor based digital systems; large scale integrated circuit (VLSI) design and testing; computer aided design, testing and manufacture; high frequency linear network design; high speed digital design.

**E E 810.3  
Communication Theory I  
1(3L)**

Deterministic signal theory, noise and its physical origin, random signal theory, performance of analog and digital communication systems in the presence of noise.

**E E 811.3  
Antenna Engineering  
2(3L)**

*Prerequisite(s): E E 818.*  
EM radiation, Green's function technique for the radiation problem, principle of

equivalence, concept of magnetic current, radiations from electric and magnetic current sources, aperture antennas, lens and reflector antennas, printed antennas, variational technique for antenna impedances, antenna array theory.

**E E 812.3  
Active Microwave Devices and Circuits  
1/2(3L)**

*Prerequisite(s): E E 818.*

Topics include: matching networks and signal flow graphs, characteristics of amplifiers and oscillators, noise theory, avalanche devices and circuits, gunn devices, bipolar and field effect transistors, low noise amplifiers, power amplifiers, oscillators, microwave subsystems.

**E E 813.3  
Introduction to Pattern Recognition  
2(3L-3P)**

Pattern recognition systems, vector space representation of patterns. Supervised and unsupervised systems. Bayes solution. Parameter estimation. Maximum likelihood classification. Linear and nonlinear discriminants. Discussion of feature selection and clustering. A design project is also required.

**E E 814.3  
Communication Theory II  
2(3L)**

Information theory and applications in communication systems. Channel capacity and introduction to coding theory, synchronization in digital systems.

**E E 815.3  
Man-Machine Communication and  
Interactive Computer Systems  
1/2(3L-3P)**

A wide range of techniques used in interactive computer systems utilizing audio and visual interfaces is discussed. Data acquisition fundamentals, image enhancement, texture analysis, 3-dimensional displaying techniques, sound/voice synthesis, simulation of physical systems, extraction of information from real time systems, data format conversion, associative memory, artificial intelligence and neural network.

**E E 816.3  
Telephony I  
1/2(3L)**

*Prerequisite(s): E E 485; or equivalent.*

Topics will be chosen from the following: wireline transmission of analog and digital signals with references to subscriber lines, trunks and carrier facilities. Processing and coding of analog signals for digital transmission and switching. Blocking and non-blocking connecting networks with PBX and central office applications. Data transmission in analog and digital networks.

**E E 818.3  
Electromagnetic Wave Propagation  
1(3L)**

This is a fundamental course on Electromagnetic Field Theory and Microwave Passive Circuits. Includes vector calculus, electrostatics, magnetostatics, Maxwell's equations, Poynting theorem, plane-wave solution,

reflection of plane waves, rectangular waveguide, cylindrical waveguide, planar transmission lines, network parameters, branchline hybrids, dielectric resonators, isolators and attenuators, matching networks, filters, wide band directional couplers, mixers, pin diode circuits.

**E E 819.3  
Selected Topics in Communications  
and Signal Processing  
1/2(3L)**

Consists of regular lectures, assigned reading, reports and laboratory exercises. Depending on the interests of students and faculty, topics will be selected from the following areas: electromagnetic wave propagation, fiber optic transmission systems, digital microwave and satellite transmission, image processing and pattern recognition for robotic and remote sensing applications.

**E E 820.3  
Electrical Materials Science  
1/2(3L)**

Review of general solid state physics for electrical engineers. An introduction to Wave-Mechanics. Band theory of solids, metals, semiconductors and insulators. Electrical conduction in solids. Structure and properties of materials for device applications.

**E E 821.3  
Magnetic Properties of Materials  
1/2(3L)**

Brief review of the magnetic properties of bulk materials, domains in bulk and thin films; preparation of thin films; anisotropy and magnetization reversal; structure and switching of permalloy films with applications to computers; magnetic measurements, ferromagnetic resonance; paramagnetic resonance.

**E E 823.3  
Solid State Electronic Devices  
1/2(3L)**

Physics of semiconductors, emphasis on electronic and optical properties; growth mechanisms, determination of structures, modification of bulk properties, microelectronics, thin and thick films, review of recent developments in electronic materials. Principles of semiconductor devices.

**E E 829.3  
Selected Topics from Optical  
Electronics and Imaging Science  
1/2(3L)**

Basic theory with emphasis on relationship between electronic structure and optical properties of solids; Einstein A and B coefficients for stimulated transitions; the density matrix; inhomogeneous broadening; quantum noise; application of Lasers; Fourier theory to the analysis and synthesis of optical imaging, holography and electrophotography.

**E E 830.3  
Electronic Instrumentation  
1(3L)**

Sensor design and application in general, with detailed examples, followed by an examination of the problems, their use in process control and data logging, and analysis and presentation of results.

**E E 832.3**

**Automatic Cartography  
1(3L)**

The engineering design concepts relative to assembling a system of automatic cartography which is closely related to the needs of cartographers and hydrographers. Computer control of system, automatic graph plotters, automatic and semi-automatic digitizing units and display systems.

**E E 840.3**

**Mathematical Methods in Engineering  
1(3L-3P)**

Techniques for solving sets of linear algebraic equations using direct and iterative methods; methods for solving non-linear algebraic equations using digital computer methods; simulation methods for large scale dynamic systems; fast fourier transform method and digital computer solutions to other transform methods.

**E E 841.3**

**Numerical Methods in Power System  
Analysis  
1(3L-3P)**

A brief review of matrix theory. Laplace transform methods, and stability criteria of control systems. State space representation and the application of numerical techniques for investigating the effects of controller adjustments on power system dynamics. Digital computer programming methods for obtaining load flow solutions and analyzing large complex control systems.

**E E 845.3**

**Random Variables in Engineering  
Systems  
1/2(3L)**

Random variables, functions of random variables, expectations, characteristic function, joint densities and distributions, sequences of random variables, concept of stochastic processes. The emphasis is on developing a working knowledge of the above theory in engineering applications.

**E E 850.3**

**Reliability Engineering  
1(3L)**

Basic reliability concepts, elements of probability and statistical theory, application of important distributions, reliability in series, parallel and complex systems. Application of Markov chains in the evaluation of repairable system reliability. Utilization of Monte Carlo simulation in basic system reliability evaluation.

**E E 851.3**

**Power System Reliability  
2(3L)**

Reliability evaluation of static and spinning generating capacity requirements. Interconnected system reliability concepts. Transmission system reliability evaluation. Determination of composite system reliability. Distribution system reliability evaluation. Incorporation of customer interruption costs in the evaluation of power system reliability worth.

**E E 860.3**

**Power System Analysis  
1(3L)**

System representation and analytical techniques required in the solution of power system steady state and transient problems.

The use of analog and digital computers in load flow, fault and stability studies is emphasized. Insulation co-ordination, hv-dc transmission, power system reliability and control are briefly discussed.

**E E 861.3**

**Advanced Power System Analysis  
2(3L)**

Symmetrical components, balanced and unbalanced power system fault studies. B and O: positive plus negative, positive minus negative and O sequence components. Simultaneous faults. Sequence impedances of lines and cables. Measurement of sequence voltages, currents and impedances. Performance of relays during faults and swings are briefly discussed.

**E E 863.3**

**High Voltage Direct Current  
Transmission  
1(3L)**

Economics of direct current bulk power transmission. Converter circuits and valve connections. Analysis of bridge connected rectifiers and inverters. Grid control, commutation of bridge rectifiers. High voltage mercury arc and thyristor valves. Control of dc transmission lines. Harmonics in ac and dc systems. Reactive power requirements. D.C. corona.

**E E 865.3**

**Power System Relays and Protection  
1(3L)**

Electromagnetic and electronic protective relay devices. Overcurrent undervoltage, underfrequency, distance, pilot wire and carrier protective relay schemes. Protection of generators, transformers, lines and bus bars. Back up protection. Maintenance and testing of relays.

**E E 866.3**

**Power System Modeling and Control  
2(3L)**

Modelling of power systems: synchronous machines, HVDC lines, static var compensators (SVC), loads and the power network. Small-disturbance modelling and large-disturbance modelling; control of power systems: automatic generations control (AGC), frequency and voltage control. Control of power system damping and transient stability.

**E E 867.3**

**Economic System Operation  
2(3L)**

Basic concepts of economic system operation; determination of system transmission losses; development of transmission loss formulae co-ordination of incremental production costs and incremental transmission losses in composite hydro-thermal systems; economic load dispatch in thermal systems by dynamic programming; optimal economic operation of hydro-thermal systems and risk constrained unit commitment and economic load dispatch.

**E E 868.3**

**Digital Techniques for Power System  
Measurements and Protection  
1/2(3L-1.5P)**

Conditioning and sampling of power system data. Digital techniques for estimating voltage and current phasors.

Measuring current, voltage, power, reactive power, power factor, frequency and rate of change of frequency. Digital techniques for protection of generators, transformers, reactors, capacitors and, transmission and distribution lines.

**E E 869.3**

**Advanced Topics in Power System  
Analysis and Design  
2(3L/R/P)**

Consists of assigned reading, lectures by staff members, discussion periods and laboratory exercises with reports. Topics will be selected from the following areas of analysis and design of electric power systems. Switching and lightning surges, insulation coordination; composite system reliability evaluation, reliability of substations; digital relays, analog and digital filters; sensitivity analysis and simulation of outages; second-order load flows; optimal and adaptive control of power systems; planning and operation of power systems.

**E E 870.3**

**Theory of Electrical Machines  
1(3L)**

Review of fundamental laws, including Maxwell's equations. Coupling concepts, voltage equations and equivalent circuits of static and dynamic machines, operational implications of these aspects in transformers, induction and synchronous machines. Symmetrical and unsymmetrical windings, distribution of field and current-loading, production of constant and pulsating torques, harmonic torques. Introduction to generalized electrical machine theory.

**E E 871.3**

**The Generalized Theory of Electrical  
Machines  
2(3L)**

Basic principles of the general theory. The generalized rotating machines and its equation. Transformations of the equations. Applications to different electrical machines.

**E E 872.3**

**Advanced Theory of Electrical  
Machines  
2(3L)**

*Prerequisite(s): E E 870.*

Penetration of field-wave in the massive-rotor; application of Maxwell's equations; the electrical fields of transformers; shaft-voltages and fluxes, bearing-currents, oscillations in induction machines; massive-rotor induction machines; unsymmetries in stator and rotor windings; reluctance motor; asynchronous-synchronous operation of a synchronous machine; stability; power selsyns.

**E E 873.3**

**F.H.P. Motors and Special Rotating  
Electromagnetic Devices  
1(3L)**

*Prerequisite(s): E E 870 recommended.*

Linear theory of induction motor; single and polyphase F.H.P. motors; unsymmetrical connections and windings; shaded-pole motors; effect of saturations; hysteresis motors; Reluctance motor; stepper motors; induction-synchronous motors; applications and design considerations.

**E E 874.3**

**Electromagnetic Acoustic Noise in  
Electrical Machines  
2(3L)**

*Prerequisite(s): E E 870.*

Electromagnetic striction; modes of vibrations in 1-phase and 3-phase transformers; calculation of acoustic noise and means of suppression; fields and harmonics in rotating machines, nature and analysis of noise in induction and synchronous machinery. Design considerations for limiting the noise-level in power machines.

**E E 875.3**

**Electric Machine Transient  
Performance  
2(3L)**

A study of the dynamic performance of interconnected synchronous machines taking into account their non-linear properties and the effects of speed and excitation control devices.

**E E 880.3**

**Digital Signal Processing  
1/2(3L)**

*Prerequisite(s): G E 210, E E 315, 326 or equivalent; 321, 325, 484, and 485 are desirable as prerequisites.*

The fundamentals of discrete signals theory for communication, telephony, image processing and biomedical engineering. The course covers discrete Fourier transform, FFT (Fast Fourier Transform), spectral analysis, FIR (Finite Impulse Response) filters, IIR (Infinite Impulse Response) filters, DSP (Digital Signal Processing) microprocessor applications, finite word-length effects, and introduction to spectral estimation and adaptive digital filters.

**E E 902.6**

**Advanced Electrical Laboratory  
1&2(P)**

Candidates for the Postgraduate Diploma may register for work in one of the electrical Engineering Research Laboratories as in the case of the regular courses. Permission of the department must be obtained before enrolling, and will depend upon the availability of suitable facilities as well as the experience of the candidate. Normally, credit may be given for no more than 6 credit units during the academic year, following the completion of the work and the submission of a satisfactory engineering report certified by the department. This course is not acceptable for the Master's degree.

**E E 990**

**Seminar**

A seminar is held periodically throughout the regular session during which staff and graduate students discuss current research topics. Graduate students are required to attend these seminars.

**E E 992.6**

**Project**

Students undertaking the non-thesis Master's degree (M.Eng.) must register in this course. It consists of independent study and investigation of a real world problem, and submission of an acceptable report on the investigation.

## **E E 994 Research**

Students writing a Master's thesis must register for this course.

## **E E 996 Research**

Students writing a Ph.D. thesis must register for this course.

## **RE SE 780.3 Methodology and Applications of Remote Sensing Technology 1/2(3L-3P)**

An interdisciplinary course dealing with the evaluation and application of various sensor systems (photographic, spectral scanners, microwave radiometer, radar image, and radio reflectometer) to specific resource orientated programs such as soil survey, land use, crop and landform identification, and aspects of pollution detection and monitoring. Data processing and presentation of remote sensing data are discussed with particular reference to pattern recognition techniques, feature selection and numerical display of data.

## **ENGLISH**

The Department of English offers graduate studies in literature leading to the M.A. and Ph.D. degrees. Its faculty engages in a wide range of literary research from Old English to postcolonial and women's literatures, and in interdisciplinary cultural studies. Courses from the list below are offered on a rotational basis in two- to three-year cycles and special topics courses, usually reflecting current research interests of faculty, are offered most years.

M.A. candidates must be in residence for at least one academic year, demonstrate an intermediate reading knowledge of a language other than English, and successfully complete 18 credit units of course work and a thesis. Ph.D. candidates must be in residence for at least two academic years, complete 18 credit units of course work (and ENG 801 if not previously taken), and pass comprehensive examinations in their area of specialization. They must also demonstrate advanced knowledge of one language other than English relevant to the dissertation area, or intermediate knowledge of two languages other than English, at least one of which must be relevant to the dissertation area, and successfully defend a dissertation.

## **ENG 801.3 An Introduction to Textual Scholarship 1/2(2S)**

An introduction to textual authority, including the study of bibliographic description, editorial technique, textual transmission, database searches, and the history of modes of publication.

## **ENG 802.6 Studies in Literary and Cultural History 1&2(2S)**

Studies of specific literary periods, literary movements, issues of influence, reputation

or reception. Theories of literary history may also be studied.

## **ENG 803.3 Topics in Literary and Cultural History 1/2(2S)**

Particular topics in the study of periods, movements, issues of influence, reputation or reception. Theories of literary history may also be studied.

## **ENG 804.6 Studies in Individual Authors 1&2(2S) Studies in an author or selected authors writing in English.**

## **ENG 805.3 Topics in Individual Authors 1/2(2S)**

Particular topics in the work of an author writing in English, or on particular works in the author's *oeuvre*.

## **ENG 810.6 Studies in National and Regional Literatures 1&2(2S)**

Studies in national and regional literatures (Canadian, American, English, Irish, etc.) and other constructions of nationality (postcolonial, aboriginal, ethnic, etc.).

## **ENG 811.3 Topics in National and Regional Literatures 1/2(2S)**

Particular topics in national and regional literatures and constructions of nationality.

## **ENG 816.6 Studies in Literary and Cultural Theory 1&2(2S)**

Studies in selected literary and/or cultural theories, from Plato to the present.

## **ENG 817.3 Topics in Literary and Cultural Theory 1/2(2S)**

Particular topics and issues in selected theories, or on particular theorists.

## **ENG 818.6 Studies in Methods and Texts 1&2(2S)**

Studies in the application of selected methods in the practical criticism of selected texts.

## **ENG 819.3 Topics in Methods and Texts 1/2(2S)**

Particular topics and issues in the application of selected methods to selected texts.

## **ENG 842.6 Studies in Genres and Contexts 1&2(2S)**

Studies in traditional or emerging genres of writing, and in their intertextual, disciplinary, and extraliterary contexts.

## **ENG 843.3 Topics in Genres and Contexts 1/2(2S)**

Particular topics and issues in traditional or emerging genres of writing, and in their intertextual, disciplinary and extraliterary contexts.

## **ENG 898.3/899.6 Special Topics 1/2(2S), 1&2(2S)**

## **ENG 994 Research**

Students writing a Master's thesis must register for this course.

## **ENG 996 Research**

Students writing a Ph.D. thesis must register for this course.

## **ENVIRONMENTAL ENGINEERING**

The Division of Environmental Engineering is an interdepartmental and an interdisciplinary association of faculty based in the College of Engineering. Through the College of Graduate Studies and Research, the Division of Environmental Engineering offers postgraduate programs leading to the Postgraduate Diploma, M.Eng., M.Sc. and Ph.D. degrees.

The expectations of society and direct pressure from industry have generated a demand for the technical ability to solve a wide range of environmental problems. It is difficult to provide a concise definition of environmental engineering because it covers such a wide spectrum of problems. For example the following are some areas of study in environmental engineering that could be pursued by students in the Division of Environmental Engineering:

- Waste water treatment and disposal for municipal systems
- Water supply for human and industrial consumption
- Wind engineering and atmospheric dispersion of pollutants;
- Industrial waste from manufacturing and processing
- Waste management from mining and the petroleum recovery
- Groundwater contamination, remediation and containment
- Surface water management and pollution control
- Reduction in toxic emissions from forest products and pesticide plants
- Automobile emissions and alternative fuels
- Building energy conservation
- Agricultural practices, fertilizers, feedlots, etc.
- Development of energy alternatives and energy conservation
- Improving efficiency of manufacturing processes
- Urban land use

In addition to course work, submission of a research thesis is required for the M.Sc. and Ph.D. students. Candidates for the M.Eng. are required to submit a final report for their project.

In addition to the following specialized courses students may take courses offered by other colleges and departments. These courses may be selected in consultation with the chair and supervisor.

## **ENV E 710 Environmental Issues and Law 1/2(3L)**

*Prerequisite: Registration in a Graduate Studies Program.*

Designed for graduate students particularly in the areas of Engineering, Agriculture, Resources and Environmental Studies with no legal background. This course explores the legal aspects of environmental protection, environmental offences, constitutional law, environmental impact assessment, environmental audit and professional responsibility in relation to environmental advice and decision-making.

## **ENV E 898.3 Special Topics 1/2(3L)**

Two 3 credit courses can be taken independently. Topics will be selected according to the student's specific area of interest.

## **ENV E 990 Seminar**

A seminar is held each week throughout the regular session during which students, staff, and invited speakers discuss current research topics. Students are required to attend and to present at least one seminar each academic term.

## **ENV E 992.6 Project**

Students taking the non-thesis Master's degree must register in this course.

## **ENV E 994 Research**

Students writing a Master's thesis must register in this course.

## **ENV E 996 Research**

Students writing a Ph.D. thesis must register in this course.

## **ENGINEERING PHYSICS**

See Physics and Engineering Physics.

## **FOOD SCIENCE**

The Department of Applied Microbiology and Food Science offers M.Agr., M.Sc. and Ph.D. programs in Food Science. Faculty members in other departments, including Agricultural and Bioresource Engineering, Chemistry, Crop Science and Plant Ecology, and the Division of Nutrition and Dietetics, also contribute to these programs. Research generally involves basic chemistry, microbiology and unit processes applied to food systems; it may also be commodity based, with current emphasis on grains, edible oils, meats, and honey and native fruits.

## **FD SC 812.3 Fluid Food Products 1(3L)**

Designed to introduce students to the production and processing of milk,

alcoholic beverages, soft drinks and other fluid food products.

**FD SC 817.3  
Analytical Techniques in Food Science  
1(3L-3P)**

*Prerequisite(s): BIOCH 220 (or 203); or permission of the instructor.*

Modern analytical techniques and instruments for routine analysis and research on food products. Basic principles, analytical methods, applications, precision and sampling problems are discussed. Seminar and written assignments on current topics.

**FD SC 830.3  
Processing of Oilseeds and Legumes  
2(3L-4P)**

*Prerequisite(s): BIOCH 220 (or 203) or PL SC 420; or permission of the instructor.*

A detailed study of the structure, composition and processing of the principal oilseeds and legumes. Refining and utilization of the food, feed and industrial products will be discussed. Techniques for the component extraction of oil, protein, starch and fiber will be demonstrated in the pilot plant.

**FD SC 840.3  
Carbohydrates in Foods and Their Functional Properties  
2(3L)**

The physical and chemical characteristics of carbohydrates of plant origin will be discussed; their functional properties and interactions with other food components will be emphasized.

**FD SC 898.3/899.6  
Special Topics  
1&2(R/T/P)**

Assigned reading, tutorials and laboratory techniques in special areas related to the student's major field of interest. Students will be required to prepare reviews or seminars in specific topics.

**FD SC 990  
Seminar**

Current literature in the field of Food Science is reviewed and discussed. Staff and students present papers on current research topics. Graduate students are required to attend and participate.

**FD SC 992.6  
Project**

Students registering for the non-thesis Master of Agriculture degree must register in this course.

**FD SC 994  
Research**

Students writing a Master's thesis must register for this course.

**FD SC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**OTHER COURSES**

Other supporting courses which can be taken for credit in the Food Science program are:

- AP MC 836.3 Food Microbiology
- AP MC 837.3 Industrial Microbiology
- AN SC 800.3 Directed Studies in Protein Metabolism and Nutrition
- BIOCH 841.3 Biochemical Techniques
- CHEM 860.3 Proteins and Nucleic Acids
- PL SC 804.3 Processing and Analysis of Grain Crops

For details on the above courses, see the appropriate section of the *Calendar*.

**FRENCH**

The Master's program in French for students who have Honours in French from this university, or equivalent qualifications, consists of 18 credit units to be chosen in consultation with the department and the preparation of a suitable thesis. Missing prerequisites must be made up by taking suitable undergraduate courses which will not be counted as part of the 18 credits. Courses, essays, thesis and defense are in French.

**FR 808.3  
Advanced Studies in the Literature of Medieval France  
1/2(3L)**

*Prerequisite(s): FR 308; or equivalent.*

In a given year, one special topic in medieval or Renaissance French and Provençal literature will be studied, such as the epic, drama, poetry, verse-novels, the Graal-cycle, (pre-)humanistic translations, or non-literature texts, with special emphasis on the manuscripts transmission and editorial principles.

**FR 814.6  
French Literature of the Second Half of the 19th Century  
1&2(3L)**

Literary movements including Le Parnasse, symbolism, realism, naturalism. Poets studied include Hugo, Leconte de Lisle, Hérédia, Baudelaire, Rimbaud, Mallarmé. Novelists studied include Flaubert, Zola, Maupassant, Daudet.

**FR 815.6  
French Poetry  
1&2(3L)**

A study of French poetry from the medieval period to the present.

**FR 817.3  
Advanced Studies in 17th-Century French Literature  
1/2(3L)**

*Prerequisite(s): Admission to graduate studies in french.*

In a given year, a special topic in French literature of the 17th century will be studied, e.g., the theatre of Corneille and Racine; the novel; secondary genres (fables, sermons, maxims, portraits, correspondence).

**FR 818.3  
Advanced Studies in 18th-Century French Literature  
1/2(3L)**

*Prerequisite(s): Admission to graduate*

*studies in French.*

In a given year, a special topic in French literature of the 18th century will be studied, e.g., novel, theatre, Encyclopédistes, etc.

**FR 819.3  
Advanced Studies in 19th-Century French Literature  
1/2(3L)**

*Prerequisite(s): Admission to graduate studies in french.*

In a given year, a special topic in French literature of the 19th century will be studied, e.g., the second, disillusioned romantic generation (Flaubert, Baudelaire, Rimbaud and Mallarmé), which idolizes art, the antithesis of money.

**FR 820.3  
Advanced Studies in French Literature of the 20th Century  
1/2(3L)**

*Prerequisite(s): Admission to graduate studies in french.*

One aspect of 20th-century literature will be studied in depth, for example, the absurd and engagement, 20th-century attempts at tragedy, Dada and Surrealism, the Nouveau-roman.

**FR 840.6  
Seminar on a Special Subject of French or French-Canadian Literature  
1&2(S)**

**FR 843.3  
Advanced Studies in the Quebec Novel  
1/2(3L)**

*Prerequisite(s): FR 343 and admission to graduate studies in french.*

Advanced studies of a special topic in the Quebec novel, e.g., women writers, the social novel, the nouveau-roman, etc.

**FR 845.3  
Advanced Studies in Quebec Modern Drama  
1/2(1.5L-1.5P)**

*Prerequisite(s): FR 345 and admission to graduate studies in french.*

Advanced studies in Quebec modern drama, theory and practice. In the lab, students will work under the direction of an experienced actor and stage director.

**FR 897.3 Tartuffe  
1/2(6L&6S)**

*Prerequisite: FR 210.6 or equivalent and 6 credit units of French or French Canadian literature at the 300- or 400- level.*

A study of Moliere's comedy *Tartuffe*, set in the context of the author's career and of the contemporary political and religious situation in France, and dealing with the following topics: archetypal patterns, comic technique, themes, performance practice, a semiological approach to understanding a dramatic text, and problems of translating a play into English. Participants will consider problems of translating a play into English, and will attend a performance of Greystone Theatre's production of the play.

**FR 898.3/899.6  
Special Topics  
1/2(3R), 1&2(3R)**

**FR 994  
Research**

Students writing a Master's thesis must register for this course.

**GEOGRAPHY**

The Department of Geography offers graduate programs leading to M.A., M.Sc. and Ph.D. degrees. Research is encouraged in both human and physical geography. While the department can accommodate a wide range of research interest, thesis topics traditionally have been formulated within a northern Canada or Prairie setting, and have fallen into one of the following areas of specialization: geographic information science, cultural geography, development geography, economic geography, historical geography, locational analysis, population and spatial interaction, urban geography, biogeography, geomorphology, and hydrology.

**GEOG 801.3  
Spatial Analysis I  
1/2(3L)**

Deals with quantitative methods of spatial analysis as they are used in the field of

Before registering in any of the following courses, students are advised to contact the Chair of the Graduate Affairs Committee for a list and timetable of courses to be offered in the current academic year.

geography. Emphasis is placed in the application of techniques, practical exercises and projects.

**GEOG 802.3  
Spatial Analysis II  
1/2(3L)**

Deals with advanced topics in spatial analysis. Emphasis is placed on methods of analysis of complex spatial data and use of models in geography.

**GEOG 803.3  
Research in Geography  
1/2(S)**

A seminar designed to acquaint the students with the research methodologies in various branches in geography. A critical review of selected literature will be followed by discussions of specific research problems in physical and human geography, and methods of solving them. Students will be presenting a paper in their choice of field.

**GEOG 804.3  
Development of Geographical Thought  
1/2(1L-2S)**

A seminar course designed to acquaint the student with the development of the major philosophical problems faced by geographers. Students will prepare papers that address theoretical, philosophical and methodological issues in a subarea of geography.

**GEOG 805.3  
Advanced Spatial Analysis in Human Geography  
1/2(1L-2S)**

Presents advanced methods in analytical human geography. The topics will vary with instructor and student needs. Methods of spatial auto correlation, information theory, multidimensional scaling, mathematical regionalization procedures and game theory provide a sample of topics.

**GEOG 806.3  
Advanced Spatial Analysis in Physical Geography  
1/2(1L-2S)**

Examines topics in the area of digital terrain analysis, automated watershed segmentation and parameterization, and the application of GIS to problems in earth and environmental science. Topics will vary with the instructor and students.

**GEOG 813.3  
Advanced Cartography  
1/2(1L-2S)**

Deals with models and theories in cartographic communications; conceptual process and thematic symbolization; cognitive spatial theory and map perception; Sematic Differential Test for thematic map evaluation; and Data Model Concept in statistical cartography.

**GEOG 821.3  
Advanced Air Photo Interpretation I  
1/2(1L-2S)**

Includes review of current literature in air photo interpretation; and seminar discussion on advanced methods and special problems in air photo interpretation.

**GEOG 827.3  
Advanced Hydrology  
1/2(1L-2S)**

A seminar course designed to explore recent developments in hydrology. Topics to be covered at the discretion of the instructor.

**GEOG 833.3  
Advanced Climatology  
1/2(1L-2S)**

Designed to acquaint students with the theory and methods of research in synoptic climatology. Involves a critical review of literature on selected topics dealing with the problem climates of the earth. Seminar discussions will be focused to identify research problems in synoptic climatology and various methods used in solving these problems.

**GEOG 835.3  
Advanced Geomorphology  
1/2(1L-2S)**

A seminar course designed to explore recent developments in geomorphological theory and the analysis of geomorphological processes. Topics to be covered at the discretion of the instructor.

**GEOG 841.3  
Regional Development  
1/2(1L-2S)**

A review of the theories of regional development: cumulative causation,

forward and backward linkages, export-base, growth poles, and associated concepts of core-periphery diffusion, and spread-backwash processes. This course examines applications of those concepts in North America and the world.

**GEOG 843.3  
Advanced Locational Analysis  
1/2(1L-2S)**

An examination and development of the theories of the location of public and private facilities. The attending conceptual and mathematical models are presented and evaluated. The course has a theoretical orientation.

**GEOG 845.3  
Advanced Urban Geography  
1/2(2L)**

A survey of various theories of social and policy planning and their application to the geographical organization and planning of Canadian communities. The emphasis of this course lies on the links between political, economic and social processes within urban areas.

**GEOG 847.3  
Geography of Northern Development  
1/2(1L-2S)**

Problems of development in northern Canada and the application of geographic methods to solve these problems. Students will participate in these discussions by presenting their critical comments on various development questions and by giving written reports on case examples. Each student will prepare a major essay.

**GEOG 849.3  
Problems in Industrial Geography  
1/2(1L-2S)**

The examination of current themes and problems in industrial geography.

**GEOG 850.3  
Problems in Transportation  
1/2(1L-2S)**

The examination of current research themes and problems in transportation geography. Alternate topics may be covered to reflect student needs.

**GEOG 853.3  
Advanced Geography of Population  
1/2(1L-2S)**

Focuses on geographical theories of population and/or migration which have particular application for understanding the spatial changes in population. Each of these theories will be discussed and analyzed by students in the seminar. Each student will prepare a major essay on one of these geographical theories.

**GEOG 870.3  
Advanced Biogeography  
1/2(1L-2S)**

A review and discussion of current methods, problems and research areas in biogeography.

**GEOG 898.3/899.6  
Special Topics  
1/2(3S), 1&2(3S)**

A reading course for graduate students focusing on areas for which there is no

regular graduate course or for making up the deficiencies in the research program.

**GEOG 990  
Departmental Seminar**

During residence, candidates will register in GEOG 990 and will present at least one paper based on their own research (likely thesis research).

**GEOG 994  
Research**

Students writing a Master's thesis must register for this course.

**GEOG 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**GEOLOGICAL SCIENCES**

The Department of Geological Sciences offers programs leading to the M.Sc. or Ph.D. degrees and to the Postgraduate Diploma. Active research is being pursued in the following fields: geochemistry, mineralogy, igneous and metamorphic petrology, mineral deposits, sedimentology, structural geology, palaeontology, including invertebrate palaeontology, palaeoichnology, palynology and palaeobotany, stratigraphy, history of geology, applied geophysics, including seismology and gravity and electrical methods, and geological engineering, including rock mechanics, rock slope stability, hydrogeology, environmental geology and reservoir engineering.

In order to promote opportunities for research, the department maintains close ties with other science and engineering departments, the National Hydrology Research Institute, the Saskatchewan Research Council, the Saskatchewan Geological Survey, and various recourse and exploration companies.

GEOLOG courses numbered 433, 435, 437 and 439, described in the Arts and Science section of the *Calendar*, may be accepted for credit by the College of Graduate Studies and Research on recommendation of the department.

**GEOLOG 815.3  
Glacial Geology  
2(3L)**

Landforms and sediments related to glaciations. Continental glaciation during the Pleistocene and its deposits. Methods of investigation used in reconstructing the glacial history of a region. Glacial features on maps and air photographs.

**GEOLOG 816.3  
Quaternary Stratigraphy  
2(3L-3P)**

Litho-, bio-, and chrono-stratigraphy of Quaternary glacial fluvial, lacustrine, and marine sediments. The reconstruction of Quaternary history through the recording, investigating, dating and correlating of Quaternary sedimentary sequences. The importance of sedimentological, stratigraphical, and structural characteristics of Quaternary deposits for practical use in science and engineering.

**GEOLOG 822.6  
Analytical Geochemistry  
1&2(2L-3P)**

*Prerequisite(s):* GEOLOG 324, and 325.

Analytical techniques employed by earth scientists for determining the compositions, ages, and provenance of minerals and rocks. The theory, operation, and information that can be obtained from a variety of instruments will be studied. These instruments will include the X-ray diffractometer, the X-ray fluorescence spectrometer, the electron microprobe and scanning electron microscope (SEM), the atomic-absorption spectrometer, the gas chromatograph, and isotope ratio and solid source mass spectrometers.

**GEOLOG 828.6  
Geochemistry  
1&2(3L)**

The theory and application of instrumental techniques to the geochemistry of minerals and rocks. Topics include: terrestrial and cosmic abundance of elements; theory of element partitioning and its application to geothermometry and geobarometry; the behaviour of major and trace elements during partial melting and fractional crystallization; radiogenic and stable isotopic systems.

**GEOLOG 829.6  
Petrology  
1&2(3L)**

Dynamic and comprehensive treatment of important aspects of igneous and metamorphic petrology at an advanced level. Problems of current interest will be analyzed and discussed through integrated lectures, seminars, and laboratories.

**GEOLOG 832.3  
Considerations in Palaeontology  
1/2(1.5L-1.5S)**

Application of the concepts and principles of palaeontology to the interpretation of sedimentary rock sequences.

**GEOLOG 835.3  
Palynology  
1/2(1S-1P-1R)**

Advanced studies on fossil dinoflagellates and acritarchs, and spores and pollen, emphasizing their variation through geological time and their use in palaeoecological interpretation. (Practical work on material from North American and European sedimentary sequences will form a major part of this course).

**GEOLOG 836.3  
Fossils and Organic Evolution  
1/2(1.5L-1.5S)**

Concepts of organic evolution, stressing the evidence afforded by the fossil record. Topics will include biostratigraphy, variability, adaption, natural selection, radiation, extinction, and evolution in time and space.

**GEOLOG 841.3  
Sedimentary Processes  
1/2(1.5L-1.5S)**

Advanced-level consideration will be given to one or more of the following topics: fluid mechanics and its role in the



interpretation of deposition of sediment; experiments in sedimentology and their role; biological and chemical processes and their influence on sedimentation; diagenesis of sediments.

**GEOL 842.3**  
**Sedimentary Depositional Environments**  
**1/2(1.5L-1.5S)**

Investigations of selected modern environments of sedimentation and their application to the reconstruction of ancient sedimentary environments. May include consideration of a broad spectrum of environments or may focus on a few closely related environments and give them more detailed consideration.

**GEOL 848.3**  
**Concepts in Stratigraphy**  
**1(3L)**

The historical development of the concepts and principles of stratigraphy and the relative geologic time scale; the classification of stratigraphic units using a comparison of various stratigraphic codes; international problems in stratigraphic classification and correlation.

**GEOL 849.3**  
**Selected Problems in Stratigraphy**  
**2(1L-1S-1R)**

Application of the concepts and principles of stratigraphy, including sequence stratigraphic perspectives, to the interpretation of sedimentary basins.

**GEOL 853.6**  
**Structural Geology**  
**1&2(3L)**

The geometry and mode of formation of deformational structures in rocks on local and regional scales. Emphasis will be placed on mapping techniques in structurally complex terrains, the analysis of polyphase deformation, and the textures of deformed rocks. Some attention will be given to rock and crystal deformational processes and to the mechanics of faulting and folding.

**GEOL 865.3**  
**Analysis of Mineral Deposits**  
**1/2(1.5L&1.5S)**

*Prerequisite(s): Permission of the instructor.* Advanced level consideration of structural, magmatic, and hydrothermal processes involved in the formation and evolution of mineral deposits, and their relationship to the Earth and the environment. The application of petrological and geochemical techniques to mineral deposit research. Problems of current interest will be addressed through lectures, and student presentations.

**GEOL 871.3**  
**Advanced Hydrogeology**  
**1(1.5S-1.5R)**

Classification of aquifers. Microstructure and macrostructure of geological porous media. Relationships between mechanical, thermal and fluid flow properties. Parameter identification. Modelling groundwater flow, heat transport and solute transport. Introduction to multiphase flow. The course will concentrate on the use of models to quantify the transport of fluids, solutes and heat through geological systems. Particular

emphasis will be placed on the correct characterization of the materials and the importance of geological discontinuities in control of fluid flow.

**GEOL 872.3**  
**Computer Methods in Geomechanics**  
**1/2(3L-3P)**

*Prerequisite(s): GEO E 314 and 315 or 414 (preferably both); or equivalent.*

Numerical formulation of geomechanical problems: finite differences, finite elements and boundary integrals. Numerical methods for solving large linear systems. Non-linearities in geomechanical problems. Students will be expected to complete individual modelling projects.

**GEOL 874.3**  
**Advanced Rock Mechanics**  
**2(1.5S-1.5R)**

Topics selected from: Rheological behaviour of rock. Theories of stress distributions around openings in rock. Failure criteria for rock and rock masses. Behaviour of rock under dynamic stresses. Effects of blasts and shock on underground workings. Application of laboratory and in situ tests. Evaluation of the bulk properties of rock. Students will be expected to complete individual projects on specific topics and a final examination.

**GEOL 875.3**  
**Advances in Geomechanics**  
**1/2(3L-1S)**

*Prerequisite(s): GEO E 315 or 414 (preferably both); or equivalent.*

Topics selected from: ground freezing, rock remediation and ground treatment, rock support, rock excavation and fragmentation, rock slope stability and design, rock instrumentation and monitoring systems. Students will be expected to present seminars and written reports on assigned topics.

**GEOL 880.3**  
**Seismology**  
**1(3S)**

Topics selected from the theory of propagation of seismic waves in layered media; theory of reflection and refraction of spherical waves, present advances in numerical filtering; information theory as related to geophysics.

**GEOL 881.3**  
**Gravity and Magnetic Interpretation**  
**1(3S)**

Mathematical and computer techniques of interpreting gravity and magnetic maps including analytical models, Fourier techniques, analytical continuation, application to actual problems. Special topics according to student needs.

**GEOL 882.3**  
**Selected Topics in Geophysics**  
**1/2(3S)**

The detailed content may vary from year to year in accordance with the specific interests of students but will include some consideration of electrical methods, well-logging techniques, and other fields of applied geophysics.

**GEOL 883.3**

**Advances in Exploration Geophysics**  
**2(3S)**

A presentation of modern geophysical theories, emphasizing recent advances in interpretation and the influence of geophysical theories and methods on the development of modern geological thought. Topics include seismic stratigraphy, direct detection of hydrocarbons, crustal structure, rock magnetism, and airborne survey systems.

**GEOL 884.3**  
**Geophysical Inversion**  
**1/2(2L-2P)**

*Prerequisite(s): MATH 226, 338, GEOL 483, GEO E 414; or permission of the instructor.*

A practical course on inversion techniques in geophysics. Linear discrete inverse problems will be discussed, and an appreciation for the concepts of non-uniqueness, determinacy, and the use of a priori information will be emphasized. Students will be encouraged to use the techniques discussed in class in a computer laboratory and will be required to complete a term project with a written report, and a seminar.

**GEOL 898.3/899.6**  
**Special Topics**

**GEOL 990**  
**Seminar**

Presentation of papers by faculty, visiting scientists, and graduate students. Graduate students are required to attend and interested undergraduates may be invited to attend. Satisfactory participation in this course is required of all graduate students throughout their period of residence.

**GEOL 994**  
**Research**

Students writing a Master's thesis must register for this course.

**GEOL 996**  
**Research**

Students writing a Ph.D. thesis must register for this course.

**GERMANIC LANGUAGES**

Students may be accepted into a Master of Arts program in Germanic Languages on an individual basis. Programs are planned for each student in relation to the direction of the student's interests and in areas in which the faculty is competent to provide direction. Courses are offered on a seminar basis. Students who have an Honours degree from this university, or equivalent credits, must complete two seminar courses and a thesis.

Prospective students should consult the Department of Languages and Linguistics concerning possible areas of concentration.

**HERD MEDICINE AND THERIOGENOLOGY**

See Veterinary Medicine in this section of the *Calendar*.

**HISTORY**

The Department of History offers graduate programs leading to the degrees of Master of Arts and Doctor of Philosophy. The Master of Arts Degree may be taken in selected fields in the history of Canada, the Americas, Britain and the British Empire, Medieval and Modern Europe, the Ancient World, and the Far East. The Doctor of Philosophy Degree may be taken in selected fields of the history of Canada, Europe, and Britain and the British Empire.

The program leading to the M.A. degree normally consists of two seminars, (12 credit units), and the preparation of a thesis. A fully-qualified student can complete these requirements in one academic year (September to April and the following summer). All M.A. candidates must meet a second language requirement.

The prerequisite for admission into the Ph.D. program is an M.A. degree in history or its equivalent. Upon admission, students must possess a minimum history average of 80% in thesis M.A. courses, have their previous written work scrutinized by the department, and present a specific thesis proposal, demonstrating a student's ability and commitment, without, however, placing the department under the obligation of agreeing to accept this proposal. Ph.D. theses can only be written in areas where the department possesses special expertise and library resources. In any case most Ph.D. students would have to do research outside the province.

Ph.D. dissertations can be written in selected areas of the following fields.

- Western Canadian History
- Canadian General History Since 1700
- Early Modern Europe, 1400 to 1789
- Modern Europe, 1800 to Present
- Britain

Students will be examined in the comprehensive examinations on their major and two minor fields in April or the following September of their second year of study. Ph.D. students are required to take 12 credit units of classes at the graduate level.

Students are required to demonstrate reading competence in a second language, and other languages as are necessary for the proper conduct of research. When a student's thesis is in Canadian history, the second language must be French. Language examinations are to be taken by the end of February of a student's first year. Students whose theses require special skills must demonstrate competence before proceeding with their theses.

HIST 801.3 Studies in Ancient and Medieval History 1/2(3S)

HIST 820.6 Themes in Early Modern European History 1&2(3S)

HIST 821.3 Studies in Early Modern European History 1/2(3S)

HIST 830.6 Themes in Modern European History 1&2(3S)

HIST 831.3 Studies in Modern European History 1/2(3S)

HIST 840.6 Themes in British and Imperial History 1&2(3S)

HIST 841.3 Studies in British and Imperial History 1/2(3S)

HIST 848.6 Themes in Asian History 1&2(3S)

HIST 849.3 Studies in Asian History 1/2(3S)

HIST 850.6 Themes in Canadian History 1&2(3S)

HIST 851.3 Studies in Canadian History 1/2(3S)

HIST 860.6 Themes in Western Canadian History 1&2(3S)

HIST 861.3 Studies in Western Canadian History 1/2(3S)

HIST 870.6 Themes in the History of the Americas 1&2(3S)

HIST 871.3 Studies in the History of the Americas 1/2(3S)

HIST 880.3 History of History 1/2(3S)

HIST 881.3 Historiography 1/2(3S)

HIST 882.3 History Beyond Documents 1&2(3S)

HIST 892.3 Applied History 1/2(3S)

HIST 898.3 Special Topics 1/2(3S)

HIST 899.6 Special Topics 1&2(3S)

## HIST 990 Seminar 2(1.5S-1.5R)

Students and faculty will make presentations concerning their current research. All candidates for a graduate degree must make one presentation. Attendance is required throughout the graduate program.

## HIST 994 Research

Students writing a Master's thesis must register for this course.

## HIST 996 Research

Students writing a Ph.D. thesis must register for this course.

## INDIAN AND NORTHERN EDUCATION

See Education in the section of the *Calendar*.

## INDIVIDUAL INTERDISCIPLINARY GRADUATE PROGRAMS

The College of Graduate Studies and Research encourages re-alignment of traditional disciplines into new patterns, crossing department and college boundaries where this will foster new areas of learning. To facilitate this the College of Graduate Studies and Research provides opportunities for students to develop INDIVIDUAL INTERDISCIPLINARY PROGRAMS leading to the PGD, M.A., M.Sc. and Ph.D. degrees. Students in interdisciplinary graduate programs are not

restricted by traditional academic boundaries.

Many departments and colleges have graduate programs that allow sufficient flexibility to students to complete an interdisciplinary program while enjoying affiliation with an established academic unit. Individual Interdisciplinary Graduate programs are not intended to compete with or replace these programs.

The individual interdisciplinary graduate program is administered by the College of Graduate Studies and Research through the Interdisciplinary Studies Committee. Students interested in graduate interdisciplinary programs are advised to contact the College of Graduate Studies and Research Office in order to consult with the Chair of the Interdisciplinary Studies Committee for information on program requirements and on the procedure to be followed in developing their program proposal.

It should be stressed that the student is responsible for developing the program proposal which must be approved by the Interdisciplinary Studies Committee. To be considered "interdisciplinary", the proposed program must integrate course work and research into a concise program that is not available within the traditional academic setting. As well, the proposed program should not attempt to provide a graduate studies opportunity within a discipline where such graduate studies opportunities are not currently available.

Depending on the individual interdisciplinary graduate program being pursued, the following specialized courses are available:

### INT D 898.3/899.6 Special Topics

Topics will be selected according to the student's specific area of interest.

### INT D 990 Seminar

Students are required to attend and to present at least one seminar each academic term.

### INT D 992.6 Project

Students taking the non-thesis Master's degree must register in this course.

### INT D 994 Research

Students writing a Master's thesis must register in this course.

### INT D 996 Research

Students writing a Ph.D. thesis must register in this course.

## KINESIOLOGY

The College of Kinesiology offers programs leading to a Postgraduate Diploma, a Master of Science, and a Doctor of Philosophy. A Master of Education in pedagogy is offered jointly with the College of Education.

Students with an undergraduate degree in kinesiology or a relevant field can be admitted directly to the PGD and M.Sc. programs. Students whose undergraduate training is in an area other than physical education are usually required to take additional undergraduate course work. Those seeking admittance to the doctoral program must hold a recognized Master's degree in a relevant field.

The Postgraduate Diploma is specific to the field of exercise management and applied kinesiology and is designed to be completed in one calendar year of study. Students who enter fully qualified must complete 30 credit units, 18 of which must be at the graduate level. While there is no thesis requirement, the PGD has a significant practicum component. Students must complete 21 required credits: KIN 470, 803, 809, 840, 850, and PATH 205; and 9 specified elective credits.

A Master of Education is available jointly through the College of Kinesiology and the Department of Curriculum Studies in the College of Education and offers a specialization in physical education pedagogy. Students' programs will be individually designed and developed and will include the following required courses: EDCUR 801; EDRES 800, KIN 860, KIN 898, and EDCUR 990.

The Master of Science program is linked to the sport and exercise science research interests in the college: biomechanics, exercise physiology, growth and development, health and physical activity, body composition, motor control, nutrition and physical activity, and sport and exercise psychology. Fully qualified M.Sc. students are required to complete KIN 801, 900, 994 plus 12 other credit units. Depending on the area of study, at least 6 or 9 of these 12 credit units must be at the 800 level within the College of Kinesiology. Doctoral students are required to complete at least 6 credit units as well as P ED 990 and 996.

### KIN 801.6 Experimental Design and Research Methods 1&2(3L)

Emphasizes the scientific method and research techniques as they apply to research in kinesiology. Discussion of the scientific method includes history, basic principles, validity, sampling theory, sources of error, statistical concepts and basic designs. Research techniques involve library searches, computers and research, and data collection.

*Note:* Compulsory for all M.Sc. students in kinesiology.

*Note:* Students require a Kinesiology Computer Laboratory account for this course.

### KIN 803.3 Biomechanics 1/2(R)

*Prerequisite(s):* KIN 442; or equivalent.

Topics include kinetic measurements, segmental energy and power flow, stresses and strains on human tissue, modelling and simulation.

### KIN 804.3 Behavioural Aspects of Physical Education 1/2(3L)

*Prerequisite(s):* KIN 322.

A critical review of behavioural research in the physical activity domain. Emphasis is placed on current theories in the literature.

### KIN 805.3 Physiology of Exercise 1/2(3L)

*Prerequisite(s):* KIN 225 and 226; or permission of the instructor.

A reading course for the student interested in a specialized approach to the study of exercise physiology. Detailed papers will be presented by the students in both required and selected areas of exercise physiology. In addition laboratory experiences may be assigned to supplement the assigned readings. General emphasis is placed on the cardiopulmonary response to various types of exercise, but other areas such as the muscle physiology and biochemistry of exercise are considered.

### KIN 806.3 Physical Growth and Development 1/2(3L)

*Prerequisite(s):* KIN 320; or permission of the instructor.

Examines special topics related to growth and physiological development. Special emphasis is placed on the influence of exercise, physical activity, and athletic performance on the dynamics of growth. The course consists of special readings and assigned topics dealing with physiological function, exercise tolerance, strength and motor performance as they relate to the growth of the child.

### KIN 809.3 Health Aspects of Physical Activity and Physical Fitness 1/2(3S)

Involves a comprehensive investigation of the health implications of physical activity and exercise. Topics will include health aspects of exercise as related to current knowledge, gaps in knowledge and research needs.

### KIN 810.3 Psychology of Sport 1/2(3L)

*Prerequisite(s):* KIN 231; or equivalent.

Focuses on the contemporary issues of sport psychology emphasizing: presentation of the major issues in sport psychology and presentation of knowledge of both the methods and experimental foundation of sport psychology. Issues to be covered include an overview of sport psychology, competition, competitive anxiety, management of anxiety, motivation, imagery and personality as well as other contemporary concerns as they relate to sport.

### KIN 830.3 Psychosocial Aspects of Health and Exercise Behaviour 1/2(3L)

Focuses on the psychosocial aspects of health and exercise behavior. An in-depth study and application of theoretical research to practical field settings is a central theme.

**KIN 840.3**  
**Interpreting Research in Physical Activity and Health**  
**1/2(3L)**

Provides students with a basic theoretical and applied knowledge of research methods in physical activity and health. This course will cover the basic concepts of research design, data collection, and data analysis. Using these concepts students will learn to review and critique the literature in physical activity and health.

*Note:* For students in the PGD program. M.Sc. program students will not receive credit for this course.

**KIN 851.3**  
**Professional Skills Seminar**  
**1&2(2T-6P)**

Designed to develop the professional skills related to physical fitness and physical activity assessment and prescription in a variety of environments; these include a broad spectrum from athletic settings to community or occupational health/fitness programs. Both theoretical and practical issues will be discussed as they arise from ongoing practicum activities.

*Note:* This is a required course for students in the PGD program. Upon completion of KIN 470, 851 and 852, students will be eligible to write the Canadian Society of Exercise Physiology Certified Fitness Appraiser exam.

**KIN 852.3**  
**Professional Skills Seminar**  
**1&2(2T-6P)**

Designed to develop the professional skills related to physical fitness and physical activity assessment and prescription in a variety of environments; these include a broad spectrum from athletic settings to community or occupational health/fitness programs. Both theoretical and practical issues will be discussed as they arise from ongoing practicum activities.

*Note:* This is a required course for students in the PGD program. Upon completion of KIN 470, 851 and 852, students will be eligible to write the Canadian Society of Exercise Physiology Certified Fitness Appraiser exam.

**KIN 860.3**  
**Research in Physical Education: Quantitative and Qualitative**  
**1/2(3L)**

*Prerequisite(s):* EDRES 800; or equivalent  
Provides the student with a comprehensive understanding of the findings and implications of research on teaching and instruction in physical education. This course will engage the student in a critical analysis of pedagogical research.

*Note:* For students in the M.Ed. in physical education pedagogy program. M.Sc. program students will not receive credit for this course.

**KIN 861.3 Contemporary Issues in Physical Education**  
**1 2(3L)**

Required by students enrolled in the joint M.Ed. program in Physical Education Pedagogy. The purpose of this course is to familiarize the student with the major issues facing the instruction of school-based

physical education programs. The intent will be to encourage participants to take a stand on major issues and to support their positions.

**KIN 898.3**  
**Special Topics**  
**1/2(3R/P)**

Studies in selected areas of physical education may be undertaken by advanced students with the consent of the College Graduate Committee. This work consists of essay writing, special readings and reports on assigned topics relating to a common subject or upon a series of laboratory studies.

**KIN 990**  
**Seminar**

Review of related scientific studies. Graduate students are required to attend and present papers during their period of candidacy.

**KIN 994**  
**Research**

Students writing a Master's thesis must register for this course.

**KIN 996**  
**Research**

Students writing a Ph.D. thesis must register for this course.

**LAW**

The College offers programs of study leading to a Master of Laws degree in areas of public and private law. Admission to undertake studies in a particular area of the program will depend upon the availability of faculty supervision in that area. Every effort is made to structure the programs to meet the needs of the individual student. Candidates are required to complete a minimum of 9 credit units, 3 of which must be in Legal Theory. An individual directed research project (3 credit units) may be undertaken in lieu of a course. With faculty approval, one of the required courses may be taken outside the College of Law in an associated discipline. All students must undertake original research leading to a thesis of publishable quality. The program ordinarily takes one to two years to complete. Receipt of the LL.M. degree does not qualify a student for admission to the Bar in Canada.

Application for admission should be submitted to the Chair of the Law Graduate Studies Committee prior to the end of February. The requirement for admission is a LL.B. degree or equivalent.

Studies in the Native Law and Co-operative Law areas are normally undertaken in association with the University of Saskatchewan Native Law Centre and the Centre for the Study of Co-operatives.

The College of Law makes available a scholarship fund for outstanding applicants.

**LAW 801.6**  
**Native Rights I**  
**1&2(3S)**

A range of areas relating to the legal status and rights of native people both in Canada

and also in such other countries as the United States, New Zealand and Australia. Includes aboriginal land rights, treaty rights, hunting and fishing rights, the Indian Act, constitutional structures, human rights, affirmative action, the impact of the criminal law, taxation and commercial law. Assessment will be based primarily upon a series of written assignments submitted by the student, approximately 6-8 tutorial papers.

**LAW 802.3**  
**Native Rights II**  
**1/2(3S)**

Covers specific topics in areas relating to the legal status and rights of native people not covered in LAW 801. Assessment will be based primarily upon written assignments submitted by the student, approximately 2-4 tutorial papers.

**LAW 810.3**  
**Jurisprudence**  
**1/2(3S)**

Current debates within the Western idea of law will be at the core of the literature canvassed in this seminar. The selected topics addressed will not be restricted to legal theory, but may extend to writers in the fields of political and moral philosophy.

**LAW 898.3/899.6**  
**Special Topics**  
**1/2(3S), 1&2(3S)**

Individualized research projects may be undertaken with the supervision of faculty members often in conjunction with courses offered in the College of Law. Topics are chosen in consultation with faculty advisors to complement areas of thesis research. Assessment will be based primarily upon a series of written assignments prepared by the student over the term. Topics chosen may be selected from the following areas: Aboriginal Law, Commercial Law, Constitutional Law, Criminal Law or Human Rights, subject to faculty availability.

**LAW 990**  
**Seminar**

Presentations regarding current research will be made by visiting faculty, faculty and graduate students. All graduate students in residence must make a presentation at least once each year. The seminar may also seek to provide for review of current literature and developments.

*Note:* All graduate students are required to attend, and to participate in the course to the satisfaction of the Law Graduate Studies Committee. This is a *non-credit* course.

**LAW 994**  
**Research**

Completion of original research and writing of an LL.M. thesis.

**MARKETING**

The Department of Management & Marketing offers a graduate program leading to the M.Sc. degree in Marketing. The M.Sc. program for fully qualified students (undergraduate Marketing major or equivalent) requires a minimum of 15 credit units of approved graduate courses plus the preparation and successful defence of a

thesis. Students are matched with thesis supervisors in areas of mutual interest upon admission to the program. Prospective students should consult with the Head of the Department concerning the availability of programs in specific subject areas.

**MKT 898.3**  
**Special Topics**  
**1/2**

**MKT 994**  
**Thesis**

Students writing a Master's thesis must register for this course.

**MATHEMATICS AND STATISTICS**

The Department of Mathematics and Statistics offers M.Math, M.Sc. and Ph.D. degrees with specialization in the areas of algebra, applied mathematics, analysis, probability, statistics and topology. The M.Sc. degree requires a minimum of 18 credit units of course work and a thesis. The Ph.D. degree requires course work beyond the M.Sc. level. Ph.D. candidates in all areas of specialization must write qualifying exams to demonstrate knowledge in any three areas of algebra, analysis, applied mathematics, probability-statistics or topology.

The following courses are for students who have completed the Honours program in mathematics, or equivalent; other students must obtain the permission of the department.

**MATH 814.6**  
**Numerical Solution of Ordinary and Partial Differential Equations**  
**1&2(3L)**

*Prerequisite(s):* MATH 314 and 338; knowledge of a programming language.  
Ordinary Differential Equations: One-Step methods for initial-value problems, multi-step methods, boundary-value problems; discussion of discretization error and propagation of errors, convergence, and stability. Partial Differential Equations: Some finite-difference schemes for hyperbolic, parabolic and elliptic partial differential equations, their stability and convergence; applications.

**MATH 818.3/819.6**  
**Special Topics in Applied Mathematics**  
**1/2(3L), 1&2(3L)**

*Prerequisite(s):* A graduate course in applied mathematics; or permission of the department.

The topics to be discussed will be related to recent developments in applied mathematics (numerical analysis, differential equations, mechanics, applied analysis, etc.) of interest to the instructor and students.

**MATH 830.6**  
**Applied Functional Analysis**  
**1/2(3L)**

*Prerequisite(s):* A course in linear algebra and an intermediate level calculus course.  
Cauchy sequences, uniform convergence (e - d); Hilbert spaces; distributions and

Sobolev spaces; boundary - value problems in (partial) differential equations; variational methods; weak solutions; Lax - Milgram lemma; finite element method.

**MATH 832.3  
Mathematical Foundations of  
Classical Mechanics  
1/2(3S)**

*Prerequisite(s): MATH 350; or permission of the department.*

Symplectic geometry, canonical transformations, Poisson structures, Lagrangian systems, Legendre transformations, Hamiltonian systems, non-relativistic and relativistic mechanical systems.

**MATH 833.3  
Mathematical Foundations of  
Quantum Theory  
1/2(3L)**

*Prerequisite(s): MATH 373; or permission of the department.*

Linear operators in Hilbert space, spectral theorem for self-adjoint operators, axioms of non-relativistic quantum mechanics, measurements, Schrödinger and Heisenberg pictures, commutation relations.

**MATH 834.3  
Mathematical Foundations of  
Relativity  
1/2(3L)**

*Prerequisite(s): MATH 350 or Corequisite(s): MATH 852; or permission of the instructor.*

Space-time as a differentiable manifold, Minkowski space equations of general relativity, cauchy problem, cosmological models.

**MATH 835.3  
Non-linear Analysis  
1/2(3L)**

*Prerequisite(s): MATH 852; and a course in Functional Analysis or permission of the department.*

Non-linear P.D.E. including: Einstein's equations, Yang-Mills equations, non-linear wave and Schrödinger equations, Korteweg-de Vries equation. Infinite dimensional Hamiltonian systems, classical field theories, conservation laws, symmetry groups. Inverse scattering method. Backlund transformations.

**MATH 837.6  
Differential and Integral Equations  
1&2(3L)**

*Prerequisite(s): MATH 366 and 371.*

Existence and uniqueness theory, self-adjoint and non-self-adjoint boundary-value problems, Poincaré-Bendixson theory, integral equations of the Fredholm Type, singular integral equations, solutions of differential equations in a Banach space.

**MATH 838.6  
Theory of Partial Differential  
Equations  
1&2(3L)**

*Prerequisite(s): MATH 439.*

The Cauchy problem, Dirichlet and Neumann problems, existence and uniqueness.

**STATS 841.3  
Probability Theory  
1/2(3L)**

*Prerequisite(s): STATS 241 and MATH*

*371; or permission of the department.*

Probability spaces and random variables. Distribution functions. Convergence of random variables. Characteristic functions. Fundamental limit theorems. Conditional expectation.

**STATS 842.3  
Stochastic Processes  
1/2(3L)**

*Prerequisite(s): STATS 841.*

Stochastic processes and random functions. Random walks, Markov property, and Martingales. Stationary processes and ergodic theorems. Invariance principles and strong approximation.

**STATS 843.6  
Experimental Design and Analysis  
1&2(3L)**

Statistical analysis of the following experimental designs: completely randomized, randomized complete block, factorial, Latin square, incomplete block, fractional replications, confounded, lattice, split plot and nested designs. Development of the concepts of fixed, mixed and random experimental models, regression analysis, and optimality of designs.

**STATS 844.6  
Statistical Inference  
1&2(3L)**

Estimation: Problem of point estimation, unbiased estimation, lower bounds for the variance, complete and sufficient statistics, minimax estimation, admissibility, invariance, estimation by confidence sets. Testing Hypotheses: Neyman-Pearson fundamental lemma and uniformly most powerful tests, unbiased invariance, linear hypotheses, minimax principle.

**STATS 845.3  
Statistical Methods for Research  
1/2(3L)**

*Prerequisite(s): STATS 242 or 245; or permission of the department.*

Statistical methods as they apply to scientific research, including: Experimental design, blocking and confounding, analysis of multifactor experiments, multiple regression and model building.

**STATS 846.3/847.6  
Special Topics in Probability and  
Statistics  
1/2(3L), 1&2(3L)**

Topics will be related to recent developments in statistics and probability (multivariate statistics, time series, experimental design, non-parametric statistics, etc.) of interest to the instructor and students.

**STATS 848.3  
Multivariate Data Analysis  
1/2(3L)**

*Prerequisite(s): COMM 395 and STATS 345 or 845; or permission of the department.*

A survey of methods for analyzing discrete and continuous multivariate data. Includes: Log-linear models, logistic regression, canonical correlation, discriminant analysis, cluster analysis, MANOVA, factor analysis.

**STATS 849.3  
Spectral Analysis of Time Series  
1/2(3L)**

Introduction to spectral analysis for graduate students with reasonable

competence in Mathematics at the third year level and some exposure to probability and statistics. Topics include a description of Wiener and stochastic approaches to Spectral Analysis, spectral representation of univariate and multivariate time series, linear filters, spectral estimation, sampling theory for spectral estimators.

**MATH 851.6  
Differential Geometry  
1/2(3L)**

*Prerequisite(s): MATH 350; or permission of the department.*

Differentiable manifolds (over  $\mathbb{R}$  &  $\mathbb{C}$ ), tensor fields, differential forms, and Lie groups. Stoke's theorem, Poincaré and Dolbeault lemmas. Sheaf cohomology theory and the De Rham theorem. Vector bundles, connections and Chern classes, and Grassmannians. Dolbeault cohomology, Elliptic operator theory and the Hodge theorem. Poincaré and Serre duality.

**MATH 852.3  
Differential and Riemannian  
Geometry I  
1/2(3L)**

*Prerequisite(s): MATH 350.*

Manifolds, tensor fields, integral curves and flows, Lie derivative, exterior calculus, Frobenius Theorem, vector and principal bundles, connections, curvature, Cartan equations, holonomy, Riemannian and pseudo-Riemannian geometry, equivalence problem.

**MATH 860.6  
Algebraic Number Theory  
1&2(3L)**

Valuations, p-adic numbers, quadratic forms, the Hasse-Minkowski theorem, modules, orders, Dirichlet's unit theorem, divisor theory for algebraic number fields.

**MATH 862.3  
Algebra I  
1/2(3L)**

*Prerequisite(s): MATH 360.*

Rings, modules, ideals, factorization, field theory, Galois theory.

**MATH 863.3  
Algebra II  
1/2(3L)**

*Prerequisite(s): MATH 862.*

Commutative algebra, multilinear algebra, non-commutative algebra.

**MATH 871.3  
Abstract Analysis  
1/2(3L)**

*Prerequisite(s): MATH 373.*

Basic Measure and Integration Theory. Regular Borel Measure. The Radon-Nikodym Theorem, Product Measure and Fubini's Theorem. Fourier Analysis on  $\mathbb{R}^n$ .

**MATH 872.3/873.6  
Special Topics in Pure Mathematics  
1/2(3L), 1&2(3L)**

The topics to be discussed will be related to recent developments in an area of pure mathematics (analysis, topology, algebra, etc.) of interest to the students and instructor.

**MATH 875.3  
Functional Analysis**

**1/2(3L)**

Introduces functional analysis with an emphasis on Banach and Hilbert spaces. The main results of Hahn-Banach, Krein-Milman and Banach-Steinhaus are developed and used to study concrete spaces, operators, the projection lattice and the ideal of compact operators on Hilbert space.

**MATH 876.3  
Banach Algebras and Spectral  
Theory  
1/2(3L)**

*Prerequisite(s): MATH 875; or equivalent.*

The necessary theory of Banach Algebras and the functional calculus are developed for the spectral theorem for bounded self-adjoint operators on Hilbert space. Various applications and extensions presented.

**MATH 879.3  
Complex Analysis  
1/2(3L)**

*Prerequisite(s): MATH 379.*

After a review of basic properties of analytic functions the course will cover such topics as: Analytic Continuation, Riemann Mapping Theorem, Mittag-Leffler's Theorem, Runge's Theorem, Picard's Theorem, etc.

**MATH 881.6  
General Topology  
1&2(3L)**

**MATH 882.3  
Algebraic Topology I  
1/2(3L)**

*Prerequisite(s): MATH 485.*

Two-dimensional Manifolds, the Fundamental Group including the Seifert-Van Kampen Theorem, Covering Spaces, Applications to Knot Theory and Group Theory.

**MATH 883.3  
Algebraic Topology II  
1/2(3L)**

*Prerequisite(s): MATH 882.*

Simplicial and Singular Homology, The Lefschetz Fixed-Point Theorem, Cohomology, Duality in Manifolds.

**MATH 990  
Seminar**

All graduate students in the department enrol each year. Students attend the regular department colloquia. After the first year in their program, they are expected to join the regular seminar series in their area of specialization.

**MATH 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Math.) must register for this course.

**MATH 994  
Research**

Students writing a Master's thesis must register for this course.

**MATH 996  
Research**

Students writing a Ph.D. thesis must register for this course.

## MECHANICAL ENGINEERING

The Department of Mechanical Engineering offers graduate programs leading to the M.Eng., M.Sc. and Ph.D. degrees in various disciplines of Mechanical Engineering including: Applied Mechanics, Metallurgy, Fluid and Thermal Sciences and Control Systems. Multidisciplinary studies are encouraged with the cooperation of other departments. Experimental and theoretical investigations are carried out using a large number of research instruments and computer systems.

### M E 840.3 Theory of Inelastic Behaviour 1/2(3L)

Foundations of plasticity theory. Applications involving rigid plastic and elastic-plastic materials under conditions of plane strain, plane stress and axially-symmetric deformation. Characteristic field theory with numerical and graphical techniques of solution.

### M E 841.3 Inelastic Behaviour of Materials 1/2(3L)

Extremum principles and energy methods of solutions of elasto-plastic deformation. Theorems of limit analysis by energy methods. Applications in metal forming processes. Finite deformation theory. Applications of viscoelastic models and their associated constitutive equations.

### M E 845.3 Mechanics of Time-Dependent Materials 1/2(2L-1P-.5S)

*Prerequisite(s): M E 323, 324 and 450.*  
Basic methods of structural analysis for creep and viscoelastic behaviours. Mathematical Models of transient and steady creep for metals at elevated temperatures. Stress relaxation. Creep rupture. Numerical Solution of creep problems. Linear and Nonlinear Viscoelastic Theories for Polymers and Synthetic Materials. Heredity. Modified Superposition Principles and Thermodynamics Viscoelastic Theories. Numerical Methods for Nonlinear Viscoelastic Materials.

### M E 854.3 Mechanical Vibrations 1/2(3L)

*Prerequisite(s): M E 321; or equivalent.*  
Topics covered include the study of the fundamental single-degree-of-freedom systems and the complex multiple-degree-of-freedom systems using Newton's law of motion, the energy method. Rayleigh's method, Lagrange's equations, the mechanical impedance method, influence coefficients, and matrix methods. Special topics include the study of transient vibration of continuous media. Solutions to the various differential equations encountered are presented.

### M E 855.3 Optimization in Structural Design 1/2(2L-1P-.5S)

*Prerequisite(s): M E 323 and 450.*  
Optimization theory and its applications to Structural Design. Basic concepts and

terminology of the nonlinear constrained optimization problems. Numerical algorithms based on mathematical programming techniques and methods using optimality criteria. Structural optimization systems making use of the Finite Element Method Techniques are discussed and used to solve some practical problems.

### M E 856.3 Weighted Residual Methods in Mechanical Engineering 1/2(3L)

*Prerequisite(s): M E 450.*

Review of general weighted residual methods. Development of finite element, boundary element and mixed techniques, for approximate solutions of field problems of interest to mechanical engineers. Time dependent and steady state solutions will be demonstrated with problems drawn from solid mechanics, fluid flow and heat transfer.

### M E 857.3 Topics in Finite Elasticity 1/2(3L)

*Prerequisite(s): C E 802; or permission of the instructor.*

A review of tensor analysis, general theory of elasticity or finite deformations, constitutive equations, special problems with exact solutions, developments of plate and shell theories, solution by classical and weighted residual methods.

### M E 858.3 Mechanics of Thin-Walled Structures 1/2(2L-1P-.5S)

*Prerequisite(s): M E 323 and 450.*

Warping, stability, imperfection sensitivity and other problems specific for thin-walled beams, plates, membranes and shells are discussed. The emphasis is on the physical interpretations of the governing equations (mostly nonlinear) and on the numerical solution methods. Behaviour of thin-walled pressure vessels, containers, pipes, element of aircrafts and space stations, etc., may be analyzed as the practicum.

### M E 860.3 Fluid Power Control 1/2(3L)

*Prerequisite(s): M E 441 and 335.*

Advanced analysis of hydraulic and electrohydraulic systems including: transient behaviour of fluid circuits and transmission lines, control components and actuators; investigation and design of closed loop systems; application of Bond graphs.

### M E 861.3 Numerical Control 1/2(3L)

*Prerequisite(s): M E 441.*

An introduction to feedback control systems operating on discrete rather than continuous data. Topics include: digital transducers, incremental and absolute modes of control, analog to digital conversion techniques, synthesis of combinational, sequential, comparator and interpolation circuits, transient response of digital systems, stability and compensation, introduction to sampled-data control systems.

### M E 862.3 Analysis and Synthesis of Linear Control Systems 1/2(3L)

*Prerequisite(s): M E 441.*

Extension of linear feedback control principles emphasizing transfer functions and frequency response. Stability - Routh, Hurwitz, root locus, Nyquist. Bode plots. Compensation - series and minor loop equalization. Parameter plane analysis.

### M E 863.3 Advanced Topics in Linear Control Systems 1/2(3L)

*Prerequisite(s): M E 862.*

State-space approach; concepts in linear continuous and discrete systems; controllability, observability, and minimal realizations. Multivariable systems. Advanced methods of stability analysis. Introduction to optimal control systems.

### M E 864.3 Random Processes and Signal Processing 1/2(3L-3P)

*Prerequisite(s): M E 441.*

Mathematical description of random process, Pseudo-random signals; response characteristics of physical systems; mathematical theory analyzing random data; analog and digital measurement techniques; analysis of non-stationary data; estimation theory, Kalman-Bucy filtering theory; special techniques and applications.

### M E 865.3 Nonlinear Systems 1/2(3L)

*Prerequisite(s): MATH 338; or equivalent.*

Definition and classification of nonlinearities; analysis of non-linear systems emphasizing perturbation, piecewise linearization, phase-plane trajectories and first harmonic approximation; singularities; periodic solutions and limit cycles; stability; frequency response.

### M E 867.3 Applied Stochastic Optimization and Control 1/2(3L)

Calculus of extreme and single stage decision process; variational calculus and continuous optimal control; discrete maximum principle; optimum control of disturbed parameter systems; optimum state estimation in stationary and nonstationary processes; dynamic sensitivity in optimum systems; computational methods in optimum systems control; invariant imbedding; state incremental dynamic programming.

### M E 869.3 Adaptive Control Systems 1/2(3L-3P)

*Prerequisite(s): M E 862 and 864.*

Concept of adaptive control emphasizing dynamic response characteristics; types of adaptivity and the performance criterion in both linear and nonlinear control systems; dynamics of the parameter-perturbation processes, static and dynamic considerations; methods of process identification including correlation, series expansions, Laguerre and orthonormal

functions; realization of adaptive control systems through the automatic adjustment of system parameters including an introduction to computer-controlled systems.

### M E 870.3 Solar Energy Conversion 1/2(3L)

A senior engineering course in heat transfer. Presents methods of predicting solar radiation as well as sources of solar radiation data. Solar energy conversion device characteristics are analyzed; these include water ponds, solar collectors; solar cells, windows and other absorbers. Solar energy conversion systems are simulated.

### M E 872.3 Fundamentals of Fluid Dynamics 1/2(3L)

Development and study of the fundamental principles of fluid dynamics as applied to a continuum. Development of the constitutive equations of fluids. Analysis of incompressible inviscid and viscous flows including vortex motion, fluid jets, and flow over bodies. Student interests may determine some problem examples.

### M E 873.3 Advanced Topics in Fluid Dynamics (3L)

Represents a further study of viscous, incompressible flow (specifically turbulent flows). Hydrodynamic stability and the transition to turbulent flow are first considered, followed by a study of fully developed turbulence. Of specific interest is the development of turbulence models for prediction methods. Various topics in advanced theoretical fluid mechanics are also covered, especially the application of special analytical techniques.

### M E 874.3 Heat Transfer 1/2(3L)

The three modes of heat transfer are treated in this advanced course: a) conduction - two and three dimensional heat conduction with time dependent boundary conditions and distributed heat sources; composite and anisotropic media; analytical and numerical methods; b) convection - differential and integral equations of the boundary layer, momentum and heat transfer in laminar and turbulent internal and external flows, forced and free convection; numerical methods; c) radiation - radiative exchange among various surfaces including; blackbody; gray-diffuse, real materials and specular; numerical methods.

### M E 875.3 Heating, Ventilating and Air Conditioning 1/2(3L)

Advanced topics on: human comfort and health, indoor air quality, and psychrometry, air infiltration in buildings, cooling and heating loads for buildings; air distribution and heat recovery systems; simulation of building characteristics and systems under various weather conditions including heating and cooling equipment and natural daylighting; optimization of the thermal design and HVAC systems for buildings.

**M E 876.3  
Multiphase Flow and Heat Transfer  
1/2(3L)**

*Prerequisite(s): M E 417.*

The fundamental concepts of the flow of multiphase mixtures, momentum and energy equations for two-phase systems, convective boiling and condensation heat transfer processes, elementary thermodynamics of vapour/liquid systems.

**M E 877.3  
Thermodynamics  
1/2(3L)**

*Prerequisite(s): M E 417; or equivalent.*

The kinetic theory of gases is developed to illustrate the molecular description of classical quantities such as temperature, pressure and work. Transport properties such as viscosity, thermal conductivity and mass diffusivity are investigated using kinetic theory. Statistical approaches based on classical and quantum mechanics are used to describe the microscopic behaviour of substances. The microscopic interpretation of entropy is discussed. The link between microscopic behaviour and macroscopic thermodynamic properties is investigated.

**M E 878.3  
Compressible Fluid Dynamics  
1/2(3L)**

Acoustical waves; one-dimensional, isentropic flow and normal shocks are reviewed. Internal flows including the effects of area variation, friction and heat transfer are studied. External flows are then considered including oblique shocks and the method of characteristics.

**M E 879.3  
Numerical Fluid Dynamics and Heat Transfer  
1/2(3L)**

*Prerequisite(s): M E 872.*

An introduction to numerical methods for solving the transport equations for flow of a viscous, incompressible fluid, including convective heat transfer. A control volume based finite difference method will be adopted. Students will have the opportunity to develop their own working codes for specific two-dimensional problems.

**M E 880.3  
Heat and Mass Transfer in Porous Media  
1/2(3L)**

*Prerequisite(s): Undergraduate courses in thermodynamics, heat transfer and fluid mechanics and at least one graduate course in heat transfer of fluid mechanics; or permission of the instructor.*

The principles of heat and mass transfer in porous media for single or two-phase flows: conduction, convection and radiation, macroscopic and microscopic flow models, thermodynamics of capillary systems, transport from porous surface interface, local volume averaging methodology, simultaneous heat and mass transfer and flow with phase change (e.g. drying theory). Finite difference numerical models and boundary conditions are developed for the above phenomena and applied to typical physical problems.

**M E 881.3  
Selected Topics in Materials  
1/2(3L)**

*Prerequisite(s): M E 474.*

Topics include: crystallography; theory of dislocations; experimental techniques in metallurgy; theory of diffusion; macroscopic and microscopic aspects of fracture.

**M E 885.3  
Neural Networks: Theory and Application  
1/2(3L)**

*Prerequisite(s): A basic understanding of signals and dynamic systems.*

Biological basis of neural networks; static and dynamic neural structures; multilayered feedforward neural networks; radial basis function networks; dynamic neural networks; fuzzy neural networks; and identification, control, vision, and pattern recognition using neural networks.

**M E 898.3  
Special Topics  
1/2(3L/R/P)**

Consists of assigned reading, lectures by staff members, discussion periods and laboratory exercises with reports. Depending on the interests of the student and the supervisor, the topics are selected from one of the following research fields in Mechanical Engineering: air conditioning, applied mechanics, control systems, fluid dynamics, heat transfer, metals, or thermodynamics. It is intended for students in Ph.D. programs.

**M E 990  
Seminar**

A seminar is held periodically throughout the regular session. The current research and literature is reviewed and discussed.

**M E 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Eng.) must register in this course. It consists of independent study and investigation of a real world problem, and submission of an acceptable report on the investigation.

**M E 994  
Research**

Students writing a Master's thesis must register for this course.

**M E 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**MICROBIOLOGY**

The Department of Microbiology offers graduate programs leading to the M.Sc. and Ph.D. degrees. Current research carried out in the department deals with the following topics: Pathogenesis/Infectious Diseases: clinical bacteriology, infections of immune-compromised patients; immuno-diagnostic/immuno-therapeutic approaches to bacterial infections, medical virology, development of rapid viral diagnostic methods. Tumor Biology/Immunology: tumor metastasis, molecular tumor immunology. Molecular Genetics/Microbial Physiology: molecular

regulation of virulence factors in pathogenic bacteria, development of DNA-based molecular probes for rapid diagnosis of pathogens, genetic regulation of gluconeogenic enzymes, chromosomal rearrangements, carcinogenesis, chemical mutagenesis, mutagenic mechanism, DNA alkylation damage and repair in eukaryotes, and mechanism of replication initiation. Immunology/Virology: molecular and cellular mechanisms responsible for self-nonself discrimination and immune class determination, cellular and molecular interactions involved in lymphocyte activation and differentiation, molecular basis of cytomegalovirus infection and the development of effective vaccines, immunochemistry of viral antigens and humoral and cellular immune responses, virus induction of autoimmune T cells, and immunoassay detection of microbes in laboratory and industrial settings.

**MICRO 812.3  
Principles of Immunology  
1(3L-3P)**

*Prerequisite(s): AP MC 212; BIOCH 220 (or 203); permission of the instructor.*

Emphasizes fundamental aspects of immunology, dealing with the nature of antigens, immunoglobulin structure and function and the cellular control of the immune response. A proportion of the course is devoted to the area of immunogenetics. The laboratory sessions introduce the student to various techniques commonly employed in immunology.

**MICRO 814.3  
Microbial Physiology  
2(3L)**

*Prerequisite(s): BIOCH 220 (or 203); or permission of the instructor.*

Emphasizes microbial cell surface and transport, energy relationships, photosynthesis, metabolism and principles of metabolic regulation, and synthesis and control of DNA, RNA and proteins.

**MICRO 816.3  
Genetic Analysis of Eukaryotic Microorganisms  
1(3L)**

*Prerequisite(s): BIOL 211 and MICRO 387 (or 386); or permission of the instructor.*

Review various biochemical, genetic and molecular biological approaches in the study of model unicellular eukaryotic microorganisms, primarily *Saccharomyces* yeasts. Emphasis will be on genome organization and manipulation, DNA metabolism, control of gene expression and cell cycle regulation. The complete yeast genome sequence and its application will be discussed. Experimental strategies developed in these lower eukaryotes for the study of other organisms will also be discussed.

**MICRO 817.3  
Molecular Virology  
1(3L)**

Representative members of known animal virus families are used as models of biological events at a macromolecular level. Topics are virus purification and analysis methods, virus structure and self-assembly, virus genomes and genome expression, virus proteins and their function, and virus-cell interactions during lytic, transforming persistent and slow virus infections. For

further graduate training in virology, see VT MC 833.

**MICRO 823.3  
Immunopathogenesis of Microbial Infections  
2(3L-3P)**

*Prerequisite(s): MICRO 812 and permission of the instructor.*

Covers in some depth the fundamental mechanisms involved in host resistance to viral, bacterial and parasitic infections.

**MICRO 827.3  
Advanced Cellular and Molecular Immunology  
2(3-4S)**

*Prerequisite(s): Permission of the department.*

Assesses the current understanding of the immune system, and the experimental means by which this has been achieved, by analyzing papers from the current and past literature.

**MICRO 850.3  
Tumor Biology  
2(3S)**

*Prerequisite(s): BIOCH 430 and 830 and permission of the department.*

Discussion of current aspects of tumor biology including tumor metastasis, signal transduction, oncogenes and tumor suppressor genes, tumor immunology and tumor markers. Papers from the current scientific literature in these area will be analyzed.

**MICRO 860.6  
Microbial Genetics  
1/2(2L-1T)**

*Prerequisite(s): BIOCH 220 (or 203); and permission of the instructor.*

Using paradigms for gene organization and expression in bacterial viruses and microorganisms, the student will gain basic understanding molecular genetics, i.e., the approaches, mechanisms, and classical and reverse genetics tools, necessary for solving modern genetics research problems.

**MICRO 898.3  
Special Topics  
1/2(2L/R)**

*Prerequisite(s): An introductory Microbiology course and permission of the department.*

Study in selected areas of microbiology may be undertaken by senior students with permission of the department. The study will be arranged to suit the requirements of individual students. It may consist of lectures, essays, literature surveys and reports on assigned topics related to a specific subject. Laboratory work may be required.

**MICRO 990  
Seminar**

Graduate students are required to present one seminar per year on their research during Term 1 or Term 2 in the Microbiology Graduate Seminar Series. The presentation will include a review of current literature and description of research progress by the student. Yearly registration, attendance and participation is required throughout the graduate program.

**MICRO 994  
Research**

Students writing a Master's thesis must register for this course.

**MICRO 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**MUSIC**

The Department of Music offers graduate programs in composition, music theory, musicology, and performance leading to the degree of Master of Music. For graduate programs in Music Education see entry under Education. The special case Master of Arts degree allows graduate students to combine music seminars with graduate classes from a cognate field of study. Graduate programs leading to the Ph.D. degree are available to students only on a special case basis.

The Master of Music programs in composition, music theory, and musicology require 18 course credits plus a thesis. The Master of Music program in performance requires 18 course credits, a recital, and a document. All areas of concentration also include the successful completion of a comprehensive examination and a foreign language. The normal time for completion of the Master of Music degree is two years, including a one-year residency. There will be no admissions to Music in 2000-2001.

Admission to the Master of Music program is a required prerequisite for the following courses.

**MUSIC 840.3  
Seminar in Music Literature  
1/2(3S)**

A seminar in which students will conduct intensive studies of a clearly defined repertoire. This repertoire may be identified by any one of a number of criteria (medium, style, style-period, nationality, composer) provided that it is directly related to the student's specific area of graduate study.

**MUSIC 841.3  
Advanced Bibliography and Research  
Techniques  
1/2(3S)**

An in-depth examination of significant research materials in the principal area of applied music, music theory and musicology. Focuses on the effectiveness of research at the graduate level through the preparation of seminars, papers, and the proposing of the topic for the M.Mus. thesis.

**MUSIC 842.6  
Seminar in Composition  
1&2(3S)**

Composition in the smaller and larger forms. Works for vocal and instrumental ensemble, chorus, band, and orchestra will be included among the major projects. Composition for the theatre will also be considered as will composition utilizing the synthesizer and the computer.

**MUSIC 843.3  
Seminar in 20th-Century Music  
Materials  
1/2(3S)**

Examines current tendencies in orchestration and composition. It will examine the role of the synthesizer and the computer in musical analysis, in music printing, and in composition. Contemporary vocal and instrumental performance practices will also be considered.

**MUSIC 844.6  
Applied Performance Seminar  
1&2(1S)**

The intensive study of a wind, percussion, string, keyboard instrument or the voice will include advanced performance techniques, repertoire and recital preparation.

**MUSIC 845.3  
Seminar in Music Analysis  
1/2(3S)**

The student applies theoretical knowledge to the analysis of complete compositions. Structures and relationships revealed by the analysis will be applied to the particular area of specialization.

**MUSIC 850.3  
History of Theory  
1/2(3S)**

Examines a representative group of music theorists covering the period from antiquity to the present era.

**MUSIC 851.3  
Seminar in Music Theory  
1/2(3S)**

Emphasizes the basic tenets with special attention given to chromatic harmony, contrapuntal practices, analysis, and selected 19th- and 20th-century theoretical concepts.

**MUSIC 852.3  
Seminar in Performance Practices  
1/2(3S)**

A detailed discussion of selected problems and aspects of performance practices of a particular period or genre of music. Considers aspects of articulation, ornamentation, style, tempo, dynamics, organology, iconography, tuning and temperament and will also include the reading of selected treatises on performance practices.

**MUSIC 853.3  
Seminar in Musicology I  
1/2(3S)**

A research seminar on selected topics in musicology, chosen from the Middle Ages, Renaissance, or Baroque eras. May focus on the study of manuscripts, repertoires of monophonic and/or polyphonic music, the development of genres, the examination of style(s), the consideration of composers and significant monuments of music.

**MUSIC 854.3  
Seminar in Musicology II  
1/2(3S)**

A research seminar on selected topics in musicology, chosen from the Classical Period, Romantic Period or 20th century. May focus on the study of manuscripts, repertoires of polyphonic music, the development of genres, the examination of

style(s), the consideration of composers and significant monuments of music.

**MUSIC 855.3  
Seminar in 20th-Century Music  
Theory  
1/2(3S)**

Encompasses the major theoretical thought of the 20th century, both that which deals with new approaches to the study of earlier music and that which presents new methods or systems of musical organization.

**MUSIC 856.3  
Approaches to the Study of Music  
Theory  
1/2(3S)**

Studies the way in which music theorists have approached the various traditional theoretical disciplines: tonal harmony, counterpoint, form, stylistic analysis and ear training. Focuses on the most recent approaches with a study of earlier theorists in order to establish historical context.

**MUSIC 898.3/899.6  
Special Topics****MUSIC 994  
Research**

Students writing a Master's thesis must register for this course.

**MUSIC EDUCATION**

See Education in this section of the *Calendar*.

**NATIVE STUDIES**

The Department of Native Studies offers a graduate program leading to the Master of Arts degree. A department prospectus on the program is available on request.

**Master of Arts in Native Studies**

Admission requires an Honours degree in native studies. Students from allied social science or humanities areas, or from other fields where there has been a focus on Native peoples, will also be continued.

All students in this program are required to complete 18 credit units of course work plus a thesis. Required courses are NATST 802 and 803. Students must also register in NATST 990 for one year.

**NATST 802.3  
Applied Native Studies Research  
Methods  
1/2(3S)**

Emphasizes the development of skills to conduct research on, for and with Native peoples. Technical skills, evaluation skills and ethical issues will be addressed.

**NATST 803.3  
Theoretical Issues in Native Studies  
1/2(3S)**

Critically examines theoretical developments in Native Studies and relevant cognate disciplines, such as Sociology, History, and Anthropology where Native issues are being addressed.

**NATST 898.3/899.6  
Special Topics**

Concentrated reading and research in selected areas of Native Studies.

**NATST 990  
Seminar**

All students will be required to register for and attend for one year NATST 990 (Graduate Seminar) and offer one seminar on their thesis research prior to graduation.

**NATST 994  
Research**

Students writing a Master's thesis must register for this course.

**NURSING**

The College of Nursing offers a program leading to a Master of Nursing (M.N.) degree. Both a thesis and non-thesis option are available as well as specialization in clinical nursing, teaching in nursing or nursing administration. The thesis program consists of 21 credit units plus thesis while the non-thesis program consists of 30 credit units including the project course.

Thesis research will normally emphasize a clinical nursing, health system, or nursing educational problem. Current research interests of the faculty include: psychogerontological issues, management of pain and other clinical issues, risk factors for specific diseases, issues in nursing education, and health promotion.

Admission requirements to the program include: a Bachelor's degree in nursing or equivalent, current registration as a nurse in a Canadian province or the territories, the equivalent of 3 credit units in each of statistics and research methods at the undergraduate level, as well as recent nursing experience of at least one full year.

**NURS 812.3  
Nursing Administration  
1/2(3L-4P)**

*Prerequisite(s): NURS 412; or equivalent.*

Facilitates the critical analysis of management concepts, functions and skills required in the nursing role. The student is expected to apply the nursing process within an administrative framework. Ongoing integration of theoretical and research principles in a practical setting is required.

**NURS 813.3  
Clinical Teaching  
1/2(3L-4P)**

Surveys issues, trends and methods of nursing education. An examination of the nature of clinical instruction in nursing will be the main focus. A practicum is an integral part of the course.

**NURS 880.6  
Clinical Nursing  
1&2(3L-8P)**

Explores concepts, models and theories applicable to clinical nursing practice. Opportunity will be provided to test and evaluate selected frameworks in the practice area of the student's choice.

**NURS 881.3  
Advanced Clinical Nursing  
1/2(1.5S-12P)**

In-depth analysis of selected theoretical frameworks applicable to the student's field of inquiry will be undertaken. Students will have an opportunity to refine existing frameworks for nursing practice, to develop new models and to test these in the clinical setting. Emphasizes skill development and integration of theory and research in practice.

**NURS 890.3  
Independent Reading and Study**

Provides an opportunity for a student to pursue a topic of interest outside the scope of other courses offered. It could be a topic of a multidisciplinary nature. The student is responsible for defining the area of interest. Approval of the student's advisor must be obtained before registering for the course. A paper or papers will be required for satisfactory completion of the course.

**NURS 891.3  
Theory Development in Nursing  
1/2(3S)**

Considers the current stage of theory development in nursing. Based on a historical survey of the subject. The application of theories or conceptual models to nursing practice will be discussed.

**NURS 892.3  
Nursing Research  
1/2(3S)**

Focuses on research methodology with application to clinical nursing problems. Major emphasis will be placed on elements of the research process, critical analysis and evaluation of nursing research, research design and developing proposals of nursing research investigation.

**NURS 898.3/899.6  
Special Topics**

A combination of seminars, guided reading and special projects in selected areas of nursing. The topics to be considered will relate to the special interests of students enrolled in the course. A practicum or internship may be one of the learning methods used. Reports on readings and projects will be required.

**NURS 990  
Seminar**

Reports and discussion of current nursing research. Graduate students are required to attend and participate throughout their program.

**NURS 992.6  
Project**

Students in the non-thesis option must register for this course. It consists of independent study and investigation of a nursing problem. An acceptable report of the investigation must be submitted. The paper will be examined by a supervisor and two other faculty members of the College.

**NURS 994  
Thesis**

Students writing a Master's thesis must register for this course.

**NUTRITION**

The Division of Nutrition and Dietetics within the College of Pharmacy and Nutrition offers programs in graduate studies leading to an M.Sc. degree in Nutrition. Graduate programs leading to the Ph.D. degree are available to exceptional students on a special case basis. Prospective students should consult with the Administrative Assistant. The Division also participates in the Food Science and Toxicology graduate programs.

Applicants to the M.Sc. in Nutrition program must hold a recognized four year Bachelor's degree in Nutrition or related discipline. M.Sc. students are required to take a minimum of 15 credit units of approved course work plus NUTR 990 Seminar.

Research opportunities are available in the following areas: maternofetal trace element metabolism; nutritional influences on erythrocyte function and deformability; human colonic function; metabolic effects of colonic fermentation; dietary fibre analysis; dietary surveys; trends in dietary fat consumption; nutrition studies in athletes; dietary factors affecting calcium metabolism; calcium absorption from calcium supplements; risk factors for osteoporosis; peak bone mass attainment; protein and amino acid metabolism; stable isotopes in nutrition; body composition and energy requirements; community nutrition; nutrition education; nutrition program planning and evaluation; and dietetics issues.

**NUTR 810.3  
Advances in Human Nutrition  
Research  
1/2(3L/S)**

*Prerequisite(s): Undergraduate courses in nutrition at the second-year level and above.* Recent human nutrition research is described and discussed, with emphasis on micronutrient nutrition. Students will read the current literature and participate in classroom lectures and seminars.

**NUTR 820.3  
Current Issues in Nutrition  
2(3L)**

*Prerequisite(s): Senior nutrition course; or permission of the instructor.* An in-depth examination of contemporary issues such as diet and heart disease, influence of lifestyle factors on nutrition, nutrition labelling and health claims, and nutraceuticals. Controversies in nutrition and cultural aspects of food are also discussed.

**NUTR 825.3  
Nutritional Assessment  
2(3L-1.5T)**

*Prerequisite(s): Senior nutrition course; or permission of the instructor.* Theory and methods of nutritional assessment for individuals and groups, including methods for assessment of dietary intake, biochemical, anthropometric and clinical evaluation.

**NUTR 850.3  
Nutrition Program Planning and  
Evaluation**

*Prerequisite(s): NUTR 350; or permission*

*of the instructor.*

Provides an understanding of the theories, principles and techniques involved in planning and evaluating nutrition programs. Students will work together to plan a nutrition program for a local agency or organization.

**NUTR 898.3/899.6  
Special Topics  
1/2(R), 1&2(R)**

Advanced level of guided reading and special projects in selected areas of nutrition.

**NUTR 990  
Seminar**

Staff and graduate students present papers and discuss current research topics at meetings held regularly throughout the year. Graduate students under the direction of the Division are required to attend these seminars.

**NUTR 994  
Research**

Students writing a Master's thesis must register for this course.

**OTHER COURSES**

AN SC 800.3 Protein Metabolism and Nutrition

AN SC 817.3 Advanced Mineral Nutrition\*

AN SC 825.3 Nutritional Toxicology\*

AN SC 898.3 Special Topics

CH&EP 800.3 Epidemiology I

CH&EP 805.3 Biostatistics

PL SC 813.3 Statistical Methods in the Life Sciences

EDCNT 875.3 Adult Learning and Development

FD SC 840.3 Carbohydrates in Foods and Their Functional Properties

PHSIO 826.3 Cardiovascular Physiology

PHSIO 828.3 Physiology of Body Fluids

VT P 828.3 Gastrointestinal Physiology

\* Nutrition faculty participate in these courses.

For details on the above courses, see the appropriate section of the *Calendar*.

**PATHOLOGY**

The Department of Pathology offers programs of graduate studies leading to the Certification and Fellowship of the Royal College of Physicians and Surgeons of Canada in the specialties of Laboratory Medicine. The Department of Pathology also offers M.Sc. and Ph.D. programs in the areas of Anatomic, Biochemical, Haematopathology and Experimental Pathology. Research activities include role of oxygen free radicals in various clinical diseases, biochemical mechanisms of signal transductions, oncogenes and anti-oncogenes in hemopoietic malignancies, use of computers in laboratory medicine, lipid studies, toxicology, immunoassays, forensic pathology, breast pathology, medical-legal relationship and bio-ethics, and molecular biology of carcinoma.

Brochures describing detailed research interests are available from the Department of Pathology. A recognized undergraduate degree such as M.D., D.V.M. or B.Sc. is required for admission to the programs. The requirement for M.Sc. and Ph.D. programs will be established by the College of Graduate Studies and Research Office.

**PATH 740.6  
Chemical Pathology  
1&2(2S-12P)**

*Prerequisite(s): Acceptance to graduate or resident program in pathology. Admission to course by permission of the department.*

Practical, applied Chemical Pathology, intended for students in General Pathology programs, and is a prerequisite for PATH 841. Deals with the routine operation of a Clinical Chemistry laboratory. All the common Clinical Chemical procedures are examined with respect to laboratory techniques and clinical applications.

**PATH 803.3  
Neuropathology  
1/2(2T)**

Gross specimens and microscopical slides of neuropathological material will be studied and discussed.

**PATH 811.6  
Clinical Pathology (Haematology)  
1&2(3T)**

Covers the applied pathology of blood diseases with emphasis on more recent advances in this field. Course only given by special arrangement with the department.

**PATH 841.6  
Chemical Pathology  
1,2&3(2S-12P)**

*Prerequisite(s): PATH 740. Permission of department is required for registration. With permission the student may register for PATH 740 and 841 concurrently.*

Consists of theoretical Chemical Pathology and is intended for students specializing in Chemical Pathology. Deals with management and operation of a hospital Chemical Laboratory. All the modern analytical techniques are studied with emphasis on principles, quality control, instrumentation and clinical interpretations. Both classical techniques and recent advances are included. A 32-week schedule is provided each student who will be required to do three half days per week in the laboratory. Details of reading requirements are also provided with the study schedule.

**PATH 898.3  
Special Topics**

**PATH 910.6  
Pathology Seminar  
1&2(S)**

A monthly seminar of interesting pathological cases or presentations of scientific work of the department.

**PATH 911.6  
Pathology Conferences  
1&2(3S)**

A review and discussion of current cases with clinical, radiological, haematological,



cytological and neuropathological correlation.

**PATH 990 Seminar**

A seminar is held jointly with other medical departments. Graduate students are required to attend and take part in the seminar throughout their program.

**PATH 994 Research**

Students writing a Master's thesis must register for this course.

**PATH 996 Research**

Students writing a Ph.D. thesis must register for this course.

**PHARMACOLOGY**

The Department of Pharmacology offers graduate programs leading to the M.Sc. and Ph.D. degrees. The M.Sc. program for fully-qualified students requires a minimum of 15 credit units of approved graduate courses (usually at the 800 level) while the Ph.D. program requires at least 6 additional credit units above the M.Sc. degree or a total of 21 credit units. Research opportunities are available in the following areas: cancer molecular biology and chemotherapy; cardiovascular and endocrine pharmacology; clinical pharmacology; drug metabolism and pharmacokinetics; neurochemistry and neuropharmacology; and psychopharmacology.

**PHCOL 768.3 Psychopharmacology 1/2(10L, 3 weeks)**

An introduction to the effects of drugs on brain function and behaviour. Designed to assist clinical psychologists in understanding the actions and mechanisms of various psychoactive drugs.

**PHCOL 832.6 Special Topics in Pharmacology 1&2(3R-3S)**

Work in selected areas of pharmacology may be undertaken by advanced students with the consent of the department. This work may consist of essays, readings, and reports on assigned topics relating to a common subject and/or series of laboratory exercises.

**PHCOL 843.6 Current Pharmacology 1&2(3R-3S)**

Supervised departmental tutorials reviewing current literature and topics of interest. Students are required to prepare and present their reviews and to participate in the discussions.

**PHCOL 850.6 Pharmacology 1&2(3L-3T)**

A lecture, laboratory and seminar course dealing with pharmacodynamics, therapeutics and toxicology of drugs. Emphasis will be placed on the basic principles of pharmacology, particularly mechanism of action and structure-activity relationship.

**PHCOL 851.3 Recent Advances in Pharmacology 1/2(10L, 3 weeks)**

*Prerequisite(s): PHCOL 301 or 350; or permission of the instructors.*  
Deals practically with the most recent developments in drug therapy. Emphasizes new approaches of pharmacotherapy as well as to new, unique individual drugs. Instruction in the technique of new drug appraisal will be given with heavy emphasis on the areas of pharmacodynamics, pharmacokinetics, toxicology and therapeutics.

**PHCOL 853.3 Neuropharmacology 1/2(10L, 3 weeks)**

*Prerequisite(s): PHCOL 301 or 350 or 850; or permission of the instructors.*  
An advanced course on drug-induced changes in neural functioning. Focuses on the mechanisms of action and the therapeutic uses of drugs affecting the central nervous system, the autonomic nervous system and the neuromuscular junction. Extensive use of the recent literature will be made.

**PHCOL 854.3 Cardiovascular-Renal Pharmacology 1/2(10L, 3 weeks)**

*Prerequisite(s): PHCOL 301 or 350 or 850; or permission of the instructors.*  
An advanced course dealing with mechanisms of action of drugs affecting the cardiovascular system and kidney function.

**PHCOL 856.6 Molecular Aspects of Anticancer and Antiviral Chemotherapy 1,2&SS(9L-2S-12P)**

*Prerequisite(s): PHCOL 301, 350, 850; or written approval of the course coordinators.*  
An advanced course dealing with molecular mechanisms of action of chemotherapeutic agents with particular emphasis on anticancer and antiviral drugs. Assigned readings and seminar periods will accompany didactic sessions.

**PHCOL 898.3 Special Topics**

**PHCOL 990 Seminar**

Graduate students in the department are required to attend, and to take part in the seminars throughout their program.

**PHCOL 994 Research in Pharmacology**

Students writing a Master's thesis must register for this course.

**PHCOL 996 Research**

Students writing a Ph.D thesis must register for this course.

**PHARMACY**

The College of Pharmacy and Nutrition offers graduate programs leading to the M.Sc. and Ph.D. degrees in various disciplines of Pharmacy including: Pharmaceutical and Medicinal Chemistry, Pharmacognosy, Pharmaceutics, Biopharmaceutics and Pharmacokinetics, Toxicology, and Clinical Pharmacy.

Students in the M.Sc. program are required to complete 15 credit units as well as the seminar course (PHARM 990) and Research (PHARM 994). Students in the Ph.D. program require completion of an additional 6 credit units as well as the seminar course (PHARM 990) and Research (PHARM 996).

Research activities include synthesis, evaluation of the bioactivity, analysis and metabolism of drugs, formulation and evaluation of drug products, investigation of the pharmacokinetics of drugs in animals and man, and applied therapeutic research.

**PHARM 831.3 Natural Products 1/2(3S)**

*Prerequisite(s): BIOCH 211 (or 203) and PHARM 331.*  
Advanced study of medicinal compounds of natural origin, including antibiotics, alkaloids, glycosides, and steroids. The preparation and presentation of papers is required.

**PHARM 832.3 Drug Design 1(3L)**

*Prerequisite(s): PHARM 432 or permission of the department.*  
Consideration is given to the way in which new drugs are developed and the importance of drug latentiation is stressed. Some of the chemical, physicochemical and biochemical parameters affecting bioactivity are outlined.

**PHARM 847.3 Specialized Topics in Pharmaceutics 1/2(3L/P)**

An advanced course involving the principles in product development.

**PHARM 848.3 Advanced Biopharmaceutics and Pharmacokinetics 1/2(3L)**

Selected topics in biopharmaceutics and pharmacokinetics: qualitative and quantitative aspects of drug absorption, distribution and elimination.

**PHARM 854.3 Metabolic Transformations of Xenobiotics 1/2(3L)**

An advanced study of the basic principles of the metabolism of foreign compounds in mammals. The xenobiotics covered will include drugs, food additives, agricultural chemicals and industrial chemicals. The detoxification and toxicological implications of metabolism are emphasized.

**PHARM 856.3 Forensic Toxicology 1(3L-4P)**

Deals with the analytical procedures involved in the detection of chemicals and drugs in the body tissues and fluids, and the identification of drugs of abuse. Appropriate analytical chemical techniques are discussed and used during the practical component of the course.

**PHARM 857.3 Advanced Pharmacotherapy I 1/2(S)**

*Prerequisite(s): PHARM 550, 552; or permission of the instructor.*  
A detailed drug therapy course designed to prepare the student for the advanced clinical clerkship. Pathophysiology, clinical presentation, laboratory and clinical monitoring, monitoring and therapeutic regimens, both current and investigational, will be discussed.

**PHARM 858.3 Advanced Pharmacotherapy II**

*Prerequisite(s): PHARM 550, 552; or permission of the instructor.*  
A detailed drug therapy course designed to prepare the student for the advanced clinical clerkship. Pathophysiology, clinical presentation, laboratory and clinical monitoring, monitoring and therapeutic regimens, both current and investigational, will be discussed.

**PHARM 862.3 Advanced Clinical Pharmacy I 1/2(2L-12C)**

*Prerequisite(s): PHARM 560, 562 and 564; or equivalent.*  
Advanced course in clinical pharmacy designed to enhance the student's practical knowledge of drug therapy and to attain skills in interprofessional and patient communications. Practical experience in an ambulatory and institutional health care environment will be featured.

**PHARM 863.3 Advanced Clinical Pharmacy II 1/2(2L-12C)**

Continuation of PHARM 862, with focus on more advanced experiences in drug monitoring. Practical experience in the ambulatory and institutional health care environment will be a featured part of this course.

**PHARM 898.3 Special Topics**

**PHARM 990 Seminar**

Papers and discussion on recent developments in pharmaceutical fields. Graduate students are required to attend and to take part in the seminars.

**PHARM 994 Research**

Students writing a Master's thesis must register for this course.

**PHARM 996 Research**

Students writing a Ph.D. thesis must register for this course.

**PHILOSOPHY**

The Department of Philosophy offers a graduate program which leads to the Master of Arts degree. To earn the M.A. degree students must successfully satisfy the requirements below.

Students must complete 15 credit units of course work and prepare a suitable thesis.

All students must register in the Graduate Seminar 990 in their resident year. The department will offer a limited number of courses each year. The list to be offered in coming years is available in the department after January 1. Residency for the degree is one year, though it is usual for students to take 1 1/2 to 2 years to complete the degree. Students will normally complete their course work in the first year. If required by their thesis topics and as determined by the Graduate Committee, students must demonstrate a reading knowledge of a language other than English.

Admission to the program requires an Honours degree in Philosophy, awarded by this university, or its equivalent. Students with particularly strong academic credentials who do not meet this requirement may be accepted on the condition that they complete senior undergraduate courses to make up deficiencies as required by the department.

PHIL 808.3 Topics in Greek and Roman Philosophy 1/2(3S)

PHIL 813.3 Topics in 17th- and 18th-Century Philosophy 1/2(3S)

PHIL 814.3 Kant 1/2(3S)

PHIL 815.3 Topics in 19th-Century Philosophy 1/2(3S)

PHIL 816.3 Topics in Contemporary European Philosophy 1/2(3S)

PHIL 817.3 Topics in Contemporary Analytic Philosophy 1/2(3S)

PHIL 818.3 Topics in Contemporary American Pragmatism 1/2(3S)

PHIL 819.3 Wittgenstein 1/2(3S)

PHIL 820.3 Philosophical Texts 1/2(3S)

PHIL 826.3 Seminar in Philosophy of Mind 1/2(3S)

PHIL 833.3 Seminar in Ethics 1/2(3S)

PHIL 842.3 Topics in Philosophical Logic 1/2(3S)

PHIL 844.3 Seminar in Epistemology 1/2(3S)

PHIL 845.3 Seminar in Metaphysics 1/2(3S)

PHIL 846.3 Seminar in the Philosophy of Language 1/2(3S)

PHIL 851.3 Seminar in the Philosophy of Science 1/2(3S)

PHIL 862.3 Seminar in Social and Political Philosophy 1/2(3S)

PHIL 871.3 Seminar in Aesthetics 1/2(3S)

**PHIL 990 Seminar**

This seminar meets every two weeks throughout both terms of the regular academic year. Under the direction of a faculty member of the department, graduate students study current literature on selected topics and also present papers on their research projects. All graduate students in Philosophy are required to attend this seminar throughout their program and are expected to present at least one paper to the seminar every year.

**PHIL 994 Research**

All Masters' students must register in this course.

**PHYSICS AND ENGINEERING PHYSICS**

The Department of Physics and Engineering Physics offers graduate programs leading to M.Sc. and Ph.D. degrees.

The following courses are for students who have completed the Honours program in Physics, or a program in Engineering Physics; other students must obtain the permission of the instructor.

**PHYSICS**

**PHYS 811.3 Classical Mechanics 1/2(3L)**

Lagrange's equation of Motion, Hamilton formulation, Phase-space considerations, Liouville theorem, Poisson brackets, Action-angle variables, Hamilton-Jacobi Equation, Integrable systems, Canonical Perturbation theory, KAM theorem, Phase-space mapping, Henon, Standard and tangent Maps, Local and Global Chaos, Dissipative systems.

**PHYS 812.3 Electromagnetic Theory 1/2(3L)**

Topics include boundary-value problems of electrostatics and magnetostatics, time varying fields, radiation and multipole fields.

**PHYS 821.3 Introduction to Aeronomy 1(3L)**

The structure and composition of the Earth's atmosphere; mean circulation, tides and wave motions; the major photochemical processes and their implications; the physical processes of the ionosphere and the magnetosphere; and experimental methods.

*Note:* Instruction is given jointly by members of the Institute of Space and Atmospheric Studies.

**PHYS 822.3 Radio Physics of the Upper Atmosphere 2(3L)**

Deals with the application of radio methods to studies of the upper atmosphere. Topics discussed include the magneto-ionic theory; scattering of radio waves by meteors and aurora, scattering, generation and absorption of radio waves in the solar and terrestrial atmospheres, solar-terrestrial-relations and the methods of radio astronomy applied to upper atmospheric measurements.

**PHYS 823.3 Advanced Aeronomy 1/2(3L)**

*Prerequisite(s):* PHYS 821; or with permission if taken concurrently. Basic Photochemistry. Absorption of radiation on a rotating planet. Minor constituents, diurnal variations. Airglow. Mechanical and chemical models. Environmental studies.

**PHYS 824.3 Ionospheric and Magnetospheric Physics 1/2(3L)**

*Prerequisite(s):* PHYS 821; or with

*permission if taken concurrently.*

The Earth's ionosphere and magnetosphere, also for other planets. Techniques of investigation, physical processes, structure and models.

**PHYS 826.3 Atmospheric Dynamics 1/2(3L)**

*Prerequisite(s):* PHYS 821; or with permission if taken concurrently. Modern observational systems (radars, lidars and other optical systems) from ground and satellite platforms used for sounding the atmosphere up to the lower thermosphere (130km). Theoretical treatments for the mean winds, planetary waves, tides and gravity waves. Comparison of theory with observations, global reference atmospheres and global circulation models.

**PHYS 827.3 Atmospheric Spectroscopy and Radiative Transfer 1/2(3L)**

*Prerequisite(s):* PHYS 821; or permission of the instructor.

Solar and terrestrial radiation; absorption, emission and scattering in terrestrial and planetary atmospheres; radiative transfer; remote sensing of atmospheric properties; climate models (greenhouse effect, atmospheric evolution).

**PHYS 833.3 General Relativity and Gravitation 1/2(3L)**

Development of the physical ideas and mathematical skills leading to general relativity as a theory of gravitation; solutions of the Einstein field equations and observational tests of general relativity; applications to black holes and cosmological models.

**PHYS 841.3 Introduction to Atomic and Molecular Spectra 1(3L)**

Introduction to the theory of spectroscopy. Topics include spectra and structure of hydrogen and complex atoms, multiplet spectral terms, Zeeman effect, intensities of atomic spectra, rotational and vibration energy levels and spectra of diatomic and polyatomic molecules, electronic energy levels and spectra of polyatomic molecules.

**PHYS 843.3 Cybernetic Systems 1/2(3L)**

*Prerequisite(s):* An intermediate course in probability theory or statistical physics and a basic knowledge of the concepts of linear algebra.

Applies the theory of multiple stochastic processes to physical systems for the purposes of communication, computation and control. Techniques of filtering, linear prediction and spectral analysis in a discrete, multi-dimensional domain are emphasized. Examples from the fields of optics and geophysics are used but can be changed depending on the specific interests of the students.

**PHYS 851.3 Introductory Nuclear Physics 1(3L)**

*Prerequisite(s):* PHYS 482 and 452. Introduction to electromagnetic and weak interactions as relevant to nuclear and particle physics. Symmetries in sub-atomic physics, weak decays, selection rules and electromagnetic processes.

**PHYS 852.3 Advanced Nuclear Physics 2(3L)**

*Prerequisite(s):* PHYS 851. Advanced topics in nuclear and particle physics. Relativistic kinematics as it concerns experiments. Students will be required to write a review paper of a major research topic.

**PHYS 853.6 Electron Scattering 1&2(3L)**

Develops in detail the theoretical framework used in treating electron scattering from nuclei. The first half provides an introduction to quantum field theory and S-matrix expansions. These techniques are applied to derive formulae for electron scattering cross sections. The predicted form factors from various nuclear models are studied. Finally the electroproduction process is studied in detail.

**PHYS 856.3 Radiation Therapy Physics 2(4L&2S)**

*Prerequisite:* Permission of the instructor. Interaction of x- and gamma rays with matter, interaction of particulate radiations with matter; radiotherapy linear accelerators; radiation quality, exposure; absorbed dose; dosimetry of high energy x-ray and electron beams; x-ray dose distribution parameters; electron dose distribution parameters; brachytherapy.

**PHYS 861.3 Plasma Physics 2(3L)**

Discusses the basic concepts of plasma physics. Reading of assigned literature in plasma physics is required.

**PHYS 862.3 Plasma Waves I 1/2(3L)**

*Prerequisite(s):* PHYS 861. Dispersion relations are derived for small amplitude waves in plasmas, both in the presence and in the absence of magnetic fields. The topics treated in this course include the kinetic model of the plasma, Landau damping, instabilities, the effect of inhomogeneities or wave propagation, and the effect of oscillating external fields on waves and instabilities.

**PHYS 863.3 Plasma Waves II 1/2(3L)**

*Prerequisite(s):* PHYS 861 and 862. Deals with nonlinear wave phenomena in plasma physics. Quasilinear theory, the theory of a single plasma mode and the equation of Korteweg-de Vries are covered. Other topics to be chosen from the Dupree-Weinstock theory of plasma turbulence, fluctuations, wave scattering and applications to fusion plasmas.

**PHYS 864.3  
Controlled Fusion  
1/2(3L)**

*Prerequisite(s):* PHYS 861.

Plasma equilibria. Particle and thermal diffusion. MHD stability (concept of minimum B and average minimum B). Velocity space instabilities (loss-cone, trapped particle, and beam-driven instabilities). Plasma heating (ohmic, compression, neutral beam, wave). New concepts.

**PHYS 865.3  
Plasma Transport Properties and  
Diagnostic Techniques  
1/2(3L)**

*Prerequisite(s):* PHYS 861.

Provides a kinetic theory treatment of plasma transport phenomena - conductivity, diffusion, heat flow - and the relaxation times for particle deflection, momentum transfer, energy relaxation. Various plasma measurement techniques are then discussed, including the use of microwaves, probes, laser scattering and particle energy analyzers.

**PHYS 881.6  
Quantum Mechanics  
1&2(3L)**

Designed to acquaint students with some of the concepts of quantum mechanics.

**PHYS 882.6  
Quantum Mechanics  
1&2(3L)**

*Prerequisite(s):* Permission of the instructor.

Concepts in advanced quantum mechanics. Topics include second quantization, the Greens function approach to many particle systems, field quantization and relativistic wave equations. Topics in relativistic field theory include solvable models, Wick's Theorem, and perturbation expansions. Field theory is used to discuss problems in strong, electromagnetic, and weak interactions.

**PHYS 893.3  
Selected Topics in Physics and  
Engineering Physics  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.

Advanced topics in Physics and Engineering Physics selected to aid graduate students with their research. Consists of assigned readings in texts and/or scientific journals, related discussions, and additional lectures.

**PHYS 894.3  
Selected Topics in Theoretical  
Physics  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.

Advanced topics in theoretical physics selected to aid graduate students with their research. Consists of assigned readings in texts and/or scientific journals, related discussions, and additional lectures.

**PHYS 895.3  
Selected Topics in Subatomic  
Physics  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.

Advanced topics in subatomic physics selected to aid graduate students with their research. Consists of assigned readings in

texts and/or scientific journals, related discussions, and additional lectures.

**PHYS 896.3  
Selected Topics in Plasma Physics  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.

Advanced topics in plasma physics selected to aid graduate students with their research. Consists of assigned readings in texts and/or scientific journals, related discussions, and additional lectures.

**PHYS 897.3  
Selected Topics in Space and  
Atmospheric Physics  
1/2(3L)**

*Prerequisite(s):* Permission of the instructor.

Advanced topics in space and atmospheric physics selected to aid graduate students with their research. Consists of assigned readings in texts and/or scientific journals, related discussions, and additional lectures.

**PHYS 898.3  
Special Topics  
1/2(3L), 1&2(3L)**

Consists of assigned reading in texts and scientific journals on which the students report; additional lectures by the professor in charge are also given. Depending on the interests of the students, the topics are in the field of nuclear, or theoretical or upper atmospheric physics.

**PHYS 990  
Seminar**

Papers on recent developments in Physics and Engineering Physics are given. Candidates for the Master's degree and for the Ph.D. degree in this department are required to participate.

**PHYS 994  
Research**

Students writing a Master's thesis in physics must register for this course.

**PHYS 996  
Research**

Students writing a Ph.D. thesis in physics must register for this course.

**ENGINEERING PHYSICS****E P 994  
Research**

Students writing a Master's thesis in Engineering Physics must register for this course.

**E P 996  
Research**

Students writing a Ph.D. thesis in Engineering Physics must register for this course.

**PHYSIOLOGY**

The Department of Physiology offers graduate programs leading to the Master's and Ph.D. degrees. Research opportunities are available in the following areas: gastrointestinal physiology; liver development and function; neural and endocrine control of water and electrolyte balance; comparative respiratory and cardiovascular physiology;

thermoregulation (neural control, cellular physiology of brown adipose tissue); cardiovascular physiology (electrophysiology and signal transduction in cardiac and smooth muscle cells, atherosclerosis and protection of ischemic myocardium); and neurophysiology (electrophysiology, cellular imaging in neurons and glial cells, in vitro and in vivo studies of cerebral ischemia). Opportunities are also available for collaborative training with faculty in clinical departments of the College of Medicine.

The following courses are open to students of the other Departments. Students wishing to register in any of the courses should consult the Department.

**PHSIO 736.3 (Formerly PHSIO 825.6)  
Excitable Cells  
1/2(3L)**

The integrated study of bioelectrical mechanisms of cellular excitability and excitation coupled functions including contraction, secretion and signal transduction.

*Note:* Contact the department for availability.

**PHSIO 737.3 (Formerly PHIO 826.3)  
Cellular Basis of Physiological  
Function  
1/2(3L)**

*Prerequisite(s):* Permission of instructor.

Cellular mechanisms underlying physiological functions in mammals. Topics include mechanisms of communication between cells, uptake and secretion of water, ions, nonelectrolytes and macromolecules, and integration of cell functional and metabolic activities.

*Note:* Contact the department for availability.

**PHSIO 747.3 (Formerly PHSIO 827.3)  
Respiratory Physiology  
1/2(3L)**

Mechanisms of respiratory gas exchange at the lungs and tissues; gas transport in the blood; acid-base balance and regulation of the respiratory system under a variety of conditions such as exercise, high altitude, diving, and certain disease states.

*Note:* Offered alternate years. Students with credits for PHSIO 347.3, 427.3, or 827.3 may not take this course for credit.

**PHSIO 748.3 (Formerly PHSIO 834.3)  
Endocrinology  
1/2(3L)**

Nature, action and control of endocrine secretions. Topics include neuroendocrinology and examples of hormonal control in reproduction, metabolism, growth, calcium homeostasis and gastrointestinal functions.

*Note:* Offered alternate years. Students with credits for PHSIO 348.3, 434.3, or 834.3 may not take this course for credit.

**PHSIO 750.3 (Formerly PHSIO 834.3)  
Integrative Neuroscience  
1/2(3L)**

Mechanisms of integration of neural signals. Examples will be used to show how different types of sensory input are integrated at various levels of the nervous system to evoke appropriate effector responses.

*Note:* Offered alternate years. Students with credits for PHSIO 349.3, 350.3, 429.3, or 829.3 may not take this course for credit.

**PHSIO 828.3 Physiology of Body  
Fluids  
1/2(3L)**

An advanced course on the composition, functions and regulation of various body fluids, the maintenance of acid-base balance and the functions and control of the kidney.

**PHSIO 845.3 Ion Channels:  
Principles and Methodology  
1/2(2L&1S)**

*Prerequisite:* Permission of the coordinator.

Explores ion channel mechanics and the role of a variety of ion channels in normal and pathological cellular functions. Students will become familiar with the methodologies used in the study of ion channels, with a special emphasis on patch-clamp technology.

**PHSIO 898.3/899.6  
Special Topics  
1/2(3R/P), 1&2(3R/P)**

Work in selected areas of physiology may be undertaken by advanced students with the consent of the department. This work may consist of essays, readings, and reports on assigned topics and/or a series of laboratory exercises.

**PHSIO 990  
Seminar**

Throughout their program, graduate students in Physiology are required to attend department seminars and to participate in the presentation and discussion of papers in the journal club.

**PHSIO 994  
Research**

Students writing a Master's thesis must register for this course.

**PHSIO 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**PLANT SCIENCES**

The Department of Plant Sciences offers programs leading to the Postgraduate Diploma, M.Agr., M.Sc., and Ph.D. degrees. These programs provide training in all aspects of Plant Science including agronomy, biodiversity, biotechnology, crop quality, horticulture, plant breeding, plant ecology, plant pathology, plant physiology and weed science. Many members of non-university institutions on campus, including Agriculture and Agri-Food Canada and the Plant Biotechnology Institute/NRTC, are Adjunct Professors and graduate students can also carry out their thesis research in these institutions. See web site at [www.usask.ca/agriculture/cropsci/](http://www.usask.ca/agriculture/cropsci/)

**CROP SCIENCE****PL SC 803.3  
Advanced Plant Breeding  
2(3L)**

*Prerequisite(s):* PL SC 411; or equivalent; or permission of the instructor and PL SC

816; or equivalent.

Deals with important theoretical and applied issues related to crop improvement in both self-pollinated and cross-pollinated species. Theoretical aspects of artificial selection, genetic variability and population structure will be considered along with the practical implications of field testing, cultivar increase and release, and plant breeding regulations.

**PL SC 804.3  
Processing and Analysis of Grain Crops  
2(2L-4P)**

*Prerequisite(s): BIOCH 220.*

Post-harvest technologies for processing grain crops into basic food products will be reviewed with emphasis on the grain quality characteristics which influence their functionality in food systems. Laboratory exercise will provide the current experimental procedures for prediction of grain quality and potential utilization.

**PL SC 811.3  
Population and Conservation Genetics  
2(3L)**

*Prerequisite(s): BIOL 211 and PL SC 405.*

Basic conditions for maintaining genetic variability in populations. Effects of environmental changes on genetic diversity. Effects of mating system and population size on genetic structures of populations. A study of the causes of loss of genetic diversity and strategies for preservation with emphasis on plant genetic resources.

**PL SC 813.3  
Statistical Methods in Life Sciences  
2(3L)**

*Prerequisite(s): PL SC 314.*

Some parametric statistical methods commonly used in agriculture and experimental biology. Introduction to factorial experiments and analysis of covariance. Emphasizes the principles and procedures of experimental designs.

**PL SC 814.3  
Topics in the Physiology of Crop Plants  
1(3L)**

The role of plant growth regulators in growth and development. Responses of plants to light and temperature; dormancy, frost and drought resistance.

**PL SC 815.3  
Applied Plant Cytogenetics  
1(3L-3P)**

The application of cytogenetics to plant breeding. Topics include chromosomal aberrations, crop evolution, interspecific hybridization, gene transfer, euploidy and aneuploidy.

**PL SC 816.3  
Quantitative Genetics  
1(3L)**

The genetical and statistical concepts of quantitative variation in crop plants. Emphasis will be on factors which affect direct and correlated response to artificial selection. Methods of quantitative genetic research will be considered.

**PL SC 817.3  
Population Genetics  
2(3L)**

*Prerequisite(s): BIOL 211 and PL SC 405.*

Basic conditions for maintaining genetic variability in populations. Effects of environmental changes on genetic diversity. Effects of mating system and population. A study of the causes of loss of genetic diversity and strategies for preservation with emphasis on plant genetic resources.

**PL SC 818.3  
Physiology and Biochemistry of Herbicide Action  
2(3L)**

*Prerequisite(s): PL SC 340; or equivalent.*

The physiology and biochemistry of herbicide action, from the point of entry into the plant to the events leading to plant death. The fate of herbicides in plants (foliar and root absorption, translocation, and metabolism) is discussed first, followed by an examination of the various mechanisms of herbicide action. Topics such as selectivity, herbicide resistance and structure-activity relationships are also covered.

**PL SC 824.3  
Biotechnology in Crop Development  
1/2(3L)**

*Prerequisite(s): BIOCH 220, BIOL 202, 325, 331; or permission of the instructor.*

An overview of the current status of the application of biotechnology to crop improvement. The class will emphasize the role of genetic engineering in plant breeding and will include a survey of the techniques available and a review of current and prospective areas of application.

**HORTICULTURE**

**PL SC 841.3  
Advanced Fruit Growing  
2(3L-2P)**

Fundamentals of commercial fruit production including environmental adaptation, breeding, site development, marketing, cultural management, tree fruits, small fruits, tropical fruits, harvesting, diseases and pests.

*Note:* Students with credit for PL SC 441 may not take this course for credit.

**PL SC 850.3  
Advanced Vegetable Growing  
1(3L-2P)**

Fundamentals of commercial vegetable production outdoors and under glass. Breeding, planting, culture, harvesting, grading, diseases and pests are discussed.

*Note:* Students with credit for PL SC 450 may not take this course for credit.

**PL SC 870.3  
Principles of Plant Propagation and Nursery Management  
1(3L)**

Principles and commercial procedures for the propagation and nursery management of horticultural plants. Term papers will also be required.

**PLANT ECOLOGY**

**PL SC 812.3  
Physiological Plant Ecology  
1(3L-3P)**

*Prerequisite(s): Courses in plant ecology and plant physiology; or permission of the*

*instructor.*

A study of the physiological basis for the interaction of the individual species with its environment. Included are discussions of the energy environment of the plant and how temperature, light, water status, soil conditions etc., affect plant function and distribution.

**PL SC 822.3  
Range Management  
1(3L-2T)**

*Prerequisite(s): Permission of the instructor.*

Emphasizes the principles of managing rangeland to ensure sustained productivity. Plant morphology, physiology, palatability, nutritional value, energy flow, and nutrient cycling are integrated and emphasized in relation to the impacts of grazing on soil-plant-animal interactions. Inventory, evaluation, and manipulation of rangeland resources are also studied. Field trips are required.

**PL SC 823.3  
Ecology of Vegetation Management  
2(3L-2P)**

*Prerequisite(s): BIOL 253, GEOG 270, PL SC 213; or permission of the instructor.*

Theories relating to succession and disturbance in plant communities and how succession can be manipulated to achieve vegetation complexes for specific needs. Methods of completing resource inventories, defining landscape management objectives, inducing disturbances to alter vegetation in order to achieve specific goals and monitoring impacts of management will be discussed. Field trips will be required.

**PL SC 831.3  
Wildland Ecology  
1(3L-3P)**

*Prerequisite(s): Courses in plant ecology or animal ecology, and a course in plant taxonomy.*

Structure, composition and genesis of vegetated landscapes and their ecology, with emphasis on ecological methodology. Readings assigned in relevant environmental sciences.

**PL SC 862.3  
Plants and Microclimate  
2(3L-3P)**

*Prerequisite(s): Permission of the instructor.*

A treatment of the physical basis for the interactions between plants and their atmospheric and edaphic environments. The main emphasis will be placed on the study of the exchange of radiation heat and matter between the environment and individual leaves, soil surfaces and, particularly, plant communities.

**PL SC 891.3  
Literature Survey  
1/2 or 1&2(R)**

Reading will be assigned for the purpose of extending the student's knowledge of chosen subjects.

**PL SC 990  
Seminar**

The current literature is reviewed and discussed, and papers on the investigations of staff and graduate students are presented. Undergraduates specializing in Plant Ecology are required to attend this

seminar for at least one year, and graduate students must attend throughout their program.

**PL SC 994  
Research**

Students writing a Master's thesis must register for this course.

**PL SC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**PLANT SCIENCES**

**PL SC 898.3  
Special Topics  
1/2(1L-3P)**

Assigned reading and tutorials in a specific field related to the student's major interest. Students will be required to prepare reviews or seminars on specific topics.

**PL SC 990  
Seminar**

Reviews of literature and recent investigations. Graduate students are required to attend and present papers during the period of their candidacy.

**PL SC 992.6  
Project**

M.Agr. students must complete this course as part of the requirements for the degree.

**PL SC 994  
Research**

Students writing a Master's thesis must register for this course.

**PL SC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**POLITICAL STUDIES**

The Department of Political Studies has a graduate program leading to the M.A. degree. The intent of the M.A. program, which is one calendar year in length, is to allow students to proceed to doctoral work or better prepare them for public service or private sector employment.

The department publishes a separate brochure, which is available upon request, describing in detail the nature and the requirements of the graduate program, including awards and scholarships.

**MASTER OF ARTS IN POLITICAL STUDIES**

The course requirements for a political studies degree are under review and is expected to be in place for the 1999-2000 academic year. Interested students are asked to inquire about these requirements at the Department of Political Studies. In addition, students are required to write a thesis of 75 pages in length.

**POLST 767.6  
Ethical Issues in International Relations  
1&2(25S)**

Examines the nature and limits of ethical values in international relations and explores the responsibilities and difficulties

of states, statesmen and individuals in seeking to act ethically in an anarchic international system. Ethical issues involved in war, nuclear strategy, humanitarian intervention, sanctions and the promotion of democracy and human rights are examined.

**POLST 801.3  
Federalism  
1/2(3S)**

A seminar on theories of federalism with particular emphasis on the Canadian experience. In addition to the Confederation Debates, some of the authors to be studied include K. C. Wheare, William Livingston, Alan Cairns, and D. V. Smiley.

**POLST 802.3  
Canadian Government and Politics  
1/2(3S)**

An examination of the structure and operation of Canadian political institutions.

**POLST 805.3  
Provincial Government and Politics  
1/2(3L)**

A comparative examination of the political process, political institutions and political cultures of Canada's provinces.

**POLST 809.3  
Canadian Constitution & Politics  
1/2(3S)**

Topics include the Constitutional Act, Canadian Charter of Rights and Freedoms, Canada Elections Act, and intergovernmental relations.

**POLST 818.6  
Readings in Contemporary Political  
Studies  
1/2(3L)**

Required of all graduate students. Issues and themes are drawn from the current scholarly literature in political studies. Conduct of the seminar is shared among members of staff, according to topic. Several meetings and assignments are devoted to thesis preparation.

**POLST 820.3  
Canadian Public Administration  
1/2(3L)**

The Canadian public service within the Canadian political system. The structure and operations of the civil service will be related to policy formulation and implementation. Several topics of concentration include: public accountability, representative bureaucracy, the ministry system, the budgetary process, public corporations and federal-provincial administrative relations.

**POLST 832.3  
Selected Topics in Political Thought I  
1(3L)**

Problems in the philosophy of social science are examined.

**POLST 833.3  
Selected Topics in Political Thought II  
2(3L)**

Selected topics in political philosophy are examined: natural rights, the public interest, justice, obligation, freedom and others.

**POLST 835.6  
Nationalism  
1&2(3L)**

The philosophical origins, the characteristics, and the implications of nationalism; criticisms, and traditions of

criticism, of nationalist doctrine; nationalism as a movement and its relations with other movements such as socialism. Also the manifestations of nationalism, and the characteristics of nationhood, in specific countries, notably Canada, and also France, Germany, other parts of Europe, the English-speaking world (including the two parts of Ireland), and some of the nation-states of Asia, Africa, and the Caribbean, emphasis depending on the interests of individual students.

**POLST 838.6  
Rights and Community  
1&2(3S)**

A survey of major theoretical issues underlying questions of rights in the context of contemporary politics, with special attention to Canada.

**POLST 839.3  
Contemporary Political Philosophy  
1/2(3S)**

Examines several of the approaches and thinkers of the rebirth of political philosophy in the last half of the 20th century. In particular, how some of these contemporary political theorists analyze central topics in political philosophy: justice, obligations, rights, public interests, power, state, society, history, etc.

**POLST 840.3  
Comparative Government  
Bureaucracy  
1/2(3S)**

An examination of the functioning and implications of bureaucracy in selected industrialized states.

**POLST 841.3  
Comparative Public Policy  
1/2(3S)**

An examination of public policy and policy making in selected industrialized states.

**POLST 849.3  
Theory and Method in Comparative  
Government and Politics  
1/2(3S)**

Investigates the range of theories that are being used in contemporary political science to examine political phenomena from a cross-national perspective. Also examines the methodological issues that arise in approaching the study of politics and government in this way.

**POLST 852.6  
Selected Topics in Political  
Sociology  
1&2(3L)**

A discussion of metaphors, models and "systems" within the context of modern ideologies, socio-political doctrines and political "cultures."

**POLST 853.3  
Political Leadership in Anglo-  
Western Democracies  
1/2(3L)**

A comparative analysis of political leadership in Great Britain, the United States, and Canada, with particular reference to the selection of party leaders and the characteristics of those who lead political parties.

**POLST 854.3  
Political Parties and Voting Behaviour  
1(3L)**

An examination of political parties, party systems and electoral behaviour.

**POLST 859.3  
Political Sociology  
1/2(3S)**

*Prerequisite(s): There are no formal prerequisites, but students should have completed previous coursework in political philosophy or social and political thought.*  
Intensive examination of the work of one or more contemporary political sociologists or social theorists, or of the debate concerning one or more key concepts in the literature of political sociology.

**POLST 865.3  
Decision-Making Theory and  
Canadian Foreign Policy  
1/2(3.5S)**

Explores some of the more advanced theoretical literature in the area of foreign policy decision-making and adapts it for use in the study of Canadian foreign policy. Employs a variety of analytical models, e.g., "rational actor", "national interest", "role analysis", "operational codes", etc. to examine specific cases of Canadian foreign policy decision-making in the post World War II period.

**POLST 866.3  
The Canadian Foreign Policy Process  
1/2(3.5L)**

Explores in depth various aspects of the Canadian foreign policy process. The focus will be on the executive (Prime Minister and Cabinet) the bureaucracy (The Department of External Affairs, and the relevant central agencies) and the legislature (Parliament and its committees) and the role played within the policy process of special interests, the media and the provinces.

**POLST 869.3  
Graduate Seminar in International  
Relations: Theories in International  
Relations  
1/2(2.5S)**

Surveys and assesses major theories of international relations and examines the assumptions and methodological approaches which underlie them. Both classical and modern scientific theories are examined in terms of internal consistency, relationship to date, and over-all utility for the describing, explaining and predicting of international behaviour.

**POLST 898.3/899.6  
Special Topics  
1/2(3L)**

Reading, essays, and discussion in an approved special field.

**POLST 990  
Seminar**

Papers and discussions on topics in political studies. Graduate students are required to attend and take part in these meetings. Every graduate student is expected to present a seminar on their thesis topic before receiving the graduate degree.

**POLST 994  
Research**

Students writing a Master's thesis must register for this course.

**PSYCHIATRY**

The Department of Psychiatry has a graduate program leading to an M.Sc. or to a Ph.D. in Neuropsychiatry. Extensive facilities exist to support basic and clinical research in psychiatric and neurological disorders. The current research areas include: drug design, discovery and development; study of the mechanisms of and potential treatments for neurodegenerative disorders such as Parkinson's and Alzheimer's Diseases, and acute neurological conditions such as stroke and ischemia; search for neurotrophic factors involved in neuronal protection, survival and rescue; molecular biological studies on neurotrophic factors, enzymes and receptors; gene regulation of monoamine synthesizing and catabolizing enzymes; investigations on biological markers and of the correlations between mood or behavior and the levels of neurochemicals in body fluids; clinical studies on the effects of psychiatric drugs on neurotransmitters and metabolites; studies of the uptake, release, binding and signal transduction mechanisms of a variety of CNS transmitters and modulators; mapping of the distribution of biogenic amines using selective lesions, drugs and ligand binding; studies of the enzymes involved in synthesis and catabolism of neuroactive compounds; role of alcohol-metabolizing enzymes in the development of alcoholism; the development of ultra-sensitive methods for analysis of drugs, biogenic amines, other neurotransmitters, their metabolites and associated enzymes. Neuropsychiatry (PSIAT 850) is a core class and must be taken by all students.

**PSIAT 850.6  
Neuropsychiatry  
1&2(3L/S)**

*Prerequisite(s): PHCOL 350, BIOCH 220 (or 203); or equivalents or permission of the instructor.*

Offered in alternate years and is designed for graduate students and residents in Psychiatry. Comprised of: (1) a series of basic lectures covering many areas of neuroscience such as neurochemistry, neurophysiology, neuropharmacology, neuroendocrinology, etc. especially as applied to psychiatry and neurology, (2) a series of lectures on the diagnosis and treatment of a variety of psychiatric and neurological disorders combined with a case presentation, and (3) a series of student presentations in a seminar/discussion format on the biological theories of the mechanisms underlying selected psychiatric and neurological disorders.

**PSIAT 898.3/899.6  
Special Topics  
1/2(3R/T), 1&2(3R/T)**

*Prerequisite(s): PSIAT 850.*

Study in selected areas of neuroscience or neuropsychiatry may be undertaken by advanced students with the permission of the department head. Consists of

supervised readings and discussion leading to the preparation of a term paper by the student.

**PSIAT 990 Seminar**

Students are required each year to attend the departmental seminar series and to present one formal seminar on an assigned topic and one informal seminar on their research activities.

**PSIAT 994 Research**

Students registered in a Master's thesis program must register in this course.

**PSIAT 996 Research**

Students registered in a Ph.D. thesis program must register in this course.

**PSYCHOLOGY**

Graduate programs are offered in three main areas: clinical psychology (Ph.D.), applied social psychology (M.A. and Ph.D.), and general experimental psychology (M.A. and Ph.D.).

The doctoral program in clinical psychology follows a scientist-practitioner model, blending scholarly research with professional skill training. The program trains clinical psychologists for employment in academic, research, clinical, community, and private practice settings. Admission requires a B.A. (Hons.) degree or equivalent in psychology; students may be accepted for advanced standing after they complete an M.A. degree in another program. Clinical skill training in assessment and therapy begins early in the program and continues over the five years of the program. Courses in basic areas of psychology, statistics and research methodology, and an M.A. project and Ph.D. dissertation are required. While the master's degree is not normally awarded within the program, the first two years comprise 30 credit units at the M.A. level plus two practicum placements. An additional 21 credit units (plus two practica and a full-year-internship) are required to complete the Ph.D.

The Applied Social program trains students to work as researchers/consultants within government, business, and community organizations. It is unique in its focus on applied research and the inclusion of two research practica and one four-month research internship for each degree. Most students require at least two years to complete the M.A. and three more years to complete the Ph.D. In addition to the practica (PSY 902) and clerkship (PSY 903), the required courses at the M.A. level are: 805; 807; 810; 811; 806 or 808; and 9 credit units of electives. At the Ph.D. level students complete two more practica (PSY 902) and another clerkship (PSY 903). The required courses are: 862 and 863; 890 or 891; 806 or 808; and 9 credit units of electives. Faculty supervise applied research, training, and consulting activities relevant to organizational

functioning and the development of health, mental health, and criminal justice programs.

The general-experimental area allows for considerable flexibility. Programs can be tailored to the needs of students interested in brain and behavior, developmental, neuropsychology, cognitive, social, etc. although statistics and basic area courses are required in all programs. Most students require two years to complete a general-experimental M.A. program, but completion in one calendar year is possible. The M.A. degree requires 18 credit units and the thesis. In addition to the dissertation, the Ph.D. requires completion of 9 credit units of course work and comprehensive examinations. Students in both programs are expected to participate in weekly research seminars.

Further information about the graduate programs such as admission requirements, application forms, financial aid, and faculty interests is contained in a brochure, *Graduate Studies in Psychology*, available from the department.

**PSY 800.3 Graduate Seminar in Psychology 1/2(3S)**

An advanced survey of theory and research in basic areas of psychology: learning and motivation, perception and cognition, physiological and comparative, personality and social, and developmental psychology.

**PSY 805.3 Statistics I 1/2(3L)**

Selected topics in inferential statistics, including an introduction to analysis of variance. Required of all graduate students.

**PSY 806.3 Statistics II 1/2(3L)**

Continuation of 805 with focus on more advanced analysis of variance designs. Required of all Ph.D. students.

**PSY 807.3 Statistics III 1/2(3L)**

Continuation of 806. Focus on multivariate methods, correlation and regression, and factor analysis. Introduction to computer techniques for statistical analysis.

**PSY 808.3 Advanced Psychometric Methods 1/2(3L)**

Measurement theory and some of its applications, e.g., test construction, in-depth treatment of reliability and validity. Theoretical considerations involved in the measurement of abilities, intelligence and personality.

**PSY 810.3 Methods of Applied Social Research 1&2(3S)**

An advanced coverage of the theory and practice of social research in applied settings. A practicum component involving supervised field research projects will be the major focus of the course.

**PSY 811.3 Program Evaluation 1&2(3S)**

An intensive analysis of the processes of developing and evaluating human service programs. Major topics will include the articulation of program goals, the development of measures, evaluation designs, and statistical techniques.

**PSY 815.6 Psychological Assessment 1&2(2L-2S-3P)**

A basic course in techniques for assessment of ability and personality, including interviewing skills, general intelligence testing, special ability testing, and personality appraisal.

**PSY 816.3 Topics in Psychological Assessment 1/2(3S)**

A brief but intensive seminar on selected topics in psychological assessment. Topics may include: neuropsychological assessment, forensic assessment, projective personality assessment, vocational assessment, assessment of psychological components of physical illnesses, behavioral assessment.

**PSY 820.3 Organizational Psychology and Organizational Development 1/2(3S)**

Advanced coverage of theoretical concepts and practical methodology relating to the study and change of human service organizations. Students participate in field experiences involving research and/or consultation with such organizations.

**PSY 821.3 Community Psychology I 1/2(3S)**

Current theory, research and methodology in the area of community psychology. Environmental determinants of behavioral change, preventative procedures, epidemiology and process research will be emphasized. Practicum experiences in community settings are incorporated into the course.

**PSY 830.3 Advanced Seminar in Personality 1/2(3S)**

An intensive study of current theory and research in the area of personality.

**PSY 831.3 Advanced Behavioral Pathology 1/2(3S)**

An intensive study of current theory and research in the field of behavioral pathology. Behavioral disorders in children, adults and the aged will be covered in this seminar.

**PSY 832.3 Advanced Seminar in Social Psychology 1/2(3S)**

Current theories in research and social psychology. Emphasis is on applied theories of social behaviour and the application of current theories to applied problems.

**PSY 833.3 Advanced Seminar in Environmental Psychology 1/2(3S)**

The consequences of environmental manipulation on human behaviour. Basic psychological processes in relation to the environment, current methods in environmental research, individual needs in the organization and planning of environments and cultural designs will be studied.

**PSY 834.3 Advanced Seminar in Group Processes 1/2(3S)**

A critical review of theory, research and practice related to group behaviour, including factors influencing communication, decision-making, group cohesiveness and productivity.

**PSY 835.3 Advanced Seminar in Developmental Psychology 1/2(3S)**

A critical review of theory, research and methodologies related to development psychology. The entire developmental sequence from the pre-natal period to infancy, childhood, adulthood, and senescence is reviewed.

**PSY 836.3 Advanced Seminar in Motivation 1/2(3S)**

A critical review of theories and research in the area of motivation. Data from human and infrahuman experiments are studied.

**PSY 837.3 Advanced Seminar in Learning 1/2(3S)**

A study of experimental data on basic learning processes and the theoretical significance of such data.

**PSY 838.3 Advanced Seminar in Psycholinguistics 1/2(3S)**

A critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Data on language acquisition, language competence, bilingualism and linguistic aspects of motivation learning and cognition are reviewed.

**PSY 839.3 Advanced Seminar in Perception and Cognitive Processes 1/2(3S)**

A review of empirical and theoretical materials relating to perception, concept formation, problem-solving, creative thinking, and decision-making.

**PSY 842.3 Advanced Seminar in Physiological Psychology 1/2(3S)**

A critical review of basic research in physiological psychology. Research in classical and current problems is studied with a focus on neural coding, sensory,

motor, motivational, affective, reward systems as well as learning and memory.

**PSY 843.3  
Advanced Seminar in Comparative Psychology  
1/2(3S)**

An intensive study of the comparative method and its application to behaviour with an emphasis upon infrahuman organisms. Research on innate behaviour, early experience, learning, motivation and physiological processes is reviewed from a comparative viewpoint.

**PSY 844.3  
Advanced Seminar in Behavioral Pharmacology  
1/2(3S)**

A critical review of research in the field of behavioral pharmacology. Deals with the main principles of drug action, behaviourally active drugs, and behavioral mechanisms of drug action. The experimental analysis of problems associated with drug dependence, drug-induced changes in the electrical activity of the brain, behavioral toxicology and the psychopharmacology of affective disorders is emphasized.

**PSY 846.3  
Advanced Seminar in Human Neuropsychology  
1/2(1L&2S)**

*Prerequisite(s): Registration in a psychology graduate program.*

A critical review of theory, research and methodology in human neuropsychology. Using a combination of lectures and seminars, students will be exposed to the recent literature on topics such as brain localization and lateralization of functions, brain damage and recovery, and the neuropsychology of "higher-order" functions.

**PSY 850.3  
Topics in Psychological Therapy I  
1/2(3S)**

Principles and procedures of individual psychological therapy and counselling. One or two specific systems of psychotherapy are studied.

**PSY 852.3  
Topics in Psychological Therapy II  
1/2(3S)**

An intensive study of principles and procedures of individual psychological therapy and counselling. One or two specific systems of psychotherapy are studied.

**PSY 860.6  
Seminar on Professional Skills  
1&2(3S)**

This seminar is designed to develop the professional competence of clinical-community Ph.D. students through the study and discussion of professional issues and problems in clinical and community practice. Both theoretical and practical issues will be considered as they arise from ongoing practicum activities. Required of all Clinical Ph.D. students.

**PSY 862.3  
Seminar on the Identity of Applied Social Psychology  
1/2 (3S)**

An advanced seminar on the unique and evolving identity of the field of applied

social psychology as an interdisciplinary effort by professional scholar-practitioners. Issues to be discussed include those of basic definition, relationship to experimental social psychology, graduate training, the requirements of professional practice including ethics and standards, and the future of the field.

**PSY 863.3  
Seminar on Professional Consultation  
1/2(3S)**

An advanced seminar designed to develop the professional competence of Ph.D. students in the area of consultation in applied social psychology. Study and discussion of strategies and issues in research, program, organizational and community consultation activities in field settings.

**PSY 890.6  
Clinical Research Seminar  
1&2(3S)**

A seminar on contemporary issues in clinical and community research. Theoretical, methodological and ethical issues in the areas of assessment, therapy, personality, abnormal and community research will be emphasized. There is particular focus upon students' and faculty research interests. Required of all Clinical Ph.D. students.

**PSY 891.6  
Applied Social Research Seminar  
1&2(3S)**

An advanced seminar designed to extend the research competence of Ph.D. students in the areas of utilization and social policy formation. Advanced field research designs and methods of data analysis will be discussed in relation to ongoing research activities in practicum settings.

**PSY 898.3/899.6  
Special Topics  
1/2(R), 1&2(R)**

The student pursues a program of readings in selected research topics under the supervision of individual faculty members.

**PSY 900  
Directed Research in Psychology**

Individualized research projects under the supervision of faculty members.

**PSY 994  
Research**

Completion of original research and writing of Master's thesis.

**PSY 996  
Research**

Completion of original research and writing of Ph.D. dissertation.

**PRACTICAL COURSES/INTERNSHIP**

These courses are taken in conjunction with other courses in the clinical-community and applied social programs. They permit students to obtain a closely supervised experience in the application to clinical skills or applied research methods.

**PSY 902  
Practicum in Professional Psychology  
1&2(3P-2C)**

Consists of supervised field work in professional psychology under the direction of individual faculty members.

**PSY 903  
Clerkship in Professional Psychology  
1/2(36C)**

The student is engaged for one term as an intern in a clinical community setting. Supervision is provided by departmental faculty members and psychologists in field settings.

**PSY 904  
Internship in Professional Psychology  
1,2&3(31C)**

The student is engaged for one year as an intern in a clinical community setting. Supervision is provided by psychologists in field settings.

**PSY 911  
Ethical and Professional Issues in Clinical Psychology  
1/2(1.5S)**

*Prerequisite(s): GSR 985 (taken concurrently).*

Introduction to ethical principles, codes, and processes for ethical decision-making with a special focus on clinical psychology. Readings and discussion on confidentiality, informed consent, dual relationships, duties to clients, business practices, and other professional issues. Equips students to resolve ethical dilemmas in practice and in licenture examinations.

**REHABILITATION MEDICINE**

Graduate programs leading to the M.Sc. degree in Rehabilitation Medicine are available only to exceptional students on a special case basis.

Prospective students should consult with the Head of the Department concerning the availability of a program in their area of interest.

Research may be taken in the department in several areas. Study and analysis of gait patterns. Measurement of physical therapeutic approaches to reduction of disability. Use of environmental controls for severely disabled. Quality control and outcome analysis of rehabilitation process. Epidemiological studies of specific groups of disabled in Saskatchewan. Biomedical engineering rehabilitation topics in prosthetics, orthotics, etc.

**REHMD 801.6  
Rehabilitation Medicine  
1&2(3S/C)**

*Prerequisite(s): Degree in Engineering, Medicine, Nursing, Physical or Occupational Therapy, or Science.*

Provides clinical orientation to the student's experimental work and his/her study of the basic sciences. Includes participation in clinical presentations, seminars, reading and discussions of the fundamental processes

involved in disabling diseases for which rehabilitation methods are required. Students are required to prepare and present a seminar in depth. An oral examination and a written report (at least 5,000 words) will be mandatory.

**REHMD 802.6  
Fundamentals of Electromyography  
1&2(2L)**

*Prerequisite(s): Degree in Physical or Occupational Therapy, Medicine or Science.* Study and observation of fundamental basis and clinical and research applications of electromyography and nerve conduction studies.

**RELIGIOUS STUDIES**

The special M.A. in Religious Studies is an individually tailored program to prepare students for admission to other Religious Studies Graduate Programs leading to a Ph.D. degree. Students entering into a special M.A. in the Religious Studies Program may opt for either Western Religious Traditions or Eastern Religious Traditions as the area of specialization. The Department of Religious Studies offers a special case Master of Arts program to exceptional students with a B.A. (Honours) in religious studies or its equivalent. Individual students interested in pursuing a special case M.A. in religious studies should consult with the Head of the Department regarding the possible sub-areas of specialization currently available in the department.

**SLAVIC STUDIES**

Students may be accepted into a Master of Arts program in Slavic Studies on a special case basis. Individual programs are planned for each student in relation to the direction of the student's interests and in areas in which the faculty is competent to provide direction. Courses are offered on a seminar basis. Students who have an Honours degree from this university, or equivalent credits, must complete two seminar courses, plus a thesis.

Prospective students should consult the Department of Languages and Linguistics concerning possible areas of concentration.

**SOCIOLOGY**

The department offers a thesis and a non-thesis program leading to the M.A. and Ph.D. in Sociology. The requirements for both programs generally conform to those of the College of Graduate Studies and Research.

A prospectus for Graduate Students in Sociology, which describes in greater detail the nature, requirements and potential financial assistance for graduate students, is available upon request from the Department of Sociology.

The department areas of specialization include:

- Agriculture and Development
- Criminology and the Sociology of Law
- Education and Work
- Family and Women's Studies
- Race and Ethnic Relation

The course and other requirements for the two M.A. degree programs are outlined below.

**MASTER OF ARTS IN SOCIOLOGY (WITH THESIS)**

All students in this program are required to complete a minimum of 18 graduate credit units including SOC 840 and 841. The electives are selected in Sociology in consultation with the candidate's thesis Advisory Committee and the Department of Sociology.

**MASTER OF ARTS IN SOCIOLOGY (WITHOUT THESIS)**

Students admitted to the non-thesis program are required to complete a minimum of 36 graduate credit units including SOC 840, 841 and 992 Research Project to which a weight of 6 credit units is assigned. The electives are to be selected in Sociology in consultation with the candidate's Advisory Committee and the Department of Sociology. A maximum of 6 credit units may be taken in a related discipline outside Sociology with the permission of the Advisory Committee and the Department of Sociology.

*Note:* Graduate students are normally not allowed to register in and receive credit for an 800 level course for which they have received credit at the 400 level.

Written permission of the Department Head and course instructor is required before graduate students in disciplines other than Sociology will be allowed to register.

**SOC 802.3  
Advanced Seminar in the Sociology of Agriculture  
1/2(3S) & 1&2(1.5S)**

Theoretical and research approaches to the political and social economy of agriculture. Emphasis is given to contemporary works on agro-industrial reorganization, agro-food technology, sustainability, state intervention, international trade, aid, and agrarian reform.

**SOC 805.3  
Social Change  
1/2(3S) or 1&2(1.5S)**

The application of various social models to the analysis of social change. Consideration of selected theory and research on change and development.

**SOC 809.3  
Sociology of Development  
1/2(3S) or 1&2(1.5S)**

Review of present theories of development. Emphasis will be on the search for missing variables in theories of development produced by western social scientists. Considers development as a function of mobilization of resources and commitment of local people to the process of social change.

**SOC 811.3  
Marriage and the Family  
1/2(3S) or 1&2(1.5S)**

Study and discussion of the recent developments in research and theory in selected aspects of the area of marriage and the family behaviour.

**SOC 812.3  
Advanced Seminar in Ethnic Relations  
1/2(3S) or 1&2(1.5S)**

Theoretical aspects of interethnic processes; comparative analysis of empirical research on ethnic minorities within Canada and selected other societies.

**SOC 813.3  
Seminar in Sociology of Religion  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* SOC 217 or 321; or written permission of the department.  
Advanced Seminar in Sociological Theories of Religious Behaviour.

**SOC 814.3  
Social Conflict  
1/2(3S) or 1&2(1.5S)**

Current issues and special problems in the sociology of conflict.

**SOC 815.3  
Selected Problems in Social Control  
1/2(3S) or 1&2(1.5S)**

Theoretical analysis and empirical research on selected problem of deviance and control.

**SOC 816.3  
Industrialism and Social Welfare  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* SOC 220 or 215 or 315 or 316; or permission of the instructor.  
An advanced course examining various theoretical perspectives on industrialization and the institution of social welfare in the context of industrialism. Selected issues particularly relevant to Canada, such as resource development, social policy and the Native People will be included.

**SOC 817.3  
Sociology of Industrial Relations  
1/2(3S)**

*Prerequisite(s):* SOC 215 or 316.  
Examines the need for articulated systems of industrial relations in contemporary societies. Issues covered include: the relationships between labour processes and industrial relations; variations in industrial relations regimes; specific systems including Canada, Sweden, USA, UK, and Japan as well as their historical-sociological determinants.

**SOC 818.3  
Advanced Seminar in Criminology  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* SOC 418.  
An in-depth examination of historical developments leading to contemporary criminological discourse in Western societies. An analysis and critique of theory and method which characterizes different schools of criminological inquiry and their relationship to research in an international context.

**SOC 819.3  
Advanced Seminar in Victimology  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* SOC 332 and 418.  
A critical analysis of recent development in victimology including an in-depth study of the methodological considerations necessary for studying processes and

patterns of victimization. Students will be expected to participate in field research.

**SOC 820.3  
Medical Sociology  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* Written permission of the instructor.

Comparative study of Health-Care Systems, Medical Institutions, and the relationships between Medical and Allied Health Professions, Society, the State, and the delivery of health-care.

**SOC 822.3  
Social Stratification and Social Mobility  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* 18 credit units in sociology including SOC 226.

Review of classical and modern theories of stratification and introduction to methods of studying social mobility. Emphasis on recent developments in models of stratification.

**SOC 825.3  
Political Sociology  
1/2(3S)**

Examines recent developments in theories of the state and different contemporary schools of thought, including structuralism, instrumentalism, and post-structuralism. The adequacy of emergence of social policy and the ability of theoretical models to account for historical/empirical developments.

**SOC 826.3  
Advanced Seminar in Social Policy  
1/2(3S)**

The formulation, development, management and impact of social policies. Includes analysis and evaluation of social policies in income security, social services, employment, housing and other areas concerned.

**SOC 828.3  
Small Groups  
1/2(3S) or 1&2(1.5S)**

The analysis of the small group with special reference to the problems of leadership, communication networks, deviance, and division of labour for specified group types. Review of the literature of small group experiments.

**SOC 835.3  
New Directions in the Sociology of Education  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* SOC 222; or permission of the instructor.

Critical review and analysis of significant recent developments in sociological theory and research on education.

**SOC 840.6  
Advanced Theory  
1&2(3S)**

Recent developments, current trends, and future prospects in sociological theory. Also introduction to formalization of theory; survey of evaluative criteria in Theory Building and methodological problems involved in this process.

**SOC 841.6  
Advanced Methodology  
1&2(3S)**

An advanced review of the logic, concepts and components of scientific research designs and methods and to quantitative statistical methods for the analysis and interpretation of sociological data.

**SOC 842.3  
Women's Studies  
1/2(3S)**

*Prerequisite(s):* SOC 342.

A review of established theories of gender stratification with an emphasis upon current problems in research and theory construction.

**SOC 890.3  
Critical Perspectives on Social Analysis  
1/2(3S)**

*Prerequisite(s):* Admission to the Ph.D. program in sociology or Ph.D. students in cognate departments with permission of the Sociology Department.

An advanced seminar on conventional and alternative approaches to social analysis. The course contrasts postivist, rationalist orientations to social analysis with emergent critical alternatives such as critical sociology, postmodernism, feminist epistemologies, and minority discourses such as indigenous ways of knowing. Students will integrate critical understanding of social analysis with an applied examination of social policy and substantive areas of social change.

**SOC 891.3  
Theory and Method of Social Analysis  
1/2(3S)**

*Prerequisite(s):* Admission to the Ph.D. program in sociology or Ph.D. students in cognate departments with permission of the Sociology Department.

An advanced seminar which integrates theory and method in social analysis. Various types of social analysis will be discussed, including theory driven research, policy research, action oriented research and evaluation research. The focus is to develop sound analytical frameworks in conducting social analysis and in assessing research results. Students will develop a theoretically-grounded research problem on the basis of an existing body of literature, design a method, and obtain and analyze data.

**SOC 898.3  
Special Topics  
1/2(3S) or 1&2(1.5S)**

*Prerequisite(s):* Permission required.

Concentrated reading in special areas of sociology culminating in a written report. Area of concentration must be different from regularly scheduled courses.

**SOC 990  
Seminar**

Discussions on research projects and papers by graduate students and faculty. All graduate students are required to register in and attend the seminar for at least one academic year (preferably their first year) and to present at least one seminar during their M.A. program.



**SOC 992.6  
Project**

*Prerequisite(s): Open only to students registered in the non-thesis option.*

A research paper on a topic approved by the candidate's Advisory Committee is required. The paper should be concerned with discussing a meaningful sociological question and may be empirical in nature, a critical review of the literature or a critical analysis of a substantive problem. The paper will be supervised and evaluated by the Advisory Committee.

**SOC 994  
Research**

Students writing a Master's thesis must register for this course.

**SOC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**SOIL SCIENCE**

The Department of Soil Science and the Saskatchewan Centre for Soil Research provide research opportunities in the following fields: soil mineralogy, genesis and micro-pedology, landscape-scale soil processes, soil microbiology, dynamics of soil organic constituents, soil fertility-plant nutrition, soil-plant-water relationships, soil structure, physical chemistry of soil solutions and inorganic soil constituents, soil biochemistry, interrelationships of soil and the environment, and several areas of soil management.

The department offers programs leading to the Postgraduate Diploma and requires 30 credit units of course work; and the M.Agr., M.Sc., and Ph.D. degrees. The M.Agr. degree requires a minimum of 30 credit units of classes and the completion of SL SC 992.6. The M.Sc. degree consists of a minimum of 15 credit units and completion of the M.Sc. thesis. The Ph.D. program requires a minimum of 21 credit units, of which a maximum of 15 credit units may be transferred from an approved Master's program in Soil Science, and completion of a Ph.D. dissertation.

**SL SC 802.3  
Experimental Topics in Soil Science  
1&2(2S-4P)**

Allows tutorial, reading and research in a specific area of Soil Science other than the thesis project. The student working under faculty guidance will perform specific experiments and write their data in the format of published papers. Enrolment permitted with the approval of the Chair and the instructor concerned.

**SL SC 803.3  
Instrumental Techniques in Soil  
Research  
1&2(2L-4P)**

The theory and application of instrumental techniques to the study of soil and its constituents. Techniques in the following areas will be offered in alternate years: X-ray diffraction and fluorescence, atomic absorption, isotopic measurements, chromatography, differential thermal

analysis, micropedology, soil moisture measurements, computer handling of data, continuous flow analysis, miscible displacement techniques.

**SL SC 811.3  
Physical Chemistry of Soil  
2(3L)**

The principles of the solution and surface chemistry of soil and the significance of these principles to understanding the physicochemical properties of soil, the availability of essential plant nutrients and the dynamics and equilibria of transformations of environmental pollutants. Emphasis will be on discussions of exchange, adsorption, solution-precipitation, oxidation-reduction, and chelation.

**SL SC 812.3  
Soil-Plant Interrelationships  
1(3L)**

Principles of nutrient and water movement in soils and absorption by plant roots. Examines root sampling and measurement techniques, root distributions and spatial pattern effects on nutrient absorption as well as importance of rhizosphere processes on nutrient release and uptake. Considers ways of expressing soil and plant factors and mechanisms quantitatively, and identifies parameters needed to mathematically describe soil-plant relationships. Simulation models for nutrient uptake and root growth will also be utilized.

**SL SC 821.3  
Soil Physics  
2(3L)**

The physical principles involved in the retention and movement of water, gases, heat, and chemical compounds within the soil.

**SL SC 831.3  
Soil Mineralogy  
2(3L)**

The structure, properties and origin of clay minerals occurring in soils and their relationship to other silicate minerals. Weathering and weathering sequences of importance to soil formation. The application of mineralogical and micromorphological techniques to the evaluation of pedogenic transformations.

**SL SC 832.3  
Soil Landscape Analysis  
1(2L-3P)**

Provides both practical training in the principles and techniques used to research soil landscapes and an examination of the theoretical basis for soil landscape analysis. A two to four-day field exercise is held early in the term, during which students become familiar with describing landscapes and appropriate sampling methods.

**SL SC 841.3  
Biochemistry of the Soil  
1(3L)**

A discussion of the organic fraction of the soil with emphasis on the carbon nitrogen, phosphorus and sulphur components and the behaviour of pesticides in soil.

**SL SC 842.3  
Soil Microbiology  
2(3L)**

Lectures and reading on recent advances in soil microbiology. Discussions of transformations of plant nutrients and soil humic compounds by microorganisms in soil, microbial growth, and plant-microbe interactions.

**SL SC 898.3  
Special Topics  
1&2(3S)**

Provides for a program of reading and discussion under faculty guidance. Students will prepare a series of essays in an area of concentration different from that of their thesis. Enrolment permitted with the approval of the Chairman of the department and the instructor concerned.

**SL SC 990  
Seminar**

Soil Science graduate students must register and attend annually for the duration of their program. Students are required to present one seminar a year to a maximum of two for a Master's student and three for a Ph.D. student. The student's final seminar should be on their thesis topic but seminars presented early in their program may be on any topic of general interest to the Soil Science community.

**SL SC 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Agr.) must complete this course as part of the requirements for the degree.

**SL SC 994  
Research**

Students writing a Master's thesis must register for this course.

**SL SC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**SURGERY**

Graduate programs leading to the M.Sc. degree in Surgery are offered to qualified students. Prospective candidates should consult with the Head of the Department concerning programs and research projects. Fields of interest follow:

- Cardiovascular field - studies on tissue valve prostheses and cardiac myocardial preservation; and studies of platelets function with cardiopulmonary by-pass. Biochemical changes (intra and extra myocardial) in experimental model with congestive heart failure.
- Investigations of the physiology profile of patients in a Surgical Intensive Care Unit.
- Musculoskeletal system - studies into the nature and function of connective tissue, and studies in cartilage and joint function. Special emphasis is placed on electron microscopy.
- Peripheral Vascular Laboratory for patients with vascular disease.
- Evaluation of Surgical Care - studies on the efficacy of inpatient surgical care using health status indices.

**SURG 801.6  
Surgery  
1&2(4S)**

Seminars deal with general and orthopaedic surgery, and Surgical Grand Rounds from September 1 to June 30 in order to provide a clinical orientation to the student's experimental work and study of the basic sciences. Written and oral examinations are held at the end of the course.

**SURG 802.3  
Surgery  
1/2(2L-1S)**

Each student is required to prepare work for this. A study of both basic science as applied to general surgery and the fundamentals of surgical disease processes is made.

**SURG 803.6  
Surgery  
1&2(3S)**

*Prerequisite(s): Permission of the Division of Orthopaedic Surgery.*

Seminars dealing with Orthopaedic Surgery. A study is made of basic sciences, including Anatomy, Physiology, and Biochemistry as applied to Orthopaedic Surgery. A study of both basic science and clinical aspects of musculoskeletal disease. A presentation of orthopaedic clinical material with discussion of the fundamental principles involved. Each student assists in the preparation of material for presentation.

**SURG 804.3  
Surgery  
1/2(3C)**

Designed to provide complete coverage of the field of plastic surgery.

**SURG 994  
Research**

Students writing a Master's thesis must register for this course.

**TOXICOLOGY GRADUATE  
PROGRAM  
(INTERDISCIPLINARY)**

The Toxicology Group, coordinated through the Toxicology Centre, is an interdisciplinary body under the umbrella of the College of Graduate Studies and Research. It consists of faculty members from a number of university departments as well as scientists from other laboratories on campus. It offers Postgraduate Diploma, M.Sc. and Ph.D. programs in toxicology. Activities and interests in the program include general toxicology, environmental toxicology, immunotoxicology, analytical toxicology, etc.

A recognized undergraduate degree in life sciences, such as B.Sc., M.D., D.V.M., B.S.A., B.S.P., etc. is required for admission. Undergraduate programs should include training in vertebrate physiology and biochemistry. Courses in environmental biology, chemistry, pathology and pharmacology are desirable.

Minimum requirements for a Postgraduate Diploma program consist of 30 credit units, including 18 to 21 credit units from core courses. Master's and Ph.D. programs require at least 16 credit units from the core courses with additional courses as determined by the

Advisory Committee and research work resulting in an acceptable thesis.

For further information on these programs, contact the Coordinator, Academic Programs in Toxicology, c/o Toxicology Centre.

## CORE COURSES

AN SC 825.3 Nutritional Toxicology  
AP MC 825.3 Carcinogens and Mutagens  
PHARM 854.3 Metabolic Transformation of Xenobiotics  
PHARM 856.3 Forensic Toxicology  
VT P 833.3 Subclinical Toxicology  
VT P 836.5 General Toxicology I  
VT P 837.5 General Toxicology II  
VT PA 841.3 Toxicopathology

For details on the above courses, see the appropriate section of the *Calendar*.

## TOX 810.3

### Radiation and Radionuclide Toxicology 1/2(3L)

*Prerequisite(s):* Minimum of one university-level course in any four of physics, chemistry, microbiology, statistics, cell biology, or ecology.

Describes the basic properties of ionizing radiation, the interaction of radiation with matter, radiation detection, units and dosimetry. Discusses the natural radiation environment, radioactivity and its distribution and accumulation by chemical and biological processes. Presents the biological effects of radiation, particularly carcinogenesis, both at the epidemiological and molecular level.

## TOX 860.3

### Applied Toxicology 1&2(1L-S/T)

*Prerequisite(s):* VT P 836, 837, and/or permission of the instructor. Other courses in Toxicology are highly desirable.

Provides students an opportunity to evaluate practical problems associated with various aspects of toxicology. Students will be presented with specific toxicological questions or concerns which will be examined using research information and library facilities.

## TOX 898.3/899.6

### Special Topics

## TOX 990

### Seminar

Reviews of literature and recent investigations. Graduate students are required to attend and to present seminars.

## TOX 994

### Research

Students writing a Master's thesis must register for this course.

## TOX 996

### Research

Students writing a Ph.D. thesis must register for this course.

## VETERINARY MEDICINE

Postgraduate programs leading to the Master of Veterinary Science degree and to

a general Postgraduate Diploma in Veterinary Medicine are offered within the Western College of Veterinary Medicine (W.C.V.M.). These are in addition to diploma, M.Sc. and Ph.D. programs offered by departments according to the requirements as outlined by the College of Graduate Studies and Research. The M.Vet.Sc. program is currently offered by the Departments of Herd Medicine and Theriogenology, Veterinary Anesthesiology, Radiology and Surgery, Veterinary Internal Medicine, Veterinary Microbiology, Veterinary Pathology and Veterinary Physiological Sciences. The Postgraduate Diploma in Veterinary Medicine is offered by the W.C.V.M. through the Section of Continuing Veterinary Education.

## MASTER OF VETERINARY SCIENCE

The object of the M.Vet.Sc. program is to provide instruction beyond the D.V.M. level for veterinarians who desire both postgraduate training and experience, but have no primary interest in research. Thus it does not include a thesis requirement.

In addition to meeting the standard admission requirements for a M.Sc., a candidate for a M.Vet.Sc. must hold a D.V.M. degree or its equivalent and be eligible for licensure to practice in Canada. (The requirement of licensure eligibility may be waived under certain circumstances).

The duration of the program is two calendar years.

An advisory committee of at least three members must be established for each candidate with one member selected from an outside department. The advisory committee is responsible for the development of the student's program and a final comprehensive examination, which includes evaluation of the project.

The project must deal with an applied topic related to the candidate's field of specialty and must receive both departmental and advisory committee approval. The project work must demonstrate the ability to do independent study and investigation and must be finally submitted as a report in a style suitable for publication in a reputable journal.

The program is designed to permit completion within a two year period. Any exceptions to this duration require formal approval of the department. If after successful completion of the first year the candidate wishes to proceed with research instead, then subject to the recommendation of the advisory committee concerned and the approval of the department and the College of Graduate Studies and Research, these courses may be applied as credit toward the M.Sc. degree.

## POSTGRADUATE DIPLOMA PROGRAM IN VETERINARY MEDICINE

In addition to the standard Postgraduate Diploma programs offered by several departments in the W.C.V.M., a general Postgraduate Diploma in Veterinary Medicine is offered. It is intended to meet the requirements of those veterinarians with a desire and need for postgraduate training

in veterinary medicine, which is not restricted to a specialized area or discipline.

The academic requirements are those specified under the section "Requirements for Postgraduate Diplomas." In addition, a candidate must hold a D.V.M. or its equivalent. Certain departments have additional requirements. The unique feature of the program is that it is offered by the Western College of Veterinary Medicine instead of a single department, with the administration assigned to its Continuing Veterinary Education Section. Courses taken under this program are at the graduate level and are usually offered during intersession and/or summer session to facilitate attendance. Thus the requirements for the diploma may potentially be met by attendance at five summer sessions. Additionally, with the permission of the College of Graduate Studies and Research, credit may be given for up to 12 credit units taken at other universities.

For further information on this program contact the Continuing Veterinary Education Section (306)966-7268.

## HERD MEDICINE AND THERIOGENOLOGY

The Department of Herd Medicine and Theriogenology offers programs of graduate studies leading to M.Vet.Sc., M.Sc. and Ph.D. degrees in various disciplines including: Theriogenology, Herd Medicine, Clinical Epidemiology and Clinical Preventative Medicine. The specific requirements for the M.Vet.Sc. degree are outlined by the Western College of Veterinary Medicine under Master of Veterinary Science. The specific requirements for the M.Sc. degree are a minimum of 15 credit units of graduate level work. The student is expected to take the clinical seminar series course HMT 990 and take one course in statistics unless they have had a statistical course previously. The Ph.D. program requires a minimum of 21 credit units of graduate level work and research course HMT 996.

The areas of research under investigation by this department include all aspects of reproduction of domestic animals and some non-domestic species such as wapiti and deer. Active research programs also include specific disease problems and preventative medicine programs for food-producing animals and horses. The development of a computerized data laboratory is an important part of the herd medicine programs.

## HMT 783.6

### Advanced Clinical Herd Medicine and Theriogenology 1&2(20C)

A clinical course that enhances the student's clinical education and experience under the guidance of their supervisor or a senior clinician. Emphasizes clinical practice in herd production medicine or theriogenology in the area of the student's field. Procedures in diagnostics, therapeutics and disease control will be stressed. Involves student contribution to the veterinary teaching hospital routine practice and emergency work during normal hours and the out-of-hours duty roster. The time commitment is

approximately 20% of the student's time for one year (approximately 400 hrs) or 10% of the student's time over two years of the two-year program.

## HMT 801.3

### Principles of Embryo Transfer 1/2(1L-1S) and 1,2&3(2P)

*Prerequisite(s):* Permission of the instructor.

Covers background information on embryo transfer with special emphasis on bovine embryo transfer. Specialized techniques e.g. embryo freezing, sexing, and splitting will be reviewed and in some cases form parts of laboratory exercises. Laboratory exercises will be conducted primarily on cattle. These will include superovulation, artificial insemination, embryo collection and transfer, and embryo handling techniques. Designed to provide the student with sufficient knowledge and laboratory experience to conduct the entire procedure in one species.

## HMT 803.6

### Special Field Experiences 1/2(40P, 4 weeks)

Must be full time and of at least one month's duration. Purpose is total immersion in the area of study pertinent to the graduate student. For example, a student studying feedlot diseases of cattle would spend at least a full month in residence at a recognized acceptable feedlot. A complete report is required and should come from a daily log of activities and be organized from a protocol set up by the students' advisory committee prior to going out on this experience.

## HMT 860.3

### Advanced Equine Reproduction 1/2(L-P)

*Prerequisite(s):* HMT 460; or equivalent and permission of the instructor.

Consists of lectures and seminars on equine reproduction. Candidates will present seminars on selected topics covering reproductive biology of the brood mare and stallion, reproductive diseases and management of brood mare farms.

## HMT 861.3

### Advanced Bovine Reproduction 1/2(R-P)

*Prerequisite(s):* HMT 460; or equivalent and permission of the instructor.

Clinical aspects of male and female breeding soundness evaluation. Laboratory exercises in embryo transfer, and semenology.

## HMT 871.3

### Exotic Animal Medicine 2(3L-3P)

*Prerequisite(s):* D.V.M. degree or equivalent.

Provides graduate training in several aspects of veterinary management of exotic animals including reproduction and game farming. Practical training is included, and is a major component of the course. Emphasis will be placed on capture, restraint, examination and treatment of wild animals commonly found in zoos and wildlife parks. Preventive medicine programs will be discussed for the major specie groups. Laboratories will consist of demonstrations and field trips.

**HMT 878.3  
Spermatology  
1/2(2L-1S-2P)**

*Prerequisite(s):* Permission of the instructor.

An advanced course in normal and abnormal spermatogenesis and spermatology with emphasis on the bovine species. It includes prenatal and postnatal development of the testis, pubertal changes, detailed study of the cycle of the seminiferous epithelium, semen collection, evaluation and cryopreservation.

**HMT 881.3 Clinical Trial Design  
1/2(2L-1S)**

*Prerequisite:* Permission of instructor.

Designed for veterinary graduate students who need an understanding of clinical trial design, statistics and clinical Epidemiology in order to carry out their research and to evaluate themselves as clinicians. The course will cover areas of clinical trial design, applied medical statistics, diagnostic test evaluation and writing research grants.

**HMT 882.3  
Programmed Preventive Medicine  
1/2(1P-1S)**

Application of preventive measures to disease control in the herd. Epidemiological parameters specifically applied to a species with the goal of preventing disease in a herd thus increasing the herd productivity on an economically sound basis. Weekly seminars will be given by the candidates with emphasis on clinical case presentations.

**HMT 898.3/899.6  
Special Topics  
1&2(3R)**

A study of a special topic related to the candidate's field of interest.

**HMT 990  
Seminar in Herd Medicine and  
Theriogenology**

The objective of this seminar course is to give students experience in the critical evaluation of research methods and results. Attendance of these seminars is mandatory for all M.Sc., M.Vet.Sc. and Ph.D. students throughout their programs. Students are required to make at least one presentation each year of their program to discuss their planned and completed research projects.

**HMT 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

**HMT 994  
Research**

Students writing a Master's thesis must register for this course.

**HMT 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**VETERINARY ANATOMY**

The Department of Veterinary Anatomy offers programs leading to the M.Vet.Sc., M.Sc. and Ph.D. degrees in the major morphological disciplines, viz., gross and applied anatomy, microscopic anatomy and ultrastructure, and developmental anatomy with emphasis on domestic species of birds and mammals.

Areas of research include: locomotion in domestic animals and the morphology of the locomotor system, the biology of raptorial birds, reproduction in ungulates, the development and tissue culture of fish cell lines, and the application of cultured fish cell lines in toxicology and biomedical research.

**VT AN 709.3  
Gross Anatomy of Domestic Animals  
1(2L-4P)**

*Prerequisite(s):* Permission of the instructor.

A comparative, topographical, functional study of the trunk of the domestic animals. There is therefore an emphasis on the respiratory, digestive and reproductive systems. A special project in anatomy designed by student and instructor is required.

*Note:* Students with credit for VT AN 210 may not take this course for credit.

**VT AN 710.3  
Gross Anatomy of Domestic  
Animals  
2(2L-4P)**

*Prerequisite(s):* Permission of the instructor.

A comparative and topographical study of the head and limbs of the domestic animals with an emphasis on functional aspects of the locomotor system. There is also a brief introduction to the anatomy of laboratory mammals and domestic birds.

*Note:* Students with credit for VT AN 210 may not take this course for credit.

**VT AN 711.3  
Microscopic Anatomy of Domestic  
Animals  
1(3L-4P)**

*Prerequisite(s):* Permission of the instructor.

A basic, intensive course in microscopic anatomy, covering cytology and the histology of the basic tissues and organs of domestic animals. Clinical and functional relationships of microscopic structure are emphasized. In addition to classroom work, there are out-of-class assignments. Students must furnish their own microscopes.

*Note:* Students with credit for VT AN 211 may not take this course for credit.

**VT AN 712.3  
Neuroscience of Domestic Animals  
2(3L-2P)**

*Prerequisite(s):* Permission of the instructor.

The structure and function of the nervous system of domestic animals including major neuronal pathways and their basic physiology. Clinical applications are emphasized. The basic reflexes used in neurological diagnosis are included. There are out-of-class assignments. A term paper is required.

*Note:* Students with credit for VT AN 212 may not take this course for credit.

**VT AN 713.6  
Developmental Anatomy and  
Introductory Systemic Gross Anatomy  
of Domestic Animals  
1&2(4L-4P)**

*Prerequisite(s):* Permission of the instructor.

A study of fetal development including congenital anomalies. Organogenesis is correlated with basic systemic gross anatomy. A special project in developmental anatomy designed by student and instructor is required. Students must supply their own microscope.

*Note:* Students with credit for VT AN 213 may not take this course for credit.

**VT AN 802.3  
Special Field Experiences  
2 weeks(80 hrs)**

**VT AN 803.6  
4 weeks(160 hrs)**

Total immersion in the area of study pertinent to the graduate student. A complete report is required and should come from a daily log of activities. The report should be organized according to a protocol set up by the student's advisory committee prior to going out on this experience.

**VT AN 821.3  
Ultrastructural Cytology  
1/2(4T)**

*Prerequisite(s):* Permission of the instructor.

A survey of cytoarchitecture drawing heavily on examples from mammalian species. Emphasis will be on interpretation of electron micrographs, but technical problems will also be considered. Students will be encouraged to present their own micrographs for discussion.

**VT AN 898.3/899.6  
Special Problems in Anatomy  
1&2(1S-1R)**

For graduate students in other departments, research in areas of anatomy related to thesis topic. For graduate students in Veterinary Anatomy, research in areas of anatomy unrelated to thesis topic.

**VT AN 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

**VT AN 994  
Research**

Students writing a Master's thesis must register for this course.

**VT AN 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**OTHER COURSES**

The department also participates in teaching the following course:

**INTDL 810.3  
Principles and Applications of  
Electron Microscopy  
1&2(3P)**

*Prerequisite(s):* Permission of the instructor. Work will include specimen preparation,

ultramicrotomy, study of the principles and practice with the use of the microscope and related equipment, and evaluation and interpretation of electron micrographs.

**VETERINARY  
ANESTHESIOLOGY,  
RADIOLOGY AND SURGERY**

The Department of Veterinary Anesthesiology, Radiology and Surgery offers graduate programs leading to the award of a diploma and to the M.Sc. and M.Vet.Sc. degrees. A Ph.D. program is available in the department. The diploma and M.Vet.Sc. programs are related to residency training offered in the clinical specialties supervised by the department: anesthesiology, radiology and surgery.

**VTARS 783.6  
Advanced Clinical Veterinary  
Anesthesia, Radiology and Surgery  
1&2 (20C)**

Procedures in diagnostic and therapeutics as applied to the daily clinical case load.

**VTARS 802.3/803.6  
Special Field Experiences  
1/2(40P, 2 weeks), 1/2(40P, 4  
weeks)**

Total immersion in the area of study pertinent to the graduate student. A complete report is required and should come from a daily log of activities and be organized from a protocol set up by the student's advisory committee prior to going out on this experience.

**VTARS 854.6  
Advanced Radiological Sciences  
1&2(2T-1R)**

A tutorial course covering those aspects of physics and radiobiology pertinent to the practice of veterinary radiology. Includes discussions of special radiodiagnostic procedures, radiation therapy, and alternative imaging modes such as ultrasonography and nuclear medicine.

**VTARS 860.6  
Advanced Soft Tissue Surgery  
1&2(2R-2S)**

The anatomy, pathophysiology and surgery of the urinary, hemopoietic, endocrine and alimentary systems will be studied with respect to the basic principles of wound healing, shock, tissue response to trauma and biochemical parameters. Regular seminars based on current literature reviews will be required of the candidates.

**VTARS 862.6  
Advanced Orthopedic Surgery  
1&2(2R-2S)**

Provides advanced understanding of surgical intervention in diseases of the musculo-skeletal system of the canine, equine and bovine species. The physiology of tissue healing is also considered. The candidates will be expected to undertake critical literature reviews and present regular seminars on selected topics.

**VTARS 865.3  
Advanced Radiographic Diagnosis -  
Small Animals  
1/2(1S-1R)**

A tutorial course covering the radiographic diagnosis of disease in small animals. Thoroughly familiarizes the student with normal radiographic anatomy and the radiographic signs of disease in the skeleton, thorax and abdomen of small animals.

**VTARS 866.3  
Advanced Radiographic Diagnosis -  
Large Animals  
1/2(1S-1R)**

A tutorial course covering the radiographic diagnosis of disease in large animals. Familiarizes the student with normal radiographic anatomy and the radiographic signs of disease in the skeleton, thorax and abdomen of these species.

**VTARS 868.6  
Advanced Veterinary Anesthesiology  
1&2(2L-S/C)**

Advanced veterinary anesthesiology. Subjects include anesthetic equipment, pain control, pharmacology of anesthetic agents, mechanisms of anesthesia and the effects of anesthetic agents on the various body systems. Anesthetic techniques for specific body systems and disease conditions will also be discussed.

**VTARS 869.6  
Veterinary Critical Care  
1/2(2L)**

A course designed to familiarize the student with intensive care of the veterinary patient. The course is multidisciplinary in nature and uses a body systems approach to discuss pathophysiology, pharmacology, diagnostics, supportive care, and treatment of the critically ill veterinary patient. The major focus is on small animals, but the principles discussed apply to all species.

**VTARS 898.3/899.6  
Special Topics  
1/2(3R), 1&2(3R)**

To be defined and described each time it is offered. A thorough study of a special topic pertinent to the specific goals of the candidate and their program.

**VTARS 990  
Seminar**

Discussion on research plans, protocols, and results by graduate students and faculty. Graduate students are required to attend and participate. Faculty and visiting scientists may also contribute to the course.

**VTARS 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

**VTARS 994  
Research**

Students writing a Master's thesis must register for this course.

**VTARS 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**VETERINARY  
INTERDEPARTMENTAL**

**VTINT 980  
Clinical Practice**

Recognizes the many clinical activities of students in the program that may not be otherwise credited. Students are required to make satisfactory progress in this course to maintain full-time student status in the program.

**VETERINARY INTERNAL  
MEDICINE**

The Department of Veterinary Internal Medicine offers programs leading to the Postgraduate Diploma, M.Vet.Sc., M.Sc. and Ph.D. degrees.

Programs include equine medicine, food-producing animal medicine (cattle, sheep, goats and swine), small animal medicine and body system specialties such as cardiology, neurology, dermatology and gastroenterology.

Generally, qualified students will possess a D.V.M. or an equivalent degree.

**VT IM 783.6  
Advanced Veterinary Internal  
Medicine  
1&2(20C)**

Procedures in diagnostic and therapeutics as applied to the daily clinic case load.

**VT IM 800.6  
Advanced Veterinary Internal  
Medicine I  
1/2(2L/2S)**

Deals with the pathophysiology of animal disease on a body system or organ basis. The mechanisms of disease and the rational approach to diagnosis and therapy are emphasized. Topics include an introduction to the pathophysiology, systemic states, cardiovascular system, blood and hemopoietic system, respiratory system and the gastrointestinal tract.

**VT IM 801.6  
Advanced Veterinary Internal  
Medicine II  
1/2(2L/2S)**

Deals with the pathophysiology of animal disease on a body system or organ basis. The mechanisms of disease and the rational approach to diagnosis and therapy are emphasized. Topics include the urinary system, nervous system and eyes, endocrine system, musculoskeletal system, skin and appendages, immune system, and genetics and reproduction.

**VT IM 803.6  
Special Field Experiences  
1/2(40P, 4 weeks)**

Must be full time and of at least one month's duration. Purpose is total immersion in the area of study pertinent to the graduate student. A complete report is required and should come from a daily log of activities and be organized from a protocol set up by the students' advisory committee prior to going out on this experience.

**VT IM 872.6  
Advanced Bovine Medicine  
1&2(1S-1R)**

The clinical aspects of diseases of cattle in Canada. Reading and Study assignments of cattle diseases on a systems basis. Candidates required to critically discuss current literature on the subject and offer weekly seminars with emphasis given to clinical case presentations.

**VT IM 874.6  
Advanced Equine Medicine  
1&2(1L-1S)**

Lectures and seminars on equine medicine. Each candidate will prepare and present a critical review of the current literature on selected medical diseases of the horse. The emphasis will be on the common medical diseases of horses in North America plus those exotic diseases which pose a threat to the horse industry. Weekly seminars will be given by the candidates with emphasis on clinical case presentations.

**VT IM 898.3/899.6  
Special Topics  
1/2(3R), 1&2(3R)**

To be defined and described each time it is offered. A thorough study of a special topic pertinent to the specific goals of the candidate and their program.

**VT IM 990  
Seminar**

**VT IM 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

**VT IM 994  
Research**

Students writing a Master's thesis must register for this course.

**VT IM 996  
Research**

Students writing a Ph.D. thesis must register for this course.

**VETERINARY MICROBIOLOGY**

Programs leading to Postgraduate Diploma, M.V.Sc., and Ph.D. degrees in Veterinary Microbiology are offered in the areas of bacteriology, epizootiology, immunology/pathology, parasitology and virology.

Current areas of active departmental research interest include: antibiotic resistance (bacteriology), arboviral encephalitis and host-parasite interactions (epizootiology/parasitology), bovine shipping fever pneumonias, trypanosomiasis, asthma and other allergies (cellular and molecular immunopathology), molecular regulation of herpes virus, porcine circovirus infections (immunovirology) and veterinary immunodiagnostics.

Permission of the instructors is required for registration in all courses offered by this department.

**VT MC 830.3  
Recent Advances in Microbiology  
2(1S-2T)**

*This course is a requisite for students in Veterinary Microbiology.*

Partly tutorial, but also consisting of assigned reviews of recent advances in selected areas of microbiology, including bacteriology, epidemiology, immunology, parasitology and virology. Discussions are student-driven and facilitated by individual faculty members with expertise in the areas of discussion. Training is also given in the interpretation of published scientific reports and in the writing of grant applications.

**VT MC 831.3  
Techniques in Molecular Biology  
(previously Research Techniques  
and Instrumentation)  
1/2(2L-2P)**

*Prerequisite(s): BIOCH 811.3 Introduction to Molecular Biology, or equivalent.*

A "hands-on" laboratory course designed to familiarize students with a wide variety of techniques in molecular biology: manipulation of DNA for cloning and analysis; detection of nucleic acids; sequencing of DNA; site directed mutagenesis, purification of recombinant proteins by immunological techniques; detection of rare nucleic acids by polymerase chain reaction. Students are given a gene for an "unknown" protein. They then proceed with a detailed characterization of the structure and function of the protein.

**VT MC 832.3  
Epizootiology of Infectious Diseases  
1/2(2L-1S)**

Lectures, seminars and exercises will be given on the epizootiology and control of infectious diseases of animal populations, with emphasis given to: techniques of collection of data and sampling; application of modern microbiological laboratory methods; analysis of data; and interpretation of results, as applied to epizootiological investigations.

**VT MC 833.3  
Advanced Virology  
1/2(2S-1T)**

Discusses virus genetics, mapping of virus genes, replication of virus components as well as the molecular aspects of virus-cell interactions as they relate to virus replication and cell death, virus persistence and transformation.

**VT MC 834.6/839.6  
Topics in Advanced Parasitology  
1&2(2L-1S)**

Lectures on current topics in parasitology. Group discussion based on assigned reading in scientific literature; topics selected in part according to student's interests.

**VT MC 835.3 Diagnostic Veterinary  
Bacteriology  
1/2(2L-6P)**

Devoted to the culture, biochemical reactions and identification of pathogenic, aerobic and anaerobic bacteria and fungi from domestic, exotic and "alternate species" including birds. Emphasis will be on interpretation of findings in agreement with information gathered from clinical

history/lesion(s) provided in different cases. Other responsibilities include familiarization with culture media; some new diagnostic techniques; completion by each student of 20-30 cases.

**VT MC 836.3  
Diagnostic Veterinary Virology  
1/2(2L-4P)**

Includes the culture and identification of animal viruses in animals, cell culture or chick embryos. Serology, fluorescent antibody and other techniques for virological diagnosis will be emphasized.

**VT MC 837.3  
Diagnostic Veterinary Parasitology  
1/2(2L-4P)**

The isolation and identification of parasites, both internal and external, from clinical and necropsy specimens will be emphasized. Methods of parasite culture and preservation will be covered.

**VT MC 838.6  
Applied Epizootiology  
1&2(L/S)**

Students become familiar with the philosophy and principles of epizootiology and the practical application of epizootiologic techniques especially as they apply to control. Consists of lectures, field trips, epizootiologic exercises and syndicate sessions.

**VT MC 839.3  
Topics in Advanced Parasitology  
1/2(2L-1S)**

Lectures on current topics in parasitology. Group discussion on assigned reading in scientific literature; topics selected in part according to student's interests.

**VT MC 898.3/899.6  
Special Problems in Veterinary Microbiology  
1/2(2L-1S-6P), 1&2(2L-1S-6P)**

A special problem arising in a field or clinical investigation will be assigned to the student and supervised by a departmental faculty member. The student will be responsible for the collection of data, scientific reading around the subject, and the preparation of a clinical case report or a research paper on their findings.

**VT MC 990  
Seminar**

Graduate students are required to attend and take part in the seminar throughout their program. Faculty and visiting scientists may also contribute to the course.

**VT MC 992.6  
Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

**VT MC 994  
Research**

Students writing a Master's thesis must register for this course.

**VT MC 996  
Research**

Students writing a Ph.D. thesis must register for this course.

The following courses are currently designed for the Postgraduate Diploma or M.Vet.Sc. programs and will be given only on sufficient demand.

**VETERINARY PATHOLOGY**

The Department of Veterinary Pathology offers programs leading to a Postgraduate Diploma (one year) and M.Vet.Sc. (non-thesis, 2 year residency training), M.Sc. (thesis) and Ph.D. (thesis) degrees. It is generally required that candidates for the thesis degrees hold a D.V.M. degree or its equivalent. Some exceptions may be made for candidates with a broad background in biology. Candidates for the diploma and M.Vet.Sc. degree must hold a D.V.M. degree or its equivalent and be eligible for licensure to practice in Canada. The requirement of licensure eligibility may be waived under certain circumstances. Research interests in the department include: hematology, wildlife diseases, toxicopathology, infectious diseases of cattle and pigs and metabolic diseases of poultry.

Permission of the instructors is required for registration in all courses offered by this department.

**VT PA 810.3  
Clinical Hematology  
1/2(1L-2S)**

Presented biennially in lectures and tutorial sessions utilizing current previously selected clinical laboratory material. Assigned reading, review of cases and presentation of such cases in seminars are part of this course.

**VT PA 811.3  
Clinical Chemistry  
1/2(1L-2S)**

Presented biennially in lectures and tutorial sessions utilizing current clinical laboratory specimens. Interpretation of tests and methodology are stressed. Includes assigned reading, review of cases and presentation of such cases in seminars.

**VT PA 820.3  
Mammalian Pathology I  
(Formerly 860)  
1/2(2S-6C)**

**VT PA 821.3  
Mammalian Pathology II  
1/2(2S-6C)**

Necropsy technique and examination of animals submitted for diagnosis. Pathogenesis and diagnosis are emphasized. The student will be required to complete at least 30-50 cases for 3 credit units. Selected cases are to be discussed at weekly necropsy conferences. Other studies include familiarization with histological techniques, histochemical techniques and macro and micro-photography.

**VT PA 822.3  
Mammalian Pathology III  
1/2(1/2S-8/10P)**

**VT PA 823.3  
Mammalian Pathology IV  
1/2(1/2S-8/10P)**

*Prerequisite(s): VT PA 821 or permission of the course coordinator.*

Necropsy technique and gross and histopathology submitted for diagnosis. Each course is prerequisite to the next. Students will spend 4 months on the diagnostic service roster and complete 30-50 cases for 3 credit units.

**VT PA 830.3  
Surgical Pathology I  
1/2(1S-6C)**

**VT PA 831.3  
Surgical Pathology II  
1/2(1S-6C)**

Gross and microscopic examination of biopsy material submitted to the diagnostic service. Diagnosis and prognosis is stressed, especially in regard to neoplastic diseases. Selected cases are presented by students in a weekly seminar.

**VT PA 832.3  
Surgical Pathology III  
1/2(1/2S-2/3P)**

**VT PA 833.3  
Surgical Pathology IV  
1/2(1/2S-2/3P)**

*Prerequisite(s): VT PA 830 or 831.* Gross and microscopic examination of biopsy material submitted to the diagnostic service. Diagnosis and prognosis is stressed, especially in regard to neoplastic diseases. Selected cases are presented by students in a weekly seminar.

**VT PA 841.3  
Toxicopathology  
1(2L-1S-2T)**

*Prerequisite(s): VT PA 342 and 343; or equivalent.* Given in alternate years. A review of the principles of toxicopathological testing and the most important aspects of general pathobiology will be followed by a presentation of toxic injury to specific body systems.

**VT PA 850.3  
Diagnostic Clinical Pathology I  
1/2(2/3S-10/12P)**

**VT PA 851.3  
Diagnostic Clinical Pathology II  
1/2(2/3S-10/12P)**

**VT PA 852.3  
Diagnostic Clinical Pathology III  
1/2(2/3S-10/12P)**

**VT PA 853.3  
Diagnostic Clinical Pathology IV  
1/2(2/3S-10/12P)**

*Prerequisite(s): VT PA 850 is a prerequisite for VT PA 851, VT PA 851 for VT PA 852, VT PA 852 for VT PA 853.* Diagnostic medical interpretations in clinical biochemistry, hematology, urology

and cytology. Interpretation of clinical material is supplemented with formal case discussions and directed reading.

**VT PA 869.3  
Avian Pathology I  
1/2(1L-2P)**

Reviews the pathology of the avian species by systems emphasizing histopathology. Lectures will be supplemented by slide study sets and selected reading material. May only be offered in alternate years.

**VT PA 871.3  
Avian Necropsy I  
1/2(4C)**

**VT PA 872.3  
Avian Necropsy II  
1/2(4C)**

*Prerequisite(s): VT PA 445, 869; or equivalent.*

Necropsy technique of birds submitted for diagnosis of flock diseases. Suitable laboratory procedures following necropsy examination are emphasized. Treatment and control of flock diseases encountered are discussed. Selected cases are presented and discussed by students at the weekly necropsy conferences of the department. To obtain 3 credit units the student will be required to complete approximately 30 cases.

**VT PA 873.3  
Wildlife Diseases  
1/2(2L-1S-1T)**

*Prerequisite(s): VT PA 343; or equivalent.* Deals with infectious and non-infectious diseases including environmental toxicants, of free-living mammals, birds and fish. The etiology, epizootiology, pathogenesis and ecologic significance of the conditions will be considered. Emphasizes diseases occurring in Western Canada.

**VT PA 875.3  
Diagnosis of Wildlife Diseases I  
1/2(1S-3C)**

**VT PA 876.3  
Diagnosis of Wildlife Diseases II  
1/2(1S-3C)**

Necropsy and investigative techniques for the diagnosis of disease in wild mammals, birds and fish. Laboratory procedures following necropsy will be encouraged. Selected cases will be presented and discussed by students at the weekly necropsy conferences of the department. Students will be required to satisfactorily complete approximately 40 cases.

**VT PA 877.3  
Experimental Pathology  
1/2(1L-3P-1S)**

Studies the application of scientific methods in the field of Pathology and critically evaluates scientific literature. Includes group discussion of assigned reading materials, constitution of an experimental protocol, writing of a grant proposal, and reviewing scientific papers.

## **VT PA 898.3/899.6 Special Problems in Veterinary Pathology 1/2(2C-R), 1&2(2C-R)**

A thorough study on a selected topic in veterinary pathology will be undertaken. Includes examination of pathological material, tutorial sessions, collateral reading and presentation of a seminar.

## **VT PA 990 Seminar**

A weekly seminar on interesting pathological and clinicopathological cases. All graduate students in the Department of Veterinary Pathology are required to register and attend.

## **VT PA 991 Seminar in Histopathology 1&2(1S-1R)**

A weekly seminar dealing with the histology of disease processes. All students in the Department of Veterinary Pathology are required to register and attend.

## **VT PA 992.6 Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

## **VT PA 994 Research**

Students writing a Master's thesis must register for this course.

## **VT PA 996 Research**

Students writing a Ph.D. thesis must register for this course.

## **VETERINARY PHYSIOLOGICAL SCIENCES**

The Department of Veterinary Physiological Sciences offers graduate programs leading to Master's and Ph.D. degrees in the following disciplines: Veterinary

Physiology, Veterinary Pharmacology, Veterinary Toxicology, and Veterinary Biochemistry.

Research activities include studies in reproductive endocrinology, cardiovascular pharmacology, neurophysiology, monogastric gastrointestinal biochemistry, immunotoxicology, chemotherapy and pharmacokinetics.

Permission of the instructors is required for registration in all courses offered by this department.

## **VT P 824.6 Advanced Mammalian Physiology Q1(2L), Q2(3L-3P), Q3(4L-5P), Q4(3L-5P)**

The physiological systems of mammals are studied with emphasis on domesticated species. Hematology, general physiology and biophysics, the cardiovascular, respiratory, renal and nervous systems are covered. Laboratory experiments and observations are conducted on normal animals, emphasizing an understanding of physiological measuring techniques.

## **VT P 826.3 Advanced Endocrinology 1(3L/T-3P)**

Lectures deal with all hormones except those of the gastrointestinal tract. Emphasis is placed on protein and peptide hormones, particularly those which play a fundamental role in regulation of intermediary metabolism. Tutorials are designed to require students to develop a familiarity with current scientific literature. Laboratory sessions acquaint students with current endocrine research techniques. Students select a project, design, conduct and report the data in class.

## **VT P 827.3 Advanced Neurophysiology 2(2L-4P)**

An advanced lecture and laboratory course in neurophysiology with special emphasis on current methods of investigation utilized in this field.

## **VT P 828.3 Gastrointestinal Physiology 1(3L)**

Provides an in-depth coverage of monogastric gastrointestinal physiology, stressing those aspects related to the understanding of gastroenteric disease. Includes a review of the regulation of feed intake.

## **VT P 830.3 Physiology and Endocrinology of Reproduction in Mammals 1(3L)**

Topics will be hormones of reproduction, sexual differentiation and maturation, physiology and endocrinology of male reproductive system, reproductive cyclicity in the female, gestation and parturition, reproductive behaviour, and the seasonality of reproductive activity.

## **VT P 833.3 Subclinical Toxicology 1/2(3L-1S)**

*Prerequisite(s): VT P 836; PSY 110 is desirable.*

Discusses subclinical manifestations to toxic agents. The emphasis will be on immunological and behavioral alterations produced by a variety of chemical agents. Animal models and testing methods used to evaluate the effects will be discussed, along with various public health considerations and significance.

## **VT P 836.5 General Toxicology I 1(4.5L-1S)**

*Prerequisite(s): VT P 425.*

General principles of toxicology - including principles of toxicokinetics and toxicodynamics, factors influencing toxicity, mechanisms of actions of poisons and antidotes, methods of toxicity evaluation. Toxicology of common poisons e.g. pesticides, metals and metalloids, toxic gases, poisonous plants, zootoxins, etc. Aims at the basic science aspect of toxicology and not at clinical diagnosis or treatment of specific toxicoses.

## **VT P 837.5 General Toxicology II 2(4.5L-1S)**

*Prerequisite(s): VT P 836.*

Four areas are emphasized: 1) systematic toxicology - types of injury produced in specific organs/systems by toxic agents and agents which produce these effects; 2) environmental toxicology - entry, persistence, amplification and effects of environmental pollutants; 3) subclinical toxicosis by environmental contaminants, carcinogenesis, teratogenesis, mutagenesis; 4) nutritional toxicology - methodology, national and international standards and consideration of natural and manmade toxic substances.

## **VT P 898.3/899.6 Special Problems in Veterinary Physiological Sciences 1/2(3S), 1&2(3S)**

Research on a selected topic separate from the thesis topic may be undertaken. The approach will consist of conferences, collateral reading, laboratory work and a detailed report.

## **VT P 990 Seminar**

Graduate students in the department are required to attend and participate. The staff and visiting scientists also contribute to the course. Interested undergraduates may be invited to attend and participate.

## **VT P 992.6 Project**

Students undertaking the non-thesis Master's degree (M.Vet.Sc.) must register in this course.

## **VT P 994 Research**

Students writing a Master's thesis must register for this course.

## **VT P 996 Research**

Students writing a Ph.D. thesis must register for this course.