5E, E5 — MINING, MINERALS AND MATERIALS ENGINEERING

Offered by the Department of Mining, Minerals and Materials Engineering. For contact details consult the Faculty of Engineering, Physical Sciences and Architecture entry in the Faculties, Schools and Departments chapter.

5E

5E203 Structures & Materials
#12 (3L<3C) 1st
Pre: 9E101 or 102 or (CH 112 + PH 144) Inc: 5E201 or 202 or E4210 or 214 or 230 or 231 or 232
Coordinator: Assoc. Prof. Truss.
Assessment: Examination, tutorials & laboratory work.

5E204 Manufacturing Operations
#12 (3L2P) 2nd
Pre: 5E201 or 203 or 9E102 or (CH 112 + PH 144) Inc: E5308 or 320
Coordinator: Dr Atrens.
Assessment: Examination, laboratory work.

5E205 Physical & Chemical Processing in Mineral Processing
#12 (2L<2T<2P<1F) 1st
Inc: 5E240 or 242 or E5240
Coordinator: Prof. Johnson.
Assessment: Examination, assignment.
Introduction to physical & chemical processing of minerals & recycled materials to produce metals & alloys. Processing technologies used in minerals industry, their characteristics, how & why these processes are selected & factors affecting the choice of process route. Field trip.

5E206 Fluid Mechanics
#12 (5C) 2nd
Inc: 1E203 or E1255 or 269 or 272 or 364
Coordinator: Assoc. Prof. Gilles.
Assessment: Examination, assignments, practical.

5E207 Performance Analysis of Metallurgical Systems
#12 (1L<2T<2P<1F) 2nd
Inc: 1E201 or E1211 or 261 or 266 or 368 or E5305
Coordinator: Dr Bourgeois.
Assessment: Examination, practical, field trip report.
Material & energy balancing theory for ideal systems. Sampling & data reconciliation principles for performance of real metallurgical plants. Analysis of full-scale data collected at industrial sites in a 5-day field trip. Additional fee payable.
5E208 Computer Applications in Mining I
#12 (5C) 1/2
Coordinator: Dr Kizil.
Assessment: Assignments.
Introduction to database management & spreadsheeting in mining applications. Project management & scheduling of mining projects; technical data analysis, manipulation & presentation of mining data.

5E209 Mine Planning I
#12 (3L2C) 1st
Inc: 5E258 or E5258 C: 9E107
Coordinator: Assoc. Prof. Aspinall.
Assessment: Examination, assignments, practicals.

5E210 Design & Selection of Mining Equipment
#12 (3L<1T<1P) 2nd
Pre: 9E101 or 103 or 5E209
Coordinator: Assoc. Prof. Aspinall.
Assessment: Examination, assignments.

5E239 Materials Science
#12 (2L<2T<3P) 2nd
Pre: 5E201 or 203 or 9E102 or (CH112 + PH144) Inc: E5213 or 241 or 304 or 335 or 415
Coordinator: Dr Caceres.
Assessment: Examination, assignments.

5E300 Chemical Metallurgy
#12 (5C) 1st
Pre: 9E104 or (CH112 + 113) Inc: E1361 or E5322
Coordinator: Assoc. Prof. Hayes.
Assessment: Examination, assignments.
Chemical thermodynamics & thermochemical calculations applied to metals & materials production. Thermodynamics of solutions. Use of computer databases & software in thermodynamic calculations. Reaction kinetics & mechanisms.

5E301 Metallurgical Reaction Engineering
#12 (5C) 2nd
Pre: 5E205 or E5242 or 322 or (CH113 + E5242) Inc: E1324 or 371
Coordinator: Assoc. Prof. Hayes.
Assessment: Examination, assignment.
Reaction kinetics. Design of batch, continuous flow reactions in non-catalytic, heterogeneous reaction systems. Application to metallurgical processing, in particular, the leaching of minerals from ores.

**5E302 Statistical Analysis of Metallurgical Systems**

#12 (2L<2T1P<1F) 1st
Pre: MT150 + (1E201 or 5E207) [BSc Pre: 5E207 or MT150] Inc: E1368 or ME203 or 204 or 206 or 207 or 214 or MS261
Coordinator: Dr Manlapig.
Assessment: Examination, assignments, laboratory & tutorial work.
Introduction to statistical analysis of engineering & scientific data, with emphasis on application of techniques to metallurgical data. Use of statistical techniques in sampling, experimental design, analysis & interpretation of data.

**5E303 Coal Preparation**

#12 (2L2T1P<1F) 2nd
Pre: 5E205 or E5240 Inc: E5445
Coordinator: Dr Bourgeois.
Assessment: Examination, project.
Comprehensive review of principles & processes employed in preparation of coals for market. Significant plant upgrade team project.

**5E304 Polymers**

#12 (3L2C) 2nd
Inc: E1359 or 379 or E5214 P: 9E104 or CH112 or 113
Coordinator: Assoc. Prof. Truss.
Assessment: Examination, assignments.
Polymer synthesis & characterisation. Dependence of properties on molecular structure & microstructure. Polymer rheology. Unit processing operations, formulation & uses of polymers, mechanical properties, degradation & failure methods.

**5E305 Process Modelling & Control**

#12 (2L2T) 2nd
Pre: 5E205 or 327 Inc: E1325 or 371 or E5446
Coordinator: Prof. Johnson.
Assessment: Examination, assignments.
Introduction to numerical modelling & process control that is directly applicable to the mineral processing industry. Includes use of commercial software packages.

**5E306 Comminution Systems & Flotation Analysis**

#12 (2L<2T<2P) 1st
Pre: 5E203 or E5240 Comp: GM396 Inc: E5325 or 326 or 327 or 351
Coordinator: Dr Manlapig.
Assessment: Examination, assignment, practical.
Liberation of different mineral types & textures after comminution. Design, engineering & operation of different comminution machines & circuits. Flotation circuits & their analysis on a size-by-size & liberation basis.

**5E327 Mineral Processing I**

#12 (<3L<3P) 1st
Pre: 5E240 or E5240 or GM143 or 144 or 146 or 150 or 151 or 199 Inc: E5325 or 326 or 327 or 351 or GM 348 or 376 or 384 or 389 or 396
Coordinator: Dr Manlapig.
Assessment: Examination, assignments, practicals.
Systematic mineralogy of ore & gangue minerals; applied ore mineragraphy, geological processes leading to ore deposition; structural controls & tectonic setting of ore deposits. Liberation of different mineral types & texture after comminution; design, engineering & operation of different comminution machines & circuits.

5E328 Mineral Processing II
#12 (2L3C) 2nd
Pre: (5E205 or 240 or E5240) + (GM150 or 151 or 199) Inc: E5328 or 341 or 342 or 352
Coordinator: Dr Manlapig.
Assessment: Examination, practicals, group project.

5E362 Mine Hydrology & Drainage
#5 (<2L<1P) 1st
P: E5255
Coordinator: Dr Beamish.

5E364 Mining Geomechanics I
#10 (<3L<2P) 1st
Inc: E5355 or 357 or 364 P: E2204
Coordinator: Dr Alehossein.

5E365 Mining Geomechanics II
#5 (<2L<1P) 2nd
Inc: E5374 P: 5E364 or E5364
Coordinator: Dr Alehossein.

5E372 Minerals Industry Visit (Intermediate)³
#5 (5C) 1;2
P: 5E258
Coordinator: Prof. White.
Visits organised by academic staff member to minerals industry sites, relevant conferences or other relevant minerals industry activity in Australia or overseas or approved combination of these to assist students in introductory understanding of mining & mineral processing practices & site operations. Submission of technical report to suit industry expectations. Additional fee payable.
5E375 Mining Ventilation I
#5 (2L1T) 1st
Pre: E5255 Inc: E5375
Coordinator: Assoc. Prof. Gillies.

5E377 Mining Ventilation II
#10 (3L1T2P) 2nd
Pre: 5E375 or E5375 Inc: E5377
Coordinator: Assoc. Prof. Gillies.

5E380 Mining Resource Estimation & Financing
#5 (<2L<1T) 2nd
Pre: 5E258 or E5258 Inc: E5382 or 465 P: E5379
Coordinator: Assoc. Prof. Gillies.
Assessment: Examination, tutorial assignments.

5E398 Mining Equipment
#10 (3L1P) 2nd
Pre: E2101 or 204 or E5255 or 258 Inc: E4215 or E5399
Coordinator: Assoc. Prof. Aspinall.
Assessment: Examination, assignment & reports.
Elements of machine design & analysis in context of mining equipment. Power systems including diesel engines, electric motors, hydraulic & compressed air systems. Review of drilling, excavating & haulage equipment. Selection, maintenance, productivity & safety of modern mining machinery.

5E447 Design Project
#15 (1L4T) Year
Pre: E5327 Inc: E5411 or 413 or 426 or 447
Coordinators: Dr Manlapig & Dr Morrison (JKTech).
Design studies applied to field of minerals process engineering.

5E450 Mining Management I
#5 (<2L) 1st
Inc: E5448 or 450 or E9302
Coordinator: Assoc. Prof. Aspinall.

5E451 Mining Management II
#5 (<2L) 2nd
Inc: E5451  
Coordinator: Assoc. Prof. Aspinall.  

**5E460 Mining Economics & Strategy**  
#5 (<2L <1T) 1st  
Pre: (5E382 + E5379) Inc: E5382 or E5460  
Coordinator: Assoc. Prof. Gillies.  
Marketing of mixed commodities. Mining feasibility studies, government influence & policy, mining industry foreign investment, sustainability of returns & investment strategies, mining taxation & costing.

**5E464 Special Topics III**  
#10 (3C) 1:2  
Coordinator: Prof. White.  
Advanced topics in mining or metallurgy. For details & availability consult Head of Department.

**5E466 Mining Design Projects I**  
#10 (3C) 1st  
Pre: (5E364 or E5364) + (5E377 or E5377) + E5379 Inc: E5466  
Coordinator: Assoc. Prof. Aspinall.  
Mine design projects based upon operating conditions using technical & financial procedures for analysis & evaluation. Projects include two of the following areas: underground metalliferous mining, surface metalliferous mining, underground coal mining or surface coal mining.

**5E467 Mining Design Projects II**  
#10 (3C) 2nd  
Pre: (5E364 or E5364) + (5E377 or E5377) + E5379 Inc: E5467  
Coordinator: Assoc. Prof. Aspinall.  
Mine design projects based upon operating conditions using technical & financial procedures for analysis & evaluation. Projects include two of the following areas: underground metalliferous mining, surface metalliferous mining, underground coal mining or surface coal mining. The two for 5E467 should be different areas from those covered in 5E466.

**5E468 Excavation Engineering**  
#10 (3L1P) 1st  
Pre: 5E364 or E5364 Inc: E5468 or 469 C: 5E466  
Coordinator: Dr Alehossein.  
Assessment: Examination, assignments, practicals.  

**5E472 Minerals Industry Visits (Advanced)**  
#5 (5C) 1:2  
P: 5E258  
Coordinator: Prof. White.  
Visits organised by academic staff member to minerals industry sites, relevant conferences or other relevant minerals industry activity in Australia or overseas or approved combination of these to assist students in introductory understanding of mining & mineral processing practices & site operations. Submission of technical report to suit industry expectations. Additional fee payable

**5E490 Mining Project Thesis**

#10 (3C) Year
Pre: #250 Inc: 5E491 or E5490 or 491 or 493 or 494
Coordinator: Prof. White.
Thesis on topic approved by Head of Department. Normally commences in 1st semester, but may commence in 2nd semester with approval of Head of Department. Students may, with approval of Head of Department, complete thesis in one semester. Students must present seminar on thesis project & attend other seminars as required.

**5E491 Mining Research Thesis**

#20 (5C) Year
Pre: #250 Inc: 5E490 or E5490 or 491 or 493 or 494
Coordinator: Prof. White.
Thesis on topic approved by Head of Department. Normally commences in 1st semester, but may commence in 2nd semester with approval of Head of Department. Students may, with approval of Head of Department, complete thesis in one semester. Students must present seminar on thesis project & attend other seminars as required.

**5E492 Mining Field Project Thesis**

#15 (<4C) Year
Pre: #250 Inc: 5E490 or 491 or E5490 or 491 or 493 or 494
Coordinator: Prof. White.
Assessment: Thesis.
Thesis on topic with field application approved by Head of Department. Normally commences in 1st semester, but may commence in 2nd semester with approval of Head of Department. Students may, with approval of Head of Department, complete thesis in one semester. Students must present seminar on thesis project & attend other seminars as required.

**E5**

**E5320 Material Behaviour During Processing**

#10 (2L3P) 1st
Pre: 5E201 or E5201 or 202 or 285 Inc: E5308
Coordinator: Assoc. Prof. Atrens.
Stress, strain & yielding, plastic stress-strain relationships. Upper bound forces in processing operations, slip-line field analysis, deformation-zone geometry, functional effects, flow instability, particulate processing.

**E5321 Service Performance of Materials**

#10 (2L3P) 2nd
Pre: 5E201 or E5202 or 285 Inc: E5300 or 304 or 308
Coordinator: Dr Gates.
Property specification & testing, practical strength, micromechanics of fracture, property stability under service conditions — temperature, strain & notch effects. Wear mechanisms & wear-resistant materials.
**E5333 Crystallography & Diffraction**  
#8 (<2L <1T3P) 2nd  
Pre: 5E101 or E5101 or 202 Inc: E5301 or 306 or 307  
Coordinator: Assoc. Prof. Kelly.  
Basic crystallography & diffraction theory, X-ray, electron & neutron diffraction methods in materials science.

**E5334 Ceramic Materials**  
#6 (2L) 2nd  
Pre: 5E201 or E5202 or 285 Inc: E5405  
Coordinator: Assoc. Prof. Truss.  

**E5335 Alloy Design**  
#10 (2L3P) 1st  
Pre: (5E201 or E5202)+ (E5203 or 213 or 304) Inc: E5415 or 429 or 430  
Coordinator: Dr Caceres.  
Microstructural design of important industrial alloy types. Heat treatment. Thermomechanical processing. Design of alloys for specific properties.

**E5336 Solidification Technology**  
#10 (2L3C) 1st  
Coordinator: Prof. St John.  
Pre: E5203 or 213 or 241 Inc: E5406 or 417  
Application of solidification theory. Directional solidification, single crystal growth, rapid solidification, rheo casting & squeeze casting.

**E5351 Mineral Processing I**  
#7 (<2L3C) 1st  
Pre: 5E240 or E5239 or 240  
Coordinator: Dr Manlapig.  
Characterisation of particles. Interrelationship of mineralogy, liberation, grade/recovery in mineral & coal processing. Fracture theory of solids; crushing, theory, design, operation & control. Sampling, on line solid weight & flow analysis, storage & materials handling.

**E5352 Mineral Processing II**  
#6 (<2L2C) 2nd  
Pre: 5E240 or E5239 or 240 Inc: E5328 or 341 or 342  
Coordinator: Dr Manlapig.  
Physics of separation by size, density, magnetic & electrostatic properties. Equipment design operation & control. Thickening, waste disposal & environmental control. Plant design & layout.

**E5379 Mining Evaluation Economics**  
#5 (<2L<1T) 1st  
Pre: E5251 or 258 or 284 Inc: E1363 or E5472 or E9301  
Coordinator: Assoc. Prof. Gillies.  
E5399 Mine Power Systems
#6 (2L1P) 2nd
Pre: E3276 + E5255
Coordinator: Assoc. Prof. Aspinall.

E5400 Special Topics in Minerals Processing I
#5 (2L) 1;2
Pre: E5239 or 240
Coordinator: Assoc. Prof. Hayes.
Topics & content to be determined by student interest & availability of staff.

E5401 Fracture Mechanics
#10 (<3L<2T) 2nd
Pre: 5E201 or E5202 or 285 Inc: E5310
Coordinator: Dr Griffiths.

E5403 Advanced Topics in Materials
#6 (2L) 2nd
Pre: 5E101 or 201 or E5101 or 202
Coordinator: Dr Dahle.
Lecture series on advanced topics & areas of current research activity over wide range of materials science & engineering.

E5404 Polymer Materials
#6 (2L) 2nd
Pre: (5E201 or E5202 or 285) + E5214
Coordinator: Assoc. Prof. Truss.
Relationships between polymer structure, processing & properties. Elastomers, fibre composites, thermal, chemical & environmental stability.

E5407 Surface Technology¹
#6 (2L) 1st
Pre: 5E101 or 201 or E5101 or 202 Inc: E5408
Coordinator: Assoc. Prof. Truss.
Modern techniques of surface modification for hardening & corrosion resistance. Ion implantation, ion beam mixing, metallic, ceramic & polymeric coatings.

E5408 Electronic Materials¹
#6 (2L) 2nd
Pre: 5E101 or 201 or E5101 or 202 Inc: E5407
Coordinator: Assoc. Prof. Truss.
Fundamental concepts & processing of electronic materials: magnetic materials, optical fibres, semi-conductors, dielectrics.

E5409 Special Topics in Minerals Processing II
#5 (2L) 1;2
Pre: E5239 or 240
Coordinator: Assoc. Prof. Hayes. Topics & content to be determined by student interest & availability of staff.

**E5412 Thesis**
#30 Year (May also commence 2nd)
Pre: permission of Head of Dept [For BAppSc(MatSc) & BAppSc(MinChem) students only]
Thesis on topic approved by Head of Department.

**E5414 Corrosion**
#8 (2L1P) 2nd
Pre: 5E201 or E5202 or 285 Inc: E1443 or E5410 Inc: E1443 or E5410
Coordinator: Assoc. Prof. Atrens.
Electrochemical nature of metallic corrosion, measurement & evaluation of corrosion phenomena. Corrosion control practice, material selection principles, design inhibitors, coatings, cathodic protection.

**E5421 Dislocation Theory**
#6 (2L) 1st
Pre: E5308 or 310 or 321
Coordinator: Assoc. Prof. Kelly.
Dislocation theory, dislocations in crystals, strengthening mechanisms, design of strong materials, microstructural aspects, ductile & brittle failure.

**E5422 Materials Laboratory**
#4 (3P) 2nd
Pre: E5308 or 321
Coordinator: Assoc. Prof. Kelly.
Experiments & problems in dislocations in crystals, microstructure, ductile & brittle fracture.

**E5427 Advanced Flotation**
#7 (<2L<3T<1P) 1st
Pre: E5328 + (5E344 or E5344)
Coordinator: Prof. Johnson.

**E5431 Materials Selection**
#7 (<2L<3T) 2nd
Pre: 5E201 or E5202 or 285
Coordinator: Dr Caceres.

**E5434 Hydrometallurgy**
#10 (2L2T1P) 1st
Pre: CH 203 or E1361 or E5322 P: E5240 + (E5344 or 5E344) + (GM 143 or 144 or 146 or 150 or 151)
Coordinator: Assoc. Prof. Hayes.
Principles of leaching, solution purification & metal precipitation in aqueous media. Electrochemistry of metals.

**E5438 Pyrometallurgy**
#10 (2L2T1P) 1st.
Pre: CH203 or E1361 or E5322 P: E5240 or 5E242  
Coordinator: Assoc. Prof. Hayes.  

**E5446 Mineral Process Simulation & Control**  
#8 (4T) 2nd  
Coordinator: Prof. Johnson.  
Pre: E5311 or 325 or 327 Inc: E5435 or 440  

**E5449 Metallurgy Honours**  
#100 Year (May also commence 2nd)  
Coordinator: Assoc. Prof. Kelly.  
For subject details & requirements consult Head of Department.

**E5453 Electron Microscopy of Materials I**  
#5 (1L<1T1P) 1st  
Pre: #180 Inc: E5815  
Coordinator: Dr Yao.  
Electron optics, principles of electron microscopy, scanning, transmission & scanning transmission electron microscopy, introduction to diffraction contrast, electron diffraction & microanalysis, specimen preparation.

**E5454 Electron Microscopy of Materials II**  
#5 (1L<1T1P) 2nd  
Pre: E5453 Inc: E5815  
Coordinator: Dr Yao.  
Advanced topics in electron microscopy — dynamic theory of diffraction contrast, electron diffraction, convergent beam techniques, microanalysis, electron energy loss spectrometry.

**E5455 Materials Science IVH (Honours)**  
#100 Year (May also commence 2nd)  
Coordinator: Assoc. Prof. Kelly.  
For details consult Head of Department.

**E5456 Mineral Chemistry IVH (Honours)**  
#100 Year (May also commence 2nd)  
Coordinator: Assoc. Prof. Hayes.  
For details consult Head of Department.

**E5459 Mining Environment II**  
#6 (1L1T2C) 1st
Coordinator: Assoc. Prof. Aspinall.
Planning considerations to control environmental effects of land disturbance by mining whether due to surface or underground mining. Preparation of environmental impact statements relative to mineral production developments.

**E5461 Mining Production Engineering II**
#8 (2L2T) 1st
Pre: E5254 or 258 Inc: E5362 or 476 or 488
Coordinator: Assoc. Prof. Aspinall.

**E5462 Special Topics I²**
#5 (1L1T) 1;2
Pre: E5254 or 258
Coordinator: Prof. White.
Advanced topics in mining design & operational control.

**E5463 Special Topics II²**
#5 (2L) 1;2
Coordinator: Prof. White.
Advanced topics in mining or metallurgy. For details & availability consult Head of Department.

**E5490 Mining & Metallurgical Seminar I**
#2 (1S) 1st
Coordinator: Assoc. Prof. Hayes.
Each student must present seminars totalling at least half hour on approved topic & attend all other seminars.

**E5491 Mining & Metallurgical Seminar II**
#2 (1C) 2nd
Coordinator: Assoc. Prof. Hayes.
Each student must present seminars totalling at least half hour on approved topic & attend all other seminars.

**E5496 Mining Production Engineering III**
#8 (2L2T) 2nd
Pre: E5254 or 258 Inc: E5480 or 481
Coordinator: Assoc. Prof. Aspinall.

**E5498 Thesis in Minerals Process Engineering (Honours)**
#20 (5C) Year (May also commence 2nd)
Pre: #250
Coordinator: Dr Bourgeois.

**E5499 Thesis in Minerals Process Engineering (Pass)**
#15 (4C) Year (May also commence 2nd)
Pre: #250
Coordinator: Dr Bourgeois.

Endnotes
1. Subject to availability of staff.
2. Availability to mining engineering students subject to availability of specialist lecturers; do not enrol without consulting Head of Department.
3. Subject to availability. Check with Head of Department.