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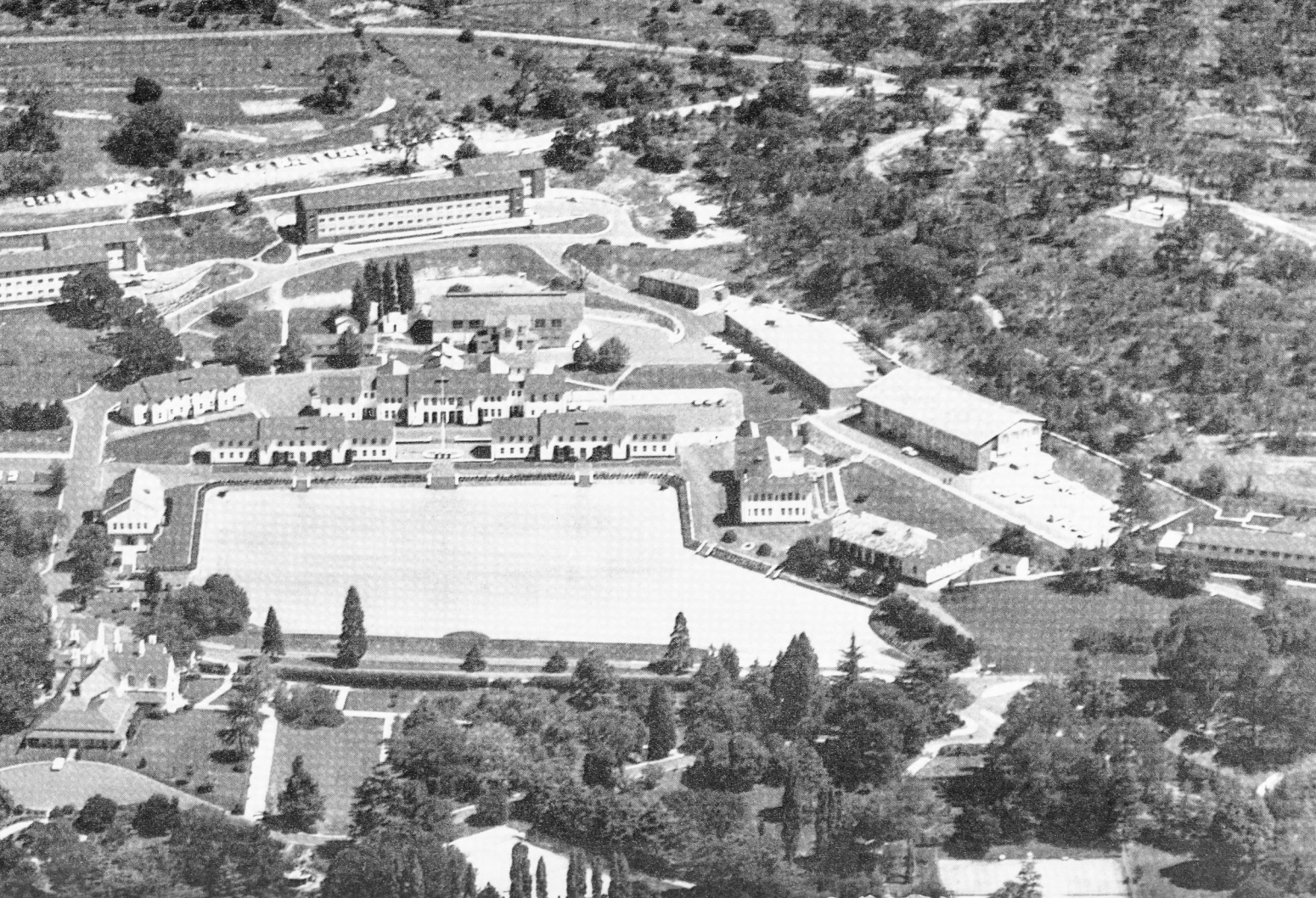
The Royal Military College Handbook 1971

THE ROYAL MILITARY COLLEGE OF AUSTRALIA
DUNTROON
AUSTRALIAN CAPITAL TERRITORY

THE ROYAL MILITARY COLLEGE HANDBOOK 1971



Handbook of The Royal Military College of Australia 1971

The Royal Military College is in affiliation with the University of New South Wales through the Faculty of Military Studies

AUSTRALIAN GOVERNMENT PUBLISHING SERVICE
CANBERRA 1970

MILITARY BOARD

Army Headquarters
Canberra, A.C.T.

Issued by Command of the Military Board

Secretary

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Origins and development of the Royal Military College

The Royal Military College of Australia was opened by the Governor-General of Australia, Lord Dudley, on 21 June 1911. The idea that Australia should have its own military college received serious consideration after the federation of the six Australian colonies in January 1901. In 1902 the first commander of the Australian Military Forces, Major-General (afterwards Lieutenant-General) Sir Edward Hutton of the British Army recommended that a military college be established along the lines of West Point in the United States of America, R.M.C. Kingston in Canada, and of the Great Public Schools of England. The Defence Act of 1909 which introduced compulsory military training for home defence also made provision for the establishment of a military college. Before the Defence Act came into operation the Government had invited Field-Marshal Lord Kitchener to visit Australia and advise it on the defences of the Commonwealth. Among the recommendations of Kitchener's comprehensive report of 1910 was that a college should be established for the training of officers of the permanent military forces. The Government then instructed Colonel (afterwards Major-General Sir) William Throsby Bridges, the Australian representative on the Imperial General Staff in London, to visit and report on military colleges in England, Canada, and the United States with a view to setting up a college suited to Australian requirements. Colonel Bridges reported to the Minister for Defence in June 1910 and in the same year was appointed commandant of the proposed Military College of Australia.

The Government decided that the college should be established near Canberra, the federal capital, provided a suitable site could be found. Brigadier-General Bridges visited the Federal (Australian) Capital Territory and chose Duntroon, a sheep station, which had been taken up by Robert Campbell, colonial merchant and pastoralist, in 1825. The Duntroon property was first leased and then purchased by the Commonwealth Government from the Campbell family.

The first intake consisted of forty-two staff cadets, including ten from New Zealand. Although a four-year course in both military and academic work had been planned the first class was specially graduated for service with the First A.I.F. and the N.Z.E.F. in August 1914. Forty of the 117 Australian graduates of the first four entries (1911–1914) died on war service in the Great War, 1914–18, including seventeen at Gallipoli where the College's first Commandant also fell.

After the First World War Australia's RMC continued to develop and produce officers for Australia's defence needs: until 1930 the College also trained officers for long service commissions in the Royal Australian Air Force. In 1931–36 the College was transferred to Victoria Barracks, Sydney, as an economy measure; it reopened again at Duntroon in February 1937. In this year the College's first permanent buildings were constructed and since then there has been a slow but continuing building programme to cater for increased numbers and more varied and more demanding courses.

The length of the course which is conceived as a whole has varied from time to time but it has usually been four years. During World War II the length of the course varied between six months and two and-a-half years. Since 1947,

however, the course has always been four years. In 1968 the University of New South Wales at Kensington, Sydney, established a Faculty of Military Studies at the Royal Military College. The Faculty is responsible for conducting full university courses at the College in Arts, Applied Science and Engineering leading to the award of the University's degrees of Bachelor of Arts and Bachelor of Science in Military Studies. Since its foundation to 1969 almost two thousand officer cadets have graduated from Australia's RMC.

* * *

Duntroon is about two miles north east of Capitol Hill in the City. It is situated on the eastern slopes of Mount Pleasant (2,150 feet) overlooking the Molongo plain; the surrounding country is undulating, well-timbered, and eminently suited for military training. A variety of different training environments is within a radius of a hundred miles. The College itself occupies 370 acres including staff quarters, playing fields, gardens and golf course. A field firing range is located nearby east of Mounts Ainslie and Majura.

The climate of the Australian Capital Territory is continental in type—hot summers and cold winters. The altitude of Canberra (1,900 feet) has a moderating influence on the summer temperature (January mean, 69.1:F) and tends to lower the winter temperature (July mean, 42.8:F). Relative humidity is low in summer. Canberra's average annual rainfall of 25 inches is equally distributed throughout the year, and the average rainfall variability low. Winds are low largely owing to the protection of the mountains in the west: this fact tends to reduce the uncomfortable effects of extremes of temperature. In summary, the climate is healthy and invigorating.

KENSINGTON UNIVERSITY OF NEW SOUTH WALES 18 FEB 1971 LIBRARY

Contents

The Charter of the Royal Military College . . . *page* 1
Affiliation with the University of New South Wales . . . 1
The Interim Council of the Royal Military College, 1970 . . 2
Staff of the Royal Military College 4
Faculty of Military Studies 9
Outline Calendar for 1971 11
Table of Principal Dates in 1971 12
The Royal Military College Course 14
The Degrees of BA(Mil) and BSc(Mil) 14
Educational Qualifications for Entry 14

The Military Curriculum:

Allotment of Military Periods 19
Scope of Military Instruction:
Armour 21
Army Health 21
Artillery 22
Character Training 22
Current Affairs 23
Drill and Ceremonial 24
Infantry Minor Tactics 24
Leadership 25
Military Engineering 25
Military Law 26
Organization 27
Orientation 27
Peace Administration 27
Physical and Recreational Training 28
Service Etiquette 29
Signals 30
Staff Duties, Training and Intelligence 31
Tactics 31
Topography 31
War Administration 32
Weapon Training 32
Field Training 33

Courses for the Degrees of BA(Mil) and BSc(Mil):

Rules Governing the Award of the Degree of BA(Mil) . . . 37
Programmes of Study for the Degree of BA(Mil) . . . 39
Rules Governing the Award of the Degree of BSc(Mil) (Applied Science Course) 40
Programme of Study for the Applied Science Course . . . 42
Rules Governing the Award of the Degree of BSc(Mil) (Engineering Courses) 43
Military Requirements for the Degrees 47

Subjects Offered by the Faculty of Military Studies:

Department of Chemistry:

1303	Chemistry	*page* 53
1305	Chemistry I	53
2303	Chemistry II	55
3303	Chemistry III	56

Department of Engineering:

1705	Engineering IE	59
2701	Mechanical Design	60
2709	Materials (Civil and Mechanical Courses)	61
2713	Materials (Electrical Course)	63
2711	Mechanics and Computations	64
2721	Civil Engineering I	65
2723	Surveying	67
2745	Electrical Engineering I	67
2763	Mechanical Engineering I	69
2765	Mechanical Engineering IE	70
3725	Civil Engineering IIA	71
3727	Civil Engineering IIB	72
3741	Electrical Technology	75
3747	Electrical Engineering II	77
3749	Electrical Engineering III	78
3765	Mechanical Engineering II	81
3767	Mechanical Engineering III	83
3769	Technical Communication	85

Department of Government and Economics:

1625	Government I	89
2625	Government II	90
3627	Government III	91
1609	Economics I	92
2605	Economics II	93
3609	Economics III	94
1651	Geography I	95
2651	Geography II	97

Department of History:

1405	History I	101
2407	History II	102
3407	History III	103
1413	History C	104

Department of Language and Literature:

1507	English I	109
2507	English II	109
3507	English III	110
1551	English Language	110
1521	English A	111
2521	English B	111

Department of Mathematics:

1105 Mathematics I . . . . . *page* 115
2103 Mathematics II 116
2113 Mathematics II 118
2173 Mathematics II 118
3103 Mathematics III 120

Department of Physics:

1203 Physics I 123
2203 Physics II 124
3203 Physics III 125

Departments of Chemistry and Physics:

1805 Science IA 127

The Royal Military College Handbook 1971

The Charter of the Royal Military College

The Charter of the Royal Military College is to train cadets for careers in the service of the Crown as officers in the Australian Army. Its aim is to give each cadet the knowledge necessary to fit him to enter upon such a career, and to foster in him the moral and mental qualities on which leadership depends. The course of instruction is designed to:

(a) Promote a sense of honour and loyalty, duty and responsibility; inculcate habits of discipline and soldierly conduct; and to give a correct understanding of the place of the Armed Services in the Australian Nation.

(b) Provide a balanced and liberal education in the Arts and Sciences, taking into account the special needs of the Service and the aptitude of the cadet.

(c) Develop a capacity for clear and logical thought and expression.

(d) Give a sound military education in the science and principles of war.

(e) Instruct the cadet in the military skills and techniques of modern warfare required of the junior regimental officer.

Affiliation with the University of New South Wales

In 1967, the Department of the Army and the University of New South Wales agreed to co-operate in developing the Royal Military College into a separate degree-granting body within a period of ten years. The College entered into an affiliation with the University in 1968, and the University established a Faculty of Military Studies at Duntroon.

The Faculty of Military Studies is responsible for conducting courses at the College in Arts, Applied Science and Engineering, leading to the award of the University's degrees of Bachelor of Arts in Military Studies (BA(Mil)), and Bachelor of Science in Military Studies (BSc(Mil)).

The Interim Council of the Royal Military College advises the University and the Military Board on facilities required for instruction at Duntroon, and on other matters relating to the College, including any action which might be taken to promote the objects and interests of the College and the University.

The Interim Council of the Royal Military College 1971

Chairman

Major General C. M. I. PEARSON, DSO, OBE, MC, jssc (US), psc
Commandant, Royal Military College

Members

Professor F. W. AYSCOUGH, BSc *Syd.*, MSc *N.S.W.*, CEng, MIChemE, ARACI
Professor of Chemical Technology, University of New South Wales

Mr N. M. BOYLE, BCom *Melb.*
Assistant Secretary (Management Services), Department of Defence

Major-General M. F. BROGAN, CB, CBE, BE *Syd.*, MIEAust, FAIM, idc, jssc, psc
General Officer Commanding Eastern Command

Professor J. C. BURNS, MSc *NZ*, BA *Cantab*, PhD *Manc*
Chairman of the Faculty of Military Studies

Professor H. BURTON, CBE, BA *Qld*, MA *Oxon & Melb.*
Emeritus Professor of the Australian National University

Lieutenant-Colonel A. J. A. COOPER, psc, RNZ Sigs
Deputy Head, New Zealand Defence Liaison Staff

The Honourable Mr Justice R. W. FOX
Resident Judge of the Supreme Court of the Australian Capital Territory

Professor E. P. GEORGE, BSc PhD *Lond.*, DSc *N.S.W.*, FInstP
Head School of Physics, University of New South Wales

Associate Professor H. S. HODGES, BSc (Econ) DipEd *Lond.*, FRGS
Member elected by the Royal Military College Staff

Mr LEWIS LUXTON, CBE, MA *Cantab*

Colonel J. M. MAXWELL, OBE, psc
Director of Military Art, Royal Military College

Professor D. M. McCALLUM, BA *Syd.*, MA BPhil *Oxon.*
Head, School of Political Science, University of New South Wales

Professor C. E. MOORHOUSE, DEng *Melb.*, FIEAust, FIEE, FACE
Associate Dean, Faculty of Engineering, University of Melbourne

Professor R. H. MYERS, MSc PhD *Melb.*, FIM FRACI, MAusIMM
Vice-Chancellor, University of New South Wales

Professor C. G. F. SIMKIN, MA DipSocSc *N.Z.*, DPhil *Oxon.*
Professor of Economics, University of Sydney

Brigadier G. D. SOLOMON, OBE, idc, psc, ptsc, fsc (US)
Director of Military Training

Professor R. STREET, DSc *Lond.*, FInstP, FAIP, MIEE
Professor of Physics, Monash University

Associate Professor D. E. SWAN, OBE, BSc *Syd.*, BEd *Qld*, AInstP, AAIP
Member elected by the Royal Military College Staff

Major General D. VINCENT, CB, OBE, idc, psc, MIREE
Adjutant General

Professor R. E. VOWELS, ME *Adel.*, SMIEEE, MIEAust, MIEE
Pro-Vice-Chancellor, University of New South Wales

Mr W. J. WEEDEN, OBE, MA DipEd *Syd.*
Senior Assistant Secretary, Department of Education and Science

Mr B. WHITE, CBE, BCom DipPubAdmin *Melb.*
Secretary, Department of the Army

Professor A. H. WILLIS, DSc (Eng) *Lond.*, CEng, MIMechE, MIEAust, MemASAE, WhSc
Pro-Vice-Chancellor, University of New South Wales

Secretary

Mr R. W. O. PUGH, BE *Syd.*, BA *A.N.U.*, MIEAust, MACE, psc
Registrar, Royal Military College

Assistant Secretary

Major A. HARKNESS, psc, pl, RAA
GSO2 (Co-ordination) Royal Military College

Staff of the Royal Military College

COMMANDANT

Major-General C. M. I. PEARSON, DSO, OBE, MC, jssc (US), psc

MILITARY STAFF

Director of Military Art
Colonel J. M. MAXWELL, OBE, psc

GSO2 (Co-ordination)
Major A. HARKNESS, psc, pl, RAA

THE CORPS OF STAFF CADETS

Commanding Officer
Lieutenant-Colonel J. D. STEWART, MC, psc, RA Inf

Second in Command
Major R. D. ASHFORTH, psc, Green Howards

Adjutant
Captain J. R. BRETT, RA Inf

Officer Commanding The Sovereign's Company
Major B. H. MITCHELL, RAA

Officer Commanding Gallipoli Company
Major J. D. THOMSON, BE *Adel.* RAE

Officer Commanding Alamein Company
Major E. J. O'DONNELL, MC, RA Inf

Officer Commanding Kapyong Company
Major L. J. TOWERS, RAASC

Regimental Sergeant-Major
Warrant Officer Class 1 N. GOLDSPINK, RA Inf

INSTRUCTORS

Tactics
Major O. M. CARROLL, psc, RA Inf

Staff Duties, Training and Intelligence
Major K. R. COOKE, BCA *N.Z.*, ANZIM, psc, RNZASC

War Administration
Major L. J. TOWERS, RAASC

Armour
Major D. A. FORMBY, RAAC

Artillery
Captain A. S. EATON, RAA

Military Engineering
Major J. D. THOMSON, RAE

Signals
Major R. L. C. TWISS, psc, qtc, RA Sigs

Infantry
Major K. R. SCHLYDER, RA Inf
Captain M. J. BARRETT, RA Inf

Drill and Ceremonial
Captain J. R. BRETT, RA Inf

Current Affairs and Leadership
Major E. J. O'DONNELL, MC, RA Inf

Military Law and Peace Administration
Captain J. D. CAMPBELL, DFC, ph(i), Avn

Physical Training
Warrant Officer Class 2 T. M. DONNELLY, RAA

Army Health
Major B. R. C. DANIEL, MB, BS, *Syd.*, RAAMC

ADMINISTRATION

Lieutenant-Colonel in Charge of Administration
D.A.A.G.
Major B. F. KELLY, qs, RA Inf
D.A.Q.M.G.
Major T. TONURI, RAAOC

Accountant
Mr E. G. McDONALD

Medical Officer
Major B. R. C. DANIEL, MB, BS, *Syd.*, RAAMC

Archivist
Colonel L. H. R. FUHRMAN, psc (RL)

CHAPLAINS

Church of England
Chaplain L. THOMPSON, RAA Ch D

Roman Catholic
Chaplain J. M. HOARE, MBE, ED, RAA Ch D (part-time)

United Churches
Chaplain F. P. McMASTER, DipRE, RAA Ch D (part-time)

Presbyterian
Chaplain J. P. MOODY, BA, *Syd.*, RAA Ch D (part-time)

Academic Departments

ADMINISTRATION

Dean
Professor B. D. Beddie, BA *Syd.*, PhD *Lond*

Vacant

Registrar
R. W. O. PUGH, BE *Syd.*, BA *A.N.U.*, MIEAust, MACE, psc

Deputy Academic Registrar
K. J. HUDSON, BA (Oriental Studies) *A.N.U.*

DEPARTMENT OF CHEMISTRY

Professor of Chemistry and Head of the Department

Vacant

Associate Professor
B. DEMPSEY, MSc *Syd.*, BEd *Melb.*, FRACI

Senior Lecturers
T. N. LOCKYER, MSc PhD *N.S.W.*
D. J. McHUGH, BSc *Syd.*, PhD *N.S.W.*, ARACI
E. P. SERGEANT, MSc *N.S.W.*, ARACI
J. W. TARDIF, MSc *Syd.*

Teaching Fellow

Vacant

DEPARTMENT OF ENGINEERING

Professor of Engineering and Head of the Department
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Professor of Engineering

Vacant

Senior Lecturers
L. A. PETERSON, BCE *Melb.*, CEng, MIEAust
C. G. J. STREATFIELD, BSc(Eng) *Lond.*, CEng, MIEE, MIEAust

Lecturers
A. J. BONHAM, BSc(Eng) *Lond.*, MEngSc *N.S.W.*, AKC, CEng, MICE, AMIWE
J. D. CASHMAN, BE *N.S.W.*, MSc BA *A.N.U.*
I. W. LINNETT, BE., MEngSc *Syd.*
R. QUARTERMAN, BSc(Eng) *Brist.*
J. SNEDDON, BE *N.S.W.*, BSc (Tech) *Newcastle*, MIEAust
C. W. THOMAS, ASTC(MechEng), MIEAust
A. R. WATSON, BE *Qld.*, CEng, MIMechE, MIEAust

Vacant—three positions

DEPARTMENT OF GOVERNMENT AND ECONOMICS

Professor of Government and Head of the Department

B. D. BEDDIE, BA *Syd.,* PhD *Lond.*

Associate Professors

H. S. HODGES, BSc(Econ) DipEd *Lond.,* FRGS
J. WILCZYNSKI, MEc *A.N.U.,* PhD *Lond.,* BEd *Melb.*

Senior Lecturer

G. R. WEBB, MCom BA *Melb.*

Vacant one position

Lecturers

E. D. DAW, BEc *Syd.*
Beverley M. MALE, BA PhD *A.N.U.*
L. J. OLIVE, BSc *N.E.*
W. H. SMITH, BSc, MPhil *Lond.*

DEPARTMENT OF HISTORY

Professor of History and Head of the Department

L. C. F. TURNER, MA *Rand.,* jsc

Senior Lecturers

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J. R. ROBERTSON, MA *W. Aust. & A.N.U.*

Lecturers

J. McCARTHY, BA *Qld,* MA, *N.S.W.*
R. C. THOMPSON, BA DipEd *Melb.,* PhD *A.N.U.*
G. P. WALSH, MA DipEd *Syd.,* MA *A.N.U.*

Tutor

Mrs. Margot Z. SIMINGTON, BA *N.E.*

DEPARTMENT OF LANGUAGE & LITERATURE

Professor of English and Head of the Department

G. K. W. JOHNSTON, MA *Oxon. & N.Z.*

Associate Professor

E. R. BRYAN, OBE, MA DipEd *Melb.*

Senior Lecturers

J. T. LAIRD, MA *Syd.*
W. H. WILDE, MA DipEd *Syd.,* MACE

Lecturer

B. G. ANDREWS, MA *N.S.W.,* DipEd *Syd.*

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DEPARTMENT OF MATHEMATICS

Professor of Mathematics and Head of the Department
J. C. BURNS, MSc *N.Z.*, BA *Cantab.*, PhD *Manc.*

Associate Professor
A. McMULLEN, MA *Syd.*

Senior Lecturers
B. A. BARNES, MSc DipEd *Syd.*
N. J. DE MESTRE, BSc DipEd *Syd.*, MSc *W.Aust.*
T. PARKES, BSc *Manc.* MSc *A.N.U.*

Lecturers
K. L. BYRNES, BA *Syd.*
D. L. HOFFMAN, BA *A.N.U.*

DIGITAL COMPUTING

Senior Lecturer in Charge
A. J. QUAINE, BEE MSc *Melb.*

Lecturer
G. W. GERRITY, MSc *Sask.*

DEPARTMENT OF PHYSICS

Professor of Physics and Head of the Department
Vacant

Associate Professor
D. E. SWAN, OBE, BSc *Syd.*, BEd *Qld.*, AInstP, AAIP

Senior Lecturers
D. C. CREAGH, BSc DipEd *Qld*, MSc *N.E.*, MSc *Brist.*, AInstP, AAIP
E. DENNIS, MSc *Adel.*, GradInstP (on study leave in 1971)

Lecturers
H. R. FOSTER, BSc *Syd.*
D. K. FOWLER, MSc *N.E.*, GradInstP
R. W. N. KINNEAR, MSc *N.Z.*, GradAIP

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Librarian
Judith A. DONNELLY, BA *Syd.*

Faculty of Military Studies

Dean

Professor B. D. BEDDIE, BA *Syd.,* PhD *Lond.*

Chairman

Professor J. C. BURNS, MSc *N.Z.,* BA *Cantab.,* PhD *Manc.*

Faculty Secretary

R. W. O. PUGH, BE *Syd.,* BA *A.N.U.,* MIEAust, MACE, psc

The Faculty comprises all the members of the academic staff at Duntroon, plus the following members of the College *ex officio:*

the Commandant,
the Director of Military Art,
the Commanding Officer, Corps of Staff Cadets,
the General Staff Officer 2 (Co-ordination),
the Company Commanders, Corps of Staff Cadets,

plus the Director of Military Training, Army Headquarters,
plus the following members of the University of New South Wales at Kensington:

Professor S. J. ANGYAL, PhD *Bud.,* DSc *N.S.W.,* FAA, FRACI,
Head, School of Chemistry

Professor F. W. AYSCOUGH, BSc *Syd.,* MSc *N.S.W.,* CEng, MIChemE, ARACI
Head, School of Chemical Technology

Professor R. A. A. BRYANT, ME *N.S.W.,* ASTC, CEng, FIMechE, MIEAust, AFRAeS
Head, School of Mechanical and Industrial Engineering

Professor V. T. BUCHWALD, BSc *Manc.,* MSc PhD *Lond.,*
Head, School of Mathematics

Professor F. K. CROWLEY, MA PhD *Melb.,* DPhil *Oxon.,*
Head, School of History

Professor E. P. GEORGE, BSc PhD *Lond.,* DSc *N.S.W.,* FInstP,
Head, School of Physics

Professor J. A. MABBUTT, MA *Cantab.,*
Head, School of Geography

Professor D. M. McCALLUM, BA *Syd.,* MA BPhil *Oxon.,*
Head, School of Political Science

Professor H. MUIR, BMetE *Melb.,* ScD *M.I.T.,* AIM, MAusIMM,
Head, School of Metallurgy

Professor J. W. NEVILE, BA *W.Aust.,* MA PhD *Calif.,*
Head, School of Economics

Professor H. J. OLIVER, MA *Syd.,*
Head, School of English

Professor H. R. VALLENTINE, BE *Syd.*, MS *Iowa*, ASTC, MIEAust, MASCE,
Head, School of Civil Engineering

Professor A. H. WILLIS, DSc(Eng) *Lond.*, CEng, MIMechE, MIEAust, MemASAE, WhSc,
Pro-Vice-Chancellor

Mr D. C. VALLENTINE, BEc *Syd.*, AASA,
Associate Registrar (representing the Registrar)

Outline Calendar for 1971

<table>
<tr><th rowspan="2">Term</th><th rowspan="2">Week No.</th><th>First Year</th><th>Second Year</th><th>Third Year</th><th>Fourth Year</th></tr>
<tr><th>Fourth Class</th><th>Third Class</th><th>Second Class</th><th>First Class</th></tr>
<tr><td rowspan="6">1</td><td>1–4</td><td>Orientation</td><td rowspan="2">Military Weeks</td><td rowspan="2">Military Weeks</td><td rowspan="2">Military Weeks</td></tr>
<tr><td>5</td><td>Military Week</td></tr>
<tr><td>5–9</td><td colspan="3" rowspan="3">Academic Weeks</td><td rowspan="2">Artillery Training</td></tr>
<tr><td>10</td></tr>
<tr><td>11–17</td><td>Military Weeks</td></tr>
<tr><td rowspan="3">2</td><td>18</td><td>Visit to Military Units in Sydney</td><td colspan="2" rowspan="2">Leave Studies</td><td>Leave</td></tr>
<tr><td>19</td><td rowspan="2">Military Weeks</td></tr>
<tr><td>20–29</td><td colspan="3">Academic Weeks</td></tr>
<tr><td rowspan="6">3</td><td>30</td><td colspan="3" rowspan="2">Leave Studies</td><td>Leave</td></tr>
<tr><td>31–32</td><td rowspan="2">Military Weeks</td></tr>
<tr><td>33–38</td><td colspan="3" rowspan="2">Academic Weeks</td></tr>
<tr><td>39</td><td rowspan="2">Course at J.T.C. Canungra</td></tr>
<tr><td>40–41</td><td colspan="3" rowspan="2">Academic Studies and Examinations</td></tr>
<tr><td>42</td><td>Military Weeks</td></tr>
<tr><td></td><td>43–45</td><td colspan="3">Military Weeks</td><td></td></tr>
<tr><td></td><td>46</td><td colspan="4">Preparation for Graduation</td></tr>
<tr><td></td><td>47</td><td colspan="4">Graduation Week</td></tr>
</table>

Principal Dates in 1971

January 12	RMC Admissions Board meets
January 18–22	Supplementary and deferred examinations
January 19	Fourth Class arrives at RMC
January 23	Other classes return from leave
January 25	First term begins
February 11	Executive Committee of the Interim Council meets
February 20	Executive of the Faculty of Military Studies meets
February 25	Eighth Meeting of the Interim Council
February 26	Executive of the Faculty of Military Studies meets
March 1	Academic year begins
March 19	Faculty of Military Studies meets
April 8–14	Easter leave
April 16	Executive of the Faculty of Military Studies meets Higher Degree Committee meets
April 25	Anzac Day
May 22	First term ends
May 31	Second term begins for First Class
June 4	Executive of the Faculty of Military Studies meets
June 7	Second term begins for Second, Third and Fourth Classes
June 10	Executive Committee of the Interim Council meets
June 12	Queen's Birthday parade and ball
June 14	Queen's Birthday holiday
June 18	Faculty of Military Studies meets
July 16	Executive of the Faculty of Military Studies meets
August 3	Second term ends
August 5–20	CGS Exercise
August 16	Third term begins for First Class
August 19	Executive Committee of the Interim Council meets
September 3	Executive of the Faculty of Military Studies meets
September 6	Third term begins for Second, Third and Fourth Classes
September 17	Faculty of Military Studies meets
September 23	Ninth meeting of the Interim Council
October 15	Executive of the Faculty of Military Studies meets Higher Degree Committee meets
October 17	First Class leave for JTC, Canungra
October 25–November 13	Academic studies and examinations for all classes except First Class

November 7 .	First Class return from JTC
November 19 .	Executive of the Faculty of Military Studies meets
November 22 .	Annual field training begins
November 26 .	Examinations Committee meets
December 4 .	Annual field training concludes Third term ends
December 12 .	Church parade
December 13 .	Presentation of prizes and sports trophies
December 14 .	Graduation parade and ball
December 15 .	Graduates leave RMC
December 16 .	Leave commences for Second, Third and Fourth Classes

The Royal Military College Course

The Royal Military College course is a four-year course of military and academic studies. The first three years are primarily academic years and the fourth year military. The course is conceived as a whole; that is, a cadet must pass in both his military and academic studies to graduate from the College. He must also meet the standards required in the qualities of leadership.

The military curriculum is common for all cadets. It is planned to achieve the best balance between the short-term requirements of a junior regimental officer and the broader foundation necessary for those who will progress to the higher ranks of the Army.

Each cadet follows one of the three academic courses, Arts, Applied Science or Engineering to qualify for the award of a degree in military studies by the University of New South Wales.

The Degrees of BA/Mil/ and BSc/Mil/ of the University New South Wales

These are new degrees of the University which are to be awarded to students in the Faculty of Military Studies who qualify in the prescribed courses. The degree of Bachelor of Arts in Military Studies (BA(Mil)) applies to the Arts Course, and the degree of Bachelor of Science in Military Studies (BSc(Mil)) to both the Applied Science and Engineering Courses.

The first students were enrolled in the Faculty in 1968, and the degrees will be awarded by the University for the first time in 1971.

Educational Qualifications for Entry to the Royal Military College in 1971

To be eligible for entry to the Royal Military College, a Candidate must satisfy the matriculation requirements of the University of New South Wales. He must also meet the faculty requirements of the Faculty of Military Studies, which are:

for the Art Course:[1]

English at Level 2 or higher;

OR

English at Level 3, provided that a candidate's performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board, and provided that a candidate so qualified shall not enrol in a course of English literature.

[1] Candidates should be aware that the Arts Course contains a compulsory science subject requiring a knowledge of mathematics and it is therefore preferable that Arts candidates should have successfully completed at least four years of secondary school mathematics.

for the Applied Science and Engineering Courses:

(a) Science at Level 2S or higher

AND

(b) either Mathematics at Level 2F or higher;

OR

Mathematics at Level 2S, provided that a candidate's performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board.

The Military Curriculum

The Military Curriculum

Allotment of Military Periods

Subject	*Class*			
	4	*3*	*2*	*1*
Armour	..	..	..	92
Army Health	23	..	..	16
Artillery	..	..	..	97
Character Training	9	7	29	7
Current Affairs	16	22	24	22
Drill and Ceremonial	82	24	32	32
Infantry Minor Tactics	39	38	67	118
Leadership	..	..	..	28
Military Engineering	..	61	34	21
Military Law	..	29	..	65
Organisation and Methods of Instruction	..	..	..	91
Orientation	30	..	..	..
Peace Administration	..	..	..	87
Physical and Recreational Training	93	45	38	48
Service Etiquette	3	..	..	3
Signals	..	35	46	28
Staff Duties, Training and Intelligence	..	6	..	192
Tactics	..	..	..	339
Topography	35	28	53	54
War Administration	..	..	..	43
Weapon Training	98	89	65	145
Jungle Training Centre Course	..	..	..	156
Reserved Periods	71	15	13	131
Total	499	399	401	1,815
Field Training	Two weeks			

Scope of Military Instruction

FOURTH CLASS

The cadet is instructed in the basic skills to bring him to a level where he will derive the maximum benefit from the Annual Field Training. He receives an introduction to other general military subjects and the importance of leadership is stressed. The first 5 weeks of the Fourth Class is devoted entirely to military work. The first 4 weeks of this period is spent in orientation training where cadets are introduced to army life. The last 2 weeks of the year are spent in the field with the remainder of the Corps of Staff Cadets.

THIRD CLASS

The cadet is brought to the standard of a trained soldier. He continues his study of general military subjects and in addition he begins training in certain aspects of arms other than infantry.

SECOND CLASS

The cadet is trained to the standard of an infantry section commander and introduced to the responsibilities of a platoon commander. More work is undertaken in general military subjects and instructional technique. The cadet continues training in certain aspects of arms other than infantry.

FIRST CLASS

Training towards the level of platoon commander continues. The cadet receives further experience in instructional technique. He continues his study of general military subjects and begins his study, at junior officer level, of Tactics and associated subjects and Peace Administration. The first class cadet is also introduced to the important Arms studies of Armour, Artillery and Signals. They undergo a course of instruction at the Jungle Training Centre during the year.

Armour

Class	*Periods*
1	92

AIM

To give cadets the knowledge of the organisation, roles and employment of armoured units to the standard required by a junior regimental officer of an infantry battalion.

SYLLABUS

The capabilities and limitations of armoured fighting vehicles; infantry/tank co-operation, with emphasis on target indication; the organisations, characteristics and roles of armoured units. A study of troop and squadron tactics. The cadet visits RAAC units at Puckapunyal.

The combination of a formal study period, tactical exercises without troops and practical application of infantry/tank co-operation is designed to familiarise the cadet with the characteristics of armoured equipments and their tactical employment.

Army Health

Class	*Periods*
4	23
1	16

AIM

To instruct cadets in first aid and in the application of the principles of army health in peace and war.

SYLLABUS

Fourth Class

The cadet undergoes a St John's Ambulance First Aid course and is awarded the St John's First Aid Certificate if he is successful. In addition he receives lectures on personal hygiene and sanitation in the field.

First Class

Medical aspects of water supply and food supply; communicable diseases; tropical diseases and the effects of heat; management of battle casualties; responsibilities of regimental officers and medical officers for the health of troops; health lessons from past campaigns; Pulheems system of medical classification; dental health; health aspects of camps and barracks.

The course is designed to equip the cadet with the knowledge of army health required by the junior regimental officer.

Artillery

Class	*Periods*
1	97

AIM

To give cadets the knowledge required of a junior regimental officer in an arm other than artillery, relating to the organisation, roles and employment of artillery units in the Division and of selected units from Army Troops.

SYLLABUS

The cadet is instructed in the tactical aspects of gunnery and introduced to some practical aspects of field gunnery so that he will appreciate the capabilities and limitations of artillery.

Tactics

Organisation of artillery; characteristics and roles of field branch artillery and its command and control, including counter battery. An outline of the components, organisation and employment of air defence artillery. The tactical employment of artillery sub-units in support of an infantry battalion, including fire planning, is taught in association with tactics.

Technical

Basic gunnery, including an appreciation of the problems at the guns and observation and control of fire. Training culminates in a four day continuous artillery exercise. Troops and equipment of the Royal Regiment of Australian Artillery form an exercise battery in which cadets fill certain executive appointments. The exercise is one of movement, deployment and firing with live ammunition.

Character Training

Class	*Periods*
4	9
3	7
2	29
1	7

AIM

(*a*) To give each cadet a foundation on which to build and strengthen his character by setting up standards and principles of conduct which will make it possible for him to grapple with the problems and difficulties of service life.

(*b*) To assist each cadet to develop those qualities of leadership required for his profession.

SYLLABUS

The syllabus is designed to foster a more mature understanding of and the practical application of basic religious principles. It is necessarily flexible and may be varied from time to time.

Basic instruction is designed to assist the cadet to adjust himself to his new environment, and to encourage him in the continued practice of his religion. Further instruction is designed to instil in the cadet a sense of moral responsibility and to encourage him to maintain and develop his personal qualities.

The Second Class is given a specia'' ed Character Training Course based on the Ten Commandments as a way of life.

Current Affairs

Class	*Periods*
4	16
3	22
2	24
1	22

AIM

To assist the cadet to understand the background to current events throughout the world, especially in those areas of interest to Australia, and to develop by discussion and debate, the cadet's own thoughts about current defence problems.

SYLLABUS

Fourth Class

Indo-China—the political, social and economic history and current situation. Debates on current situations.

Third Class

Thailand, Malaysia—the political, social and economic history and current situations. Debates on current situations.

Second Class

Indonesia, New Guinea—the political, social and economic history and current situation. Debates on current situations.

First Class

Japan—the political, social and economic history and current situation. Debates on current situations.

Drill and Ceremonial

Class	*Periods*
4	82
3	24
2	32
1	32

AIM

To ensure that a high standard of drill is achieved by individual cadets and by the Corps and that each cadet on graduation is competent to perform the duties of a regimental officer with respect to drill instruction and ceremonial parades.

SYLLABUS

Fourth Class

Squad drill with and without arms, words of command, compliments, sentry drill, platoon drill, guards of honour, cane drill, funeral exercises with the rifle, elementary ceremonial, participation in ceremonial parades.

Third Class

Revision of the instruction in the Fourth Class, guards and sentries, words of command, exercising squads, company drill, participation in ceremonial parades.

Second Class

Revision of previous instruction, company drill, advanced ceremonial rifle, colour and sword drill, participation in ceremonial parades.

First Class

Revision of the more advanced drill. Lectures on advanced ceremonial. Honours and salutes, flags and flag stations, guards of honour, street lining, military bands, *feu de joie,* administrative instructions for ceremonial parades. Participation in ceremonial parades.

Infantry Minor Tactics

Class	*Periods*
4	39
3	38
2	67
1	118

First Class course at JTC

AIM

To teach the cadet the minor tactics, skills and techniques required to command an infantry platoon.

SYLLABUS

Organisation of an infantry platoon. Use of weapons and equipments under field conditions.

The instruction is conducted in the field and is confirmed by the cadets participation in the annual training exercise.

Battle procedure. Employment of an infantry platoon in the attack, defence and withdrawal phases of war. Patrolling, Counter Revolutionary operations. Exercises are conducted to confirm all minor tactics training and to practise cadets in the command of sections, platoons and patrols.

Three weeks are spent at the Jungle Training Centre, Canungra, where cadets learn jungle warfare technique; contact/ambush drills, counter MT ambush, harbouring, section and platoon attacks, patrolling, village cordon and search, withdrawal.

First Class cadets are employed to command and instruct the junior classes during the first week of the annual training exercise.

Leadership

Class	*Periods*
1	28

AIM

To develop the qualities of leadership which are essential in a regimental officer and to prepare a cadet for the problems he will encounter in leading men, especially during his early commissioned service.

SYLLABUS

The meaning of leadership; the characteristics which make a good leader.

Practical problems which a young officer may encounter in leading a group of men, and their possible solutions. Soldiering in a regular unit; morale; courage; liberty and discipline; the day to day duties and responsibilities of a junior regimental officer.

Military Engineering

Class	*Periods*
3	61
2	34
1	21

AIM

To make the cadet proficient in those aspects of military engineering required by a junior regimental officer in any arm.

SYLLABUS

Third Class

Use, operation and maintenance of assault boats with and without outboard motors and related topics. Knots and lashings; construction of an aerial rope-way. Construction of improvised tracks and beach heads.

Second Class

Revision of current mines and mechanisms; mine laying drills; mine field breaching; reconnaissance planning and management of engineer tasks.

First Class

Organisation, characteristics and roles of the divisional engineers; employment of engineers; engineer operations. Theory of explosives; service explosives and accessories; firing small charges; battle noise simulation; safety.

In addition the cadet attends a one week course at the School of Military Engineering which covers: mine warfare and booby-traps, the theory of explosives and services explosives and accessories, firing of small charges, safety, tunnel warfare, a demonstration of current engineer plant and a demonstration of current gap-crossing equipment and an introduction to NBC warfare.

Military Law

Class	*Periods*
3	29
1	65

AIM

To instruct the cadet in the principles of military law, and to provide him with the practical knowledge of this subject required by a junior officer.

SYLLABUS

Third Class

The cadet is instructed on the foundations and principles of military law, its application and administration within the College. Subjects include: offences, evidence, summary punishments, redress of wrongs, courts of enquiry and boards.

First Class

Courts martial procedure; National Service Act; Geneva Convention; Visiting Forces Act; International Law.

Organization and Methods of Instruction

Class 1 *Periods* 91

AIM

To introduce the cadet to the techniques of Instruction and to provide him with the practical knowledge of this subject required by a junior regimental officer.

SYLLABUS

The cadet is introduced to the theoretical and practical aspects of instruction. In addition he participates in a Communication and Thinking series which includes the art of public speaking and debating.

(*a*) The five stages of instruction.
(*b*) The science of instruction.
(*c*) Preparation of the syllabus and training programme.
(*d*) Medium of instruction.
(*e*) Assessment.
(*f*) Training aids.
(*g*) Communication and thinking skills.
(*h*) Mutual instruction.

Orientation

Class 4 *Periods* 30

AIM

To introduce the new entry cadet to those traditions, customs and administrative procedures which will assist him in taking his place as a member of the Corps of Staff Cadets.

SYLLABUS

History, traditions, customs and outline organisations of the Army and the Royal Military College; Administrative procedures; Routine at the College; Ranks of the three services; the CSC Mess and Introduction to Canberra.

The course is designed to assist in the cadets' transition into the environment at the Royal Military College. The instruction is completed prior to the commencement of the academic year.

Peace Administration

Class 1 *Periods* 87

AIM

The aim of Peace Administration is to instruct, and practice cadets in those aspects of administration which will concern them as junior regimental officers.

SYLLABUS

Duties and Responsibilities of Unit Staffs

'A' Administration. Introduction to peace administration, personnel accounting, enlistment of recruits, disposal of recruits, regimental and personal documents, group classification system, reposting, transfer, JOBEX, promotion-officers, promotions, leave, movements, removals, discharge, re-engagement, investigations, illegal absentees, resettlement, medical documentation, AUSDIL and NOTICAS, investigations, injuries, AHBS, CARO, DFRBF, welfare policy, organisations, morale, educational, medical, physical and recreational, hire purchase, recruiting, National Service Act, officers' and sergeants' messes, PMF pay system, pay and allowances, pay procedure, military finance and wills.

'Q' Administration. Barrack maintenance, RAASC supplies-rations, RAASC supplies-transport and POL, stores accounting-introduction, documents and forms, unit stores account, issue, write off, transfer, E2, E2C accounting, investigations, boards of survey, internal 'Q' checking, internal 'A' checking, ammo accounting, stocktake and spot checks, stocktake exercise, security, duties of orderly officer, 'Q' preparations for exercises, operations of unit orderly room, 'Q' preparation for overseas service.

Unit Finance. The bookkeeping of mess monies, unit public monies and regimental funds.

New Zealand cadets receive separate instruction.

Physical and Recreational Training

Class	*Periods*
4	93
3	45
2	38
1	48

AIM

Physical Training at RMC is designed:

(a) To bring all cadets to a high standard of physical fitness in the first training year.

(b) To maintain a high standard of 'all round' physical fitness and develop purposeful military skills progressively through the remaining three years of the course

(c) To give cadets a wide basic knowledge of physical and recreational training so that they are prepared on graduation to perform the duties of a regimental officer in this regard.

SYLLABUS

Fourth Class

Recruit physical training, gymnastics, swimming instruction, minor team games, endurance training, obstacle course training, weight and circuit training, basic boxing instruction and testing in all subjects

Third Class

Battle physical training, gymnastics, swimming instruction, obstacle course training, minor team games and potted sports, end of term tests and weight and circuit training.

Second Class

Battle physical training, gymnastics, swimming instruction, obstacle and endurance training, lectures, theory and application of physical training and sports organisation, close combat and end of term tests.

First Class

Battle physical training, gymnastics, physical training theory, sports organisation, obstacle and endurance training, swimming instruction, close combat, end of term tests and Battle PT tests.

Service Etiquette

Class	*Periods*
4	3
1	3

AIM

To instruct cadets on those points of manners and etiquette which make for ease and pleasantness in any company, and to make them familiar with mess customs and procedures.

SYLLABUS

The syllabus is designed to make cadets aware of their social responsibilities both within and outside of the service.

Fourth Class

Dinner table etiquette; methods of address; rules for introductions; social obligations; correspondence, customs of the service.

First Class

Mess customs and procedures, social correspondence.

Signals

Class	*Periods*
3	35
2	46
1	28

AIM

(a) To teach the skills and techniques of signalling required by a junior regimental officer.

(b) To teach the organisation, roles and employment of Signals units within the division to the level required of a junior regimental officer in any other Arm or Service.

SYLLABUS

Third Class

Instruction in and operation of the PRC–F1 and the AN/PRC–25. Instruction in and practice of radio-telephone procedure for users.

Second Class

Revision and further instruction on the characteristics and operation of the PRC–F1, GRC–F2, AN/PRC–64, AN/PRC–25 and AN/GRC–125.

Instruction on and practical experience in the operation of the VHF retransmission kit, remote control and direction finding equipment.

Instruction in the propagation of HF and VHF radio waves and antenna systems leading to the resultant choice of equipment, antenna, frequency and site for a given task. Instruction and practical experience in the installation, operation and maintenance of basic field telephone systems, including the operation of man-portable telephone switchboards and the location and repair of line faults.

Brief revision in radio-telephone procedure and instruction in the use of the current radio-telephone codes.

First Class

Organisation of the Royal Australian Corps of Signals. The responsibilities of Signals. The principles and means of communications. Electronic Warfare and Communications Security. Communications in tropical areas. Organisation of the divisional signals regiment, task force signal squadron and tactical air support signal squadron. In addition signals aspects of tactical problems are included in Tactics. A brief introduction to the mechanics of signals centre operation is given.

Staff Duties, Training and Intelligence

Class	*Periods*
3	6
1	192

AIM

To provide the cadet with sufficient knowledge of Staff Duties, Training and Intelligence to fit him for a junior regimental appointment on graduation and to prepare him for a subsequent junior staff appointment.

SYLLABUS

Third Class

An introduction to the organisation of the Australian Military Forces. Introduction to service writing.

First Class

Organisations within the division; service writing; orders and instructions; appreciation and decision making; operational staff work; intelligence organisations and procedures; the preparation and conduct of various types of training exercises; road movement.

Tactics

Class	*Periods*
1	339

AIM

To provide the cadet with the technical knowledge required by a junior regimental officer in an infantry battalion and an appreciation of the all arms aspects of modern warfare.

SYLLABUS

The detailed organisation of an infantry battalion, its characteristics and roles; and introduction to tactics; enemy organisations and tactics; battle procedure and deployment; attack; defence; withdrawal; advance and counter-revolutionary operations; tropical warfare; other specialised techniques; field training covering all phases of war, in which the First Class cadets fill the key appointments in a battalion group organisation.

Topography

Class	*Periods*
4	35
3	28
2	53
1	54

AIM

To teach and practise the cadet in:

(a) The principles of map and air photo reading.

(b) Position finding and navigation by day and night in open and close country.

SYLLABUS

Fourth Class

Introduction to map reading, the use of a map, grid references and north points, the service protractor, conversion of bearings, the prismatic compass, relief and its representation, gradients, intervisibility, orientation and position finding.

Third Class

Revision of the Fourth Class syllabus; navigation exercises by day and night; position finding; map and ground comparison.

Second Class

Preparation and use of Navigational Data Sheets; route planning; position finding; map and ground comparison. Instruction is confirmed in a reconnaissance patrol exercise conducted in difficult terrain by day and night.

War Administration

Class	*Periods*
1	43

AIM

(a) To give the cadet an understanding of maintenance in the field and the functions of the major services as they affect the tactical handling of an infantry battalion.

SYLLABUS

Principles of administration; administration in the infantry battalion. Administration within the division—supplies and transport, medical, ordnance, repair and recovery and miscellaneous services; administration in a tropical theatre of operations; supply and movement by air. In addition to the periods shown, a number of Tactics periods are devoted to the application of administrative knowledge to the indoor and outdoor exercises.

Weapon Training

Class	*Periods*
4	98
3	89
2	65
1	145

AIM

(a) To make the cadet proficient in the use of the weapons of a rifle company and to give him a general knowledge of the weapons of the support company and their tactical employment.

(b) To give the cadet the knowledge and experience on all aspects of the organisation of Weapon Training and conduct of range practices necessary for a junior regimental officer.

SYLLABUS

Fourth Class

Weapons; self-loading rifle, automatic rifle, general purpose machine gun, sub-machine gun and grenades. Fieldcraft and target detection. Range practices to qualify at the Recruit Qualification Practice.

Third Class

Weapons; revision on self-loading rifle, general purpose machine gun, sub-machine gun and grenades. Instruction and field firing of the launcher grenade, light anti-tank weapon and an introduction to the M16 rifle. Annual range qualification at the Recruit Qualification Practice. Instruction and live firing of the fragmentation, white phosphorus and smoke grenades.

Second Class

Weapons; revision on self-loading rifle, general purpose machine gun, sub-machine gun, grenade launcher and light and medium anti-tank weapon. Service pistol; revision of grenades; annual range qualification at the Recruit Qualification Practice; introduction to night firing and continues his instruction in field craft.

First Class

The medium mortar; organisation and employment of the mortar platoon, characteristics of mortar fire, communications in battle, fire orders and command post procedure. Battle shot weapon training is completed with sneaker course, battle practice night shooting and section firing practice. During the year cadets are required to organise and conduct range practices using all rifle company weapons.

Field Training

AIM

The aim of field training is to exercise cadets under simulated operational conditions over a prolonged period.

SYLLABUS

General

Field training is conducted in two phases:

Phase 1. Preparatory phase for one week comprising section, platoon and company training, under First Class supervision.

Phase 2. Field exercise with cadet appointments comparative to their standard of training. This exercise is of one week's duration and covers all major phases of war.

Fourth Class

The class is exercised at recruit soldier standard. All phases of war are covered with the cadet taking part as a reinforcement soldier trained to recruit level.

Third Class

The class is exercised at trained soldier standard. All phases of war are covered with the cadet taking part as a trained soldier with particular responsibilities for sponsoring the cadets of the Fourth Class.

Second Class

The cadets are exercised at section commander level.

Depending upon his posting the Second Class cadet is exercised as section leader, specialist platoon detachment leader, signalman, clerk, etc. Thus he is given considerable insight into the workings of a battalion under operational conditions.

First Class

The class is exercised essentially at platoon commander level, but as far as possible each cadet is given an officer non-commissioned officer posting in a position most appropriate to his allocated corps on graduation. All phases of war are covered with particular emphasis being placed on leadership and command, and problems are posed that require the practical application of all military studies covered during the four-year course. As a preliminary to the annual field training exercise, the First Class cadets are exercised in a signals or headquarters exercise at battalion/company level.

Courses For The Degrees of Bachelor of Arts in Military Studies and Bachelor of Science in Military Studies of The University of New South Wales

The University of New South Wales

Faculty of Military Studies

Rules governing the award of the degree of Bachelor of Arts in Military Studies

These rules apply to all students who enrol as first year students in 1971 or in subsequent years and, in respect of Rule 4, to students who enrol as third-year students in 1971 and 1972.

1. The degree of Bachelor of Arts in Military Studies shall be conferred as a Pass Degree.

2. No person shall be permitted to enrol in any qualifying course for the degree of Bachelor of Arts in Military Studies at the same time as he is enrolled for any other degree or diploma in this University or elsewhere.

3. Where, in the following Clauses, reference is made to the requirement that a candidate shall complete a course, the requirement shall be construed as meaning that the candidate shall:

(a) Attend such lectures, seminars and tutorials as may be prescribed in that course;

(b) Perform satisfactorily in such exercises, laboratory work, essays and thesis (if any) as may be prescribed in that course; and

(c) Pass the examination or examinations in that course.

4. A candidate may not enrol in Course II of a subject until he has completed Course I of that subject; and a candidate may not enrol in Course III of a subject until he has completed Course II of that subject, except that a candidate who has completed Government I and History I and History II may enrol in Government III.

5. A candidate for the degree of Bachelor of Arts in Military Studies shall be required to complete both the academic requirements of the degree, as specified in Clause 7, and the military requirements of the degree, as specified in Clause 8.

6. The academic requirements specified in Clause 7 shall be completed over the first three years of the candidate's course and the military requirements specified in Clause 8 shall be completed over all four years of the candidate's course. In special circumstances, an extension of time of one year may be granted to a candidate in which to complete either or both of the academic and military requirements.

7. *Academic Requirements*—The following qualifying courses shall be completed:

(a) The course English Language, and the two courses History I and History II, as specified in Schedule A1.

(b) One of the courses specified in Schedule A2.

(c) Six of the courses specified in Schedule A3 so chosen as to constitute either

(i) Courses I, II and III of each of two subjects,
or

(ii) Courses I, II and III of one subject
and
Course I and II of one other subject
and
Course I of a third subject;
OR, ALTERNATIVELY:

The course History III as specified in Schedule A1, and five of the courses specified in Schedule A3 so chosen as to constitute either

(i) Course I, II and III of one subject
and
Courses I and II of one other subject,

(ii) Courses I and II of each of two subjects
and
Course I of one other subject.

Subject to his complying with Rule 4, a candidate who completes Government I and Government III will be deemed to have completed Courses I and II of one subject within the provisions of Rule 7 (c).

8. *Military Requirements*—A candidate shall complete the programme of training in the military requirements as set out in Schedule M.

SCHEDULE A1

Subject	*Course*	
English	1551	English Language
History	1405	History I
	2407	History II
	3407	History III

SCHEDULE A2

Subject	*Course*	
Chemistry	1305	Chemistry I
Physics	1203	Physics I
Science	1805	Science IA

SCHEDULE A3

Subject	*Course*	
Economics	1607	Economics I
	2603	Economics II
	3603	Economics III
English	1507	English I
	2507	English II
	3507	English III
Geography	1651	Geography I
	2651	Geography II
Government	1625	Government I
	2625	Government II
	3625	Government III
Mathematics	1103	Mathematics I
	2113	Mathematics II
	3113	Mathematics III

Programmes of study for the degree of BA (Mil)

First Year (*Fourth Class*)

All candidates take History I, a Science unit, and Course I of two of the following subjects: Economics, English, Geography, Government, Mathematics.

Second Year (*Third Class*)

All candidates take History II, English Language and Course II of one of the subjects begun in First Year. In addition they have the choice of

either (a) Course II of the other subject begun in First Year
or (b) Course I of another subject.

Third Year (*Second Class*)

All candidates have the choice of

(a) Course III of two subjects done in the previous two years;[1]

or (b) Course III of a subject done in the previous two years together with Course II of a subject previously begun;

or (c) Course III of a subject done in the previous two years together with Course I of another subject.

[1] Government III may be taken by students who have completed Government I and II *or* Government I and History I and II.

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Rules governing the award of the degree of Bachelor of Science in Military Studies

APPLIED SCIENCE COURSE

These rules apply to all students who enrolled for the first time in 1968 or in subsequent years. Faculty may, however, determine special programmes for students who enrolled for the first time in 1968.

1. The degree of Bachelor of Science in Military Studies shall be conferred as a Pass Degree.

2. No person shall be permitted to enrol in any qualifying course for the degree of Bachelor of Science in Military Studies at the same time as he is enrolled for any other degree or diploma in this University or elsewhere.

3. Where, in the following Clauses, reference is made to the requirement that a candidate shall complete a course, the requirement shall be construed as meaning that the candidate shall:

(a) Attend such lectures, seminars and tutorials as may be prescribed in that course;

(b) Perform satisfactorily in such exercises, laboratory work, essays and thesis (if any) as may be prescribed in that course; and

(c) Pass the examination or examinations in that course.

4. A candidate may not enrol in Course II of a subject until he has completed Course I of that subject; and a candidate may not enrol in Course III of a subject until he has completed Course II of that subject.

5. A candidate for the degree of Bachelor of Science in Military Studies shall be required to complete both the academic requirements of the degree, as specified in Clause 7, and the military requirements of the degree, as specified in Clause 8.

6. The academic requirements specified in Clause 7 shall be completed over the first three years of the candidate's course and the military requirements specified in Clause 8 shall be completed over all four years of the candidate's course. In special circumstances, an extension of time of one year may be granted to a candidate in which to complete either or both of the academic and military requirements.

7. *Academic Requirements.* The following qualifying courses shall be completed:

(a) The courses English A, English B and History C, as specified in Schedule S1.

(b) The courses Chemistry I, Chemistry II, Mathematics I, Mathematics II, Physics I, and Physics II, as specified in Schedule S2.

(c) One of the courses Chemistry III, Mathematics III and Physics III, as specified in Schedule S2.

(d) One or two of the courses specified in Schedule S3, to provide a third year combination with the course elected as specified in Clause 7 (c); this combination, which must be approved by the Dean of the Faculty, may consist of:

(i) Chemistry III and Mathematics IIIA
or Chemistry III and Physics IIIA
or Chemistry III and Mathematics IIIB and Physics IIIB

OR

(ii) Mathematics III and Chemistry IIIA
or Mathematics III and Physics IIIA
or Mathematics III and Chemistry IIIB and Physics IIIB

OR

(iii) Physics III and Chemistry IIIA
or Physics III and Mathematics IIIA
or Physics III and Chemistry IIIB and Mathematics IIIB

8. *Military Requirements*—A candidate shall complete the programme of training in the military requirements as set out in Schedule M.

SCHEDULE S1

Subject	*Course*	
English	1521	English A
	2521	English B
History	1413	History C

SCHEDULE S2

Subject	*Course*	
Chemistry	1305	Chemistry I
	2303	Chemistry II
	3303	Chemistry III
Mathematics	1103	Mathematics I
	2103	Mathematics II
	3103	Mathematics III
Physics	1203	Physics I
	2203	Physics II
	3203	Physics III

SCHEDULE S3

Subject	*Course*
Chemistry	3303A Chemistry IIIA 3303B Chemistry IIIB
Mathematics	3103A Mathematics IIIA 3103B Mathematics IIIB
Physics	3203A Physics IIIA 3203B Physics IIIB

Programme of Study for the Degree of BSc (Mil)

APPLIED SCIENCE COURSE

Year I	*Year II*
Chemistry I	Chemistry II
Mathematics I	Mathematics II
Physics I	Physics II
Historic C	English A

Year III

Chemistry III and Mathematics IIIA
or Chemistry III and Physics IIIA
or Chemistry III and Mathematics IIIB and Physics IIIB

OR

Mathematics III and Chemistry IIIA
or Mathematics III and Physics IIIA
or Mathematics III and Chemistry IIIB and Physics IIIB

OR

Physics III and Chemistry IIIA
or Physics III and Mathematics IIIA
or Physics III and Chemistry IIIB and Mathematics IIIB

and

English B

Rules governing the award of the Degree of Bachelor of Science in Military Studies

CIVIL, ELECTRICAL AND MECHANICAL ENGINEERING COURSES

These rules apply to all students who enrolled for the first time in 1968 or in subsequent years.

1. The degree of Bachelor of Science in Military Studies shall be conferred as a Pass Degree.

2. No person shall be permitted to enrol in any qualifying course for the degree of Bachelor of Science in Military Studies at the same time as he is enrolled for any other degree or diploma in this University or elsewhere.

3. Where, in the following Clauses, reference is made to the requirement that a candidate shall complete a course, the requirement shall be construed as meaning that the candidate shall:

(a) Attend such lectures, seminars and tutorials as may be prescribed in that course;

(b) Perform satisfactorily in such exercises, laboratory work, essays and thesis (if any) and visits to industry as may be prescribed in that course; and

(c) Pass the examination or examinations in that course.

4. Generally a candidate will be required to complete all the subjects prescribed in a year of the course before his enrolment will be accepted for any subject prescribed in a later year of the course; in exceptional circumstances, the Professor of Engineering may permit this requirement to be varied, but in no circumstances may a candidate enrol for any subject before all prerequisite subjects have been completed.

5. A candidate for the degree of Bachelor of Science in Military Studies shall be required to complete both the academic requirements of the degree, as specified in Clause 7, and the military requirements of the degree, as specified in Clause 8.

6. The academic requirements specified in Clause 7 shall be completed over the first three years of the candidate's course and the military requirements specified in Clause 8 shall be completed over all four years of the candidate's course. In special circumstances, an extension of time of one year may be granted to a candidate in which to complete either or both of the academic and military requirements.

7. *Academic Requirements*—The candidate shall complete in the years prescribed the qualifying courses pertaining to the particular branch of engineering as set out in Schedules E1, E2 and E3.

8. *Military Requirements*—The candidate shall complete the programme of training in the military requirements as set out in Schedule M.

SCHEDULE E1

THE CIVIL ENGINEERING COURSE

First Year (*Common to all Engineering*)		*Contact hours per week* Term I	Term II	Term III
1105	Mathematics I	6	6	6
1203	Physics I	6	6	6
1303	Chemistry	3	3	..
1705	Engineering IE	7	7	10
1521	English A	2	2	2
		24	24	24

Second Year		*All Terms*
2173	Mathematics	4
2709	Materials	4
2711	Mechanics and Computations	6
2721	Civil Engineering I	7
2723	Surveying	3
1413	History C	1
		25

Third Year		Term I	Term II	Term III
3725	Civil Engineering IIA	10	10	$10\frac{1}{2}$
3727	Civil Engineering IIB	10	10	$9\frac{1}{2}$
3769	Technical Communication	2	2	2
3741	Electrical Technology	4	4	4
		26	26	26

SCHEDULE E2

THE MECHANICAL ENGINEERING COURSE

First Year (*Common to all Engineering*)		*Contact hours per week* Term I	Term II	Term III
1105	Mathematics I	6	6	6
1203	Physics I	6	6	6
1303	Chemistry	3	3	..
1705	Engineering IE	7	7	10
1521	English A	2	2	2
		24	24	24

Second Year

		All Terms
2173	Mathematics	4
2709	Materials	4
2711	Mechanics and Computations	6
2763	Mechanical Engineering I	7
2701	Design	3
1413	History C	1
		25

Third Year

3741	Electrical Technology	4
3765	Mechanical Engineering II	10
3767	Mechanical Engineering III	10
3769	Technical Communication	2
3700	General Studies	*
		26

SCHEDULE E3

THE ELECTRICAL ENGINEERING COURSE

First Year

	(*Common to all Engineering*)	*Contact hours per week*		
		Term I	*Term II*	*Term III*
1105	Mathematics I	6	6	6
1203	Physics I	6	6	6
1303	Chemistry	3	3	. .
1705	Engineering IE	7	7	10
1521	English A	2	2	2
		24	24	24

Second Year

		All Terms
2103	Mathematics II	7
2203	Physics II	8
2713	Materials	3
2745	Electrical Engineering I	6
1413	History C	1
		25

Third Year		*Contact hours per week*
Term I		
6031	Electrical Engineering III	16
5661	Mechanical Engineering III	3
5062	Technical Communication	2
	General Studies	4
		25
Terms II and III		
3747	Electrical Engineering II	11
3749	Electrical Engineering III	9
2765	Mechanical Engineering	4
3769	Technical Communication	2
		26

Military requirements for the degrees of Bachelor of Arts in Military Studies and Bachelor of Science in Military Studies

SCHEDULE M

1. All candidates for either degree shall undertake a common programme of training in the subjects listed under the broad headings of Military Art, Military Science and Military Technology and the programme shall extend over four years.

2. During each of the first three years, the requirements of the programme shall, in the main, be completed in a four-week period prior to the commencement of the academic year and in a three-week period after the end of that academic year. Physical education and military drills, however, shall extend over the whole of these four and three weeks periods and the 30 week academic year.

3. The fourth year shall be devoted entirely to the military training programme and shall extend over a period of 44 weeks.

4. The individual subjects contained in the programme of military requirements are:

(a) *Military Art*

(i) Physical Education—Theory of physical training applied to physical endurance, battle efficiency, general gymnastics and sport.

(ii) Military Law—History, principles and practices of Military Law.

(iii) Military Administration—Personnel, stores and finance in a theatre of operation; a study of logistical support.

(iv) Tactics—A study of the defence, withdrawal and attack phases of war and counter-revolutionary operations.

(v) Organisation and Management—Staff duties, training and intelligence.

(b) *Military Science*

(i) Arms Training—A detailed study of weapons support and facilities available from various branches of the army—armour, artillery and nuclear support, army aviation, military engineering, signals.

(ii) Topography—An advanced study of the principles of map and airphoto reading, position finding and navigation.

(iii) Field Projects—The application of the principles of tactics to the command of an infantry platoon; field exercises.

(iv) Military Experience—Attachment to a training unit to obtain practical military experience.

(c) *Military Technology*

(i) Military Weapons—Design, operation and maintenance of infantry weapons, fire power of current Army weapons.

(ii) Research and Development—Preparatory lectures and directed reading—visits and attachments to Research and Development establishments, Army Design Establishment, selected research institutions and industries.

Subjects offered by the Faculty of Military Studies

The courses detailed in the pages that follow are grouped under the Departments in the Faculty of Military Studies, namely:

Chemistry
Engineering
Government and Economics
History
Language & Literature
Mathematics
Physics.

Each course is given an index number of four figures. The first figure indicates the year in which the course is first presented. The second indicates the Department responsible for the course: 1—Mathematics, 2—Physics, 3—Chemistry, 4—History, 5—Language & Literature, 6—Government and Economics, 7—Engineering; 8 is used for *Science IA*, which is presented jointly by Physics and Chemistry. The third and fourth figures are serial numbers allotted by the Department concerned.

Department of Chemistry

1303 Chemistry

Lectures 30 hr
Laboratory 30 hr

LECTURE COURSE

(a) *Atomic and Molecular Structure*

Sub-atomic particles; electron arrangements in atoms; periodic classification; ionic and covalent structures; hydrogen bonds; van der Waal forces; crystal structures of metals and simple salts; relationships between physical properties and structure.

(b) *Thermochemistry and Kinetics*

Heats of reaction; activation energy; rates of reaction; bond energies and heats of formation; the combustion of hydrocarbons.

(c) *Macromolecules*

Basic organic chemistry and silicate chemistry; structures and properties of organic polymers, natural silicates and silicones.

(d) *Electrochemistry*

Voltaic cells; electrode potentials; redox reactions.

LABORATORY COURSE

Exercises designed to supplement the lecture course and introduce instrumental methods of analysis.

RECOMMENDED TEXTS

Sisler, *Electronic Structure, Properties and the Periodic Law,* Reinhold, 1963.

Ryschkewitsch, *Chemical Bonding and the Geometry of Molecules,* Reinhold, 1963.

Van Vlack, *Elements of Materials Science,* Addison-Wesley, 1959.
Sisler, Van der Werf & Davidson, *College Chemistry,* Macmillan, 1967.

1305 Chemistry I

Lectures 84 hr
Tutorial 28 hr
Laboratory 84 hr

LECTURE COURSE

(a) *Atomic and Molecular Structure*

Sub-atomic particles; electron arrangements in atoms and the periodic classification; molecular and crystal structure; property-structure relationships.

(b) *Periodic Classification*

Comparative chemistry of selected groups of elements.

(c) *Stoichiometry and Thermochemistry*

The mole concept; measures of concentration; conservation laws; redox reactions; heat of reaction; heat of formation; bond energies; activation energy.

(d) *Chemical Equilibrium*

Qualitative and quantitative aspects of reversible reactions; ionisation constants; pH; acid-base indicators, titration curves; buffer solutions; formation constants; solubility products.

(e) *Electrochemistry*

Voltaic cells; electrode potentials; commercial batteries; redox titrations. Electrolysis reactions; factors which determine the discharge of ions.

(f) *Phase Equilibria*

Changes of state; vapour pressure; critical phenomena; colligative properties; types of solutions.

(g) *Organic Chemistry*

An introduction to the chemistry of aliphatic and aromatic hydrocarbons and their simple halide, oxygen and nitrogen derivatives.

LABORATORY COURSE

Exercises introducing chemical techniques and supplementing the lecture course.

RECOMMENDED TEXTS

Sisler, Van der Werf and Davidson, *College Chemistry,* Macmillan, 1967.

Schaum, *Theory and Problems of College Chemistry,* 5th ed., Schaum Publishing Co., 1966.

Sisler, *Electronic Structure, Properties and the Periodic Law,* Reinhold, 1963.

Ryschkewitsch, *Chemical Bonding and the Geometry of Molecules,* Reinhold, 1963.

Barrow et al, *Understanding Chemistry,* Benjamin, 1967.

Aylward and Findlay (ed.), *Chemical Data Book,* 2nd ed., Wiley, 1966.

Morrison and Boyd, *Organic Chemistry,* 2nd ed., Allyn and Bacon, 1966.

Banks, *Naming Organic Compounds,* Saunders, 1967.

2303 Chemistry II

	Terms		
	I	II	III
Lectures	4	3	2
Laboratory	4	5	6

LECTURE COURSE

(a) *Crystal and molecular structure*

Crystallography of ionic compounds and metals; stereochemistry of covalent compounds; coordination compounds and ligand-field theory.

(b) *Thermodynamics*

Concepts of enthalpy, entropy, free energy, equilibrium constant, chemical potential and activity, and their applications to changes of state, solutions, phase equilibria and chemical equilibria.

(c) *Electrochemistry*

Thermodynamics of electrode processes; electrolytic conductance.

(d) *Inorganic chemistry*

Chemistry of the transition elements, lanthanides, actinides and selected non-metals.

(e) *Instrumental analysis*

Principles and applications of absorption, atomic emission and atomic absorption spectrophotometry; fluorescence; potentiometry; conductimetry; polarography.

(f) *Organic chemistry*

Synthesis and reactions of aliphatic and aromatic compounds; stereochemistry; mechanisms of organic reactions.

RECOMMENDED TEXTS

Moore, *Physical Chemistry,* 4th ed., Longmans, 1963.

Morrison and Boyd, *Organic Chemistry,* 2nd ed., Allyn and Bacon, 1966.

Cotton and Wilkinson, *Advanced Inorganic Chemistry,* 2nd ed., Wiley, 1966.

Addison, *Structural Principles in Inorganic Compounds,* Longmans, 1961.

Shriner, Fuson and Curtin, *Systematic Identification of Organic Compounds,* 5th ed., Wiley, 1964.

Barnard and Chayen, *Modern Methods of Chemical Analysis,* McGraw-Hill 1965.

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3303 Chemistry III

Lecture	140 hr
Laboratory	336 hr
	476 hr

OUTLINE OF COURSE

Topics amounting to *twelve units* will be selected from the following list. Topics (a)–(d) and Topic (o) count as *two* units each, and the remainder as *one* unit each.

(a) Physical methods of structure determination.
(b) Macromolecules.
(c) Food and toxic substances.
(d) Explosives, explosions, combustion and detonation.
(e) Electrochemical cells.
(f) Corrosion.
(g) Surface chemistry.
(h) Chromatography.
(i) Chemical kinetics and reaction mechanisms.
(j) Inorganic chemistry.
(k) Nuclear fuels.
(l) Organic chemistry
(m) Chemical fuels.
(n) Radiochemistry.
(o) Computing techniques.

3303A Chemistry IIIA

OUTLINE OF COURSE

Topics amounting to *four units* will be selected from the list appearing under 3303 Chemistry III.

3303B Chemistry IIIB

OUTLINE OF COURSE

Topics amounting to *one, two or three units* (depending on the number of units selected from 3103B Mathematics IIIB and 3203B Physics IIIB) will be selected from the list appearing under 3303 Chemistry III.

Department of Engineering

1705 Engineering IE

Lecture	66 hr
Drawing Office	50 hr
Shop Work	51 hr
Laboratory and Tutorial Work	50 hr
	217 hr

SCOPE

An introduction to the principles of engineering mechanics and to the principles and practice of engineering drawing and technology for cadets commencing the study of engineering.

SYLLABUS

Introduction to Technology

The present day scope of engineering viewed against its historical background, especially in Australia.

The organisation of the profession of engineering. (A visit is made to the Snowy Mountains Hydro-electric Authority or other major engineering organisation.)

The departments of a manufacturing organisation, and their inter-relation.

The production in Australia and properties of iron, steel, and the common non-ferrous metals.

The principles of pattern-making, foundry work, metal machining, workshop measurement and gauging.

Engineering Mechanics

Forces. Classification of force systems. Composition and resolution of force systems. Principles of equilibrium; analytic solutions. Centroids, centres of gravity of geometric figures. Analysis of forces in simple trusses, frames and machines. Shearing force and bending moment diagrams for straight beams. Cables, catenaries. Graphic statics. Second moment of area, moment of inertia, product of inertia. Simple stresses and strains. Tension, compression, shear, torsion. Work: mechanical advantage, velocity ratio, efficiency. Laws of dry friction, wrapping friction. Kinematics of the plane motion of a particle and of several particles. Kinetics of the rectilinear motion of a particle and of systems of particles: equations of motion, dynamic equilibrium, work, energy, power, impulse and momentum.

Laboratory and Tutorial Work

Introduction to measurement and problem solving in engineering units: simple machines, reactions and elastic deflection of beams, shafts in torsion, forces in pin-jointed frames. Simple materials testing and calculation of stresses. (Slide rules and instruction books will be issued.)

Drawing Office

Drawing as a means of communicating information accurately; sketches from machine parts and models. An introduction to the design process, to case studies and to the principles of drawing office practice.

Workshop Practice

Instruction and practice in the use of hand and machine tools. The production of simple machine parts from drawings supplied.

ANNUAL EXAMINATION

One 3-hour paper in drawing office work, and two 3-hour papers on the lecture syllabus and workshop practice. A satisfactory standard must be reached in practical and drawing office work.

TEXTBOOKS

Beaumont, *Mechanical Testing of Metallic Materials,* Pitman.
Begeman and Amstead Manufacturing Processes, 5th ed., Wiley, 1963.
Mills, Hayward, and Rader, *Materials of Construction,* 6th ed., Wiley, 1955.
Hoelscher and Springer, *Engineering Drawing and Geometry,* 2nd ed., Wiley, 1963.
Timoshenko and Young, *Engineering Mechanics,* 4th ed., McGraw-Hill, 1956.
Beer and Johnson, *Mechanics for Engineers,* Vol. I *Statics,* 2nd ed., McGraw-Hill, 1956.
Beer and Johnson, *Mechanics for Engineers,* Vol. II *Dynamics,* 2nd ed., McGraw-Hill, 1962.

REFERENCE BOOKS

Beer and Johnson, *Vector Mechanics for Engineers, Statics and Dynamics,* McGraw-Hill, 1962.

2701 Mechanical Design

Lecture	28 hr
Design Office and Tutorial	56 hr
	84 hr

SYLLABUS

The general principles of design. The influence of manufacturing processes on design. Thread forms and standards. Strength of bolts. Limits and fits, stress concentration. Sliding bearings, ball and roller bearings. Keys, couplings, clutches and brakes. Flat and vee belt drives. Wire ropes and conveying equipment. Thin cylinders. Tension, compression and torsion springs. Welded and bolted connections. Elementary design of structures, based on lectures in 2711.

Drawing Office Practice

Design of simple elements for machines and structures.

ANNUAL EXAMINATION

One 3-hour paper on design. Marks for sketches and detail drawings, work completed in the drawing office and in drawing tests will be part of the final assessment.

TEXT BOOKS

Spotts, *Design of Machine Elements,* 3rd ed., Prentice-Hall 1961.

Hoelscher and Springer, *Engineering Drawing and Geometry,* 2nd ed., Wiley, 1961.

Doughtie and Vallance, *Design of Machine Members,* 4th ed., McGraw-Hill, 1964.

Relevant Standards and Codes.

REFERENCE BOOKS

Spotts, *Mechanical Design Analysis,* Prentice-Hall.

Maleev and Hartman, *Machine Design,* 3rd ed., International Text Book Co., 1954.

Shigley, *Mechanical Engineering,* McGraw-Hill.

Faires, *Design of Machine Elements,* Macmillan.

Phelan, *Fundamentals of Mechanical Design,* 2nd ed., McGraw-Hill.

Begeman and Amstead, *Manufacturing Processes,* Wiley.

Reynolds and Kent, *Structural Steelwork,* E.U.P.

2709 Materials

(*Civil and Mechanical Courses*)

Lecture	56 hr
Laboratory	56 hr
	112 hr

SYLLABUS

Materials in engineering. Definitions of properties of materials; measurements. Structure of metals: dislocation and other imperfections. Solid-solid phase equilibria, multi-phase systems. Grain structure, effects of deformation, recrystallisation, hot and cold working. Non-equilibrium relationships in multi-phase materials: applications to heat treatment. Behaviour of materials in service: deformation, fatigue, fracture, wear, thermal stress, creep, radiation damage. Effects of microstructure and macrostructure on properties. Metal removal, surface finishing, joining. Materials in electric and

magnetic fields. Introduction to ceramic phases and properties: refractories, cements, concretes. Organic phases: physical properties, applications. Elastomers. Insulators. Preservative coatings. Adhesives. Structure of wood, seasoning and preservation of timber.

More emphasis will be placed on electrical and magnetic properties in the Electrical course.

INDUSTRIAL TOUR

Visits to industry in which the Staff will participate will be arranged during the breaks between terms, and will include the smelting and rolling of base metals, foundry work, manufacture of electronic components, small arms and motor vehicles. Several major civil engineering works will be included.

INTEGRATED LABORATORY

The periods allotted to laboratory work in Materials, Mechanics and Mechanical or Civil Engineering will be combined to provide time for a continuous series of experiments. In relation to materials the aim will be to relate structure to properties of metals, ceramics and plastics.

ANNUAL EXAMINATION

One 3-hour paper, to include questions on laboratory work.

TEXTBOOKS

Van Vlack, *Elements of Materials Science,* 2nd ed., Addison-Wesley, 1964.

Begeman and Amstead, *Manufacturing Processes,* 5th ed., Wiley, 1957.

Beaumont, *Mechanical Testing of Metallic Materials,* 3rd ed., Pitman, 1963.

Cement and Concrete Association of Australia, *Design, Control and Characteristics of Concrete.*

REFERENCE BOOKS

Pascoe, *An Introduction to the Properties of Engineering Materials,* Blackie, 1963.

Wulff, *The Structure and Properties of Materials,* Vol. 1 1964, Vol. 2 1964, Vol. 3 1965, Vol. 4 1966, Wiley.

Hausner, H. H. (editor), *Modern Materials Advances in Development and Applications,* Vol. 1 1958, Vol. 2 1960, Vol. 3 1962, Vol. 4 1964, Vol. 5 1965, New York Academic Press.

Polakowski, N. H., and Ripling, E. J., *Strength and Structure of Engineering Materials,* 1966, Englewood Cliffs, Prentice-Hall.

Lewis, T. J., and Secker, P. E., *Science of Materials,* 1965, London, Harrap.

Jastrzebski, Z. D., *Engineering Materials,* 1959, New York, Wiley.

2713 Materials

(*Electrical Course*)

Lecture	42 hr
Laboratory/Tutorial	42 hr
	84 hr

SYLLABUS

Materials in engineering. Definitions of properties of materials; measurements. Structure of metals: dislocations and other imperfections. Solid-solid phase equilibria. Multi-phase systems. Grain structure: effects of deformation, recrystallisation, hot and cold working. Non-equilibrium relationships in multi-phase materials: applications to heat treatment. Behaviour of materials in service: deformation, fatigue, fracture, wear, thermal stress, creep, radiation damage. Effects of microstructure and macrostructure on properties. Metal removal, surface finishing, joining.

Band theory of solids, electrical conductivity, semi-conductors, semi-conductor devices, magnetic properties of materials, thermo-electricity, super-conductivity, dielectrics.

INDUSTRIAL TOUR

Visits to industry in which the Staff will participate will be arranged during the last week of second term, and will include the smelting and rolling of base metals, foundry work, manufacture of electronic components, small arms and motor vehicles. Several major civil engineering works will be included.

ANNUAL EXAMINATION

One 3-hour paper, to include questions on laboratory work.

TEXTBOOKS

Rose, Shepard & Wulff, *The Structure and Properties of Materials,* Vol. IV. Electronic Properties, Wiley, 1966.

Van Vlack, *Elements of Materials Science,* 2nd ed., Addison-Wesley, 1964.

Begeman and Amstead, *Manufacturing Processes,* 5th ed., Wiley, 1957.

Beaumont, *Mechanical Testing of Metallic Materials,* 3rd ed., Pitman, 1963.

2711 Mechanics and Computations

Topic		*Lect.*	*Tut.*	*Prac.*	*Total*
1–13	Mechanics . .	44	20	20	84
14	Design . . .	10	18	..	28
15–21	Computations . .	36	20	..	56
		90	58	20	168

SYLLABUS

1. Elastic stress and strain; elastic constants.
2. Statically indeterminate problems: temperature stresses, lack of fit.
3. Thin cylinders and rings; shrink fits.
4. Biaxial stress; Mohr's circle; principal stresses; complementary stresses.
5. Statical determinacy and indeterminacy—internal and external.
6. Shear force, bending moment, and thrust diagrams.
7. Flexure and shear stresses in beams.
8. Introduction to plastic bending of beams.
9. Beams of two materials.
10. Analysis of plane stress and plane strain.
11. Torsion of solid and hollow circular shafts.
12. Axially and eccentrically loaded 'short' and 'long' columns; Euler theory.
13. Deflection of statically determinate beams.
14. Elementary structural design of joints, beams, tension and compression members, columns.
15. Intercept charts; nomograms.
16. Solution of equations by iteration methods using tabular form.
17. Matrices.
18. Finite differences: application to solution of differential and partial differential equations.
19. Engineering applications of Fourier series and Laplace transform.
20. Relaxation methods.
21. Digital computing.

INTEGRATED LABORATORY

Hours allocated to laboratory work in all second year engineering subjects will be integrated to form a continuous series of laboratory periods in which cadets will acquire further experience in instrumentation and measurement and will study the properties of metals, ceramics and plastics.

ANNUAL EXAMINATION

Two 3-hour papers. Marks awarded for laboratory reports will be included in the assessment of the year's work.

TEXTBOOKS

Timoshenko and Young, *Elements of Strength of Materials*, 4th ed., Van Nostrand, 1962.
Timoshenko and Young, *Engineering Mechanics*, 4th ed., McGraw-Hill, 1956.
Sokolnikoff, *Higher Mathematics for Engineers and Physicists*, 2nd ed., McGraw-Hill, 1941.
Relevant Standards and Codes.

REFERENCE BOOKS

Salmon, *Materials and Structures*, Vol. 1, Longmans.
Axelrad, *Strength of Materials for Engineers*, Pitman, 1959.
Bennet, *Reinforced Concrete Members Subjected to Bending and Direct Force*, Concrete Publications Ltd, London.
Huddleston, *Introduction to Engineering Mechanics*, Addison-Wesley.
Timoshenko, *History of Strength of Materials*, McGraw-Hill.
Gaylord and Gaylord, *Design of Steel Structures*, McGraw-Hill, 1957.
Stewart, *Practical Design of Simple Steel Structures*, Vol. 1, Constable, 1957.

2721 Civil Engineering I

Topic		*Lect.*	*Tut.*	*Prac.*	*Total*
1–6	Thermodynamics . .	26	13	13	52
7–14	Fluid Mechanics . .	39	20	19	78
15–18	Geotechnics . .	26	19		45
19–21	Mechanics . .	14	7		21
		105	91		196

SYLLABUS

1. Fundamental laws of thermodynamics.
2. Thermal properties of gases and vapours (including steam).
3. Introduction to heat transfer.
4. Engine testing, indicators, loading devices, instruments.
5. Internal combustion engines, ideal cycles, performance and construction.
6. Air compressors, gas turbines.
7. Physical properties of fluids, fluid statics.
8. Linear and angular momentum.
9. Bernoulli equation, general energy equation.
10. Laminar and turbulent flow, Reynolds number, pipe and channel flow.
11. Introduction to hydraulic machines.

12. Boundary layer theory.
13. Lift and drag.
14. Dimensional analysis.
15. Rocks and minerals: engineering properties, geological structures.
16. Geophysical exploration, physiography and mapping.
17. Introduction to soil mechanics.
18. Road making materials.
19. Strain energy in tension, compression, shear, and bending.
20. Castigliano's second theorem. Least work. Virtual work. Maxwell's reciprocal theorem.
21. Application of energy methods to beams and frames.

INTEGRATED LABORATORY

Hours allocated to laboratory work in all second year engineering subjects will be integrated to form a continuous series of laboratory periods in which cadets will acquire further experience in instrumentation and measurement and will study the properties of metals, ceramics and plastics.

ANNUAL EXAMINATION

Two 3-hour papers.

TEXTBOOKS

Spalding and Cole, *Engineering Thermodynamics,* Arnold, 1964.
Walshaw and Jobson, *Mechanics of Fluids,* Longmans, 1962.
D.S.I.R., *Soil Mechanics for Road Engineers,* H.M.S.O., 1961.
Timoshenko and Young, *Elements of Strength of Materials,* 4th ed., Van Nostrand, 1956.
Emmons, Allison, Stauffer, Thiel, *Geology,* McGraw-Hill, 1960.
Robson, *Science of Geology,* Blandford, 1968.

REFERENCE BOOKS

Van Wylen, *Thermodynamics,* Wiley.
Walshaw, *Thermodynamics for Engineers,* Longmans.
Hsu, *Heat Transfer.*
Van Wylen, G. J., and Sonntag, R. E., *Fundamentals of Classical Thermodynamics,* Wiley, 1965.
Vennard, *Elementary Fluid Mechanics,* Wiley, 1961.
Streeter, *Fluid Mechanics,* McGraw-Hill, 1962.
Giles, *Theory and Problems of Fluid Mechanics and Hydraulics,* Schaum, 1962.
Addison, *Treatise on Applied Hydraulics,* Chapman and Hall, 1964.
Capper and Cassie, *The Mechanics of Engineering Soils,* Spon, 1963.
Richmond, A. J., *Problems in Heat Engines,* Arnold, 1960.
Solberg, Cromer, Spalding, *Thermal Engineering,* Wiley, 1960.
Norris and Wilbur, *Elementary Structural Analysis,* McGraw-Hill, 1960.
Schultz and Cleaves, *Geology in Engineering,* Wiley, 1958.

2723 Surveying

Lecture	36 hr
Tutorial/Field	48 hr
	84 hr

SYLLABUS

Principles of construction, adjustment, use and care of surveying instruments—steel band, clinometer, compass, barometer, level, theodolite, optical square and tacheometer. Chain surveying and ranging of straight lines. Methods of recording data in field book. Spirit and barometric levelling. Measurement of angles with the theodolite. Errors due to maladjustment. Traversing with theodolite or compass. Traverse closures and adjustment. Calculation of missing data. Areas by double meridian distances. Elementary tacheometry. Methods of contouring. Interpretation and use of contours. Plotting of field notes. Earthworks and estimation of volumes. Setting out circular and transition curves. Road location surveys. Drainage surveys.

FIELD WORK

Exercises based on the lecture syllabus.

ANNUAL EXAMINATION

One 3-hour paper.

TEXTBOOKS

Clark, *Plane and Geodetic Surveying,* Vol. 1, 5th ed., Constable, 1963.

Allan, Hollwey, and Maynes, *Practical Field Surveying and Computations,* Heinemann, 1968.

Chamber's Seven Figure Mathematical Tables.

REFERENCE BOOKS

Stephenson, *Solution of Problems in Surveying and Field Astronomy,* Pitman, 1967.

2745 Electrical Engineering I

Lecture	84 hr
Tutorial	42 hr
Laboratory	42 hr
	168 hr

SYLLABUS

1. *Electrical Circuit Theory*

Solution of networks under transient and steady-state conditions. Characteristics of two-terminal linear and non-linear components. Alternating voltages and currents. Power. Resonance. Poly-phase circuits, star-delta transformations. Symmetrical components. Fourier series. Equivalent circuits.

2. *Measurements and Measuring Instruments*

Measurement errors and their calculation. Characteristics of instruments used in the measurement of electrical and non-electrical quantities.

3. *Magnetic Circuits*

Analogy with the electric circuit. Composite magnetic circuit. Magnetic circuit of electrical machine. Field plotting. Hysteresis and eddy-current loss.

4. *Electronic Devices*

Semiconductor diodes, transistors, thyristors, vacuum tubes, cathode-ray tubes.

5. *Electronic Circuits*

Rectifiers, amplifiers, simple logic circuits.

6. *Audio-frequency Components*

Characteristics and applications of selected types of microphones, loudspeakers and pick-up heads. Principles of disc, tape and wire recording.

7. *Transformers*

Construction of transformers. No-load operation. Operation under steady-state loading conditions. Phasor diagrams and equivalent circuits.

8. *Rotating Machines*

The machine as an energy conversion device. Electrical, mechanical and magnetic interaction and losses. Elementary consideration of commutation.

ANNUAL EXAMINATION

Two 3-hour papers.

TEXTBOOKS

Morley and Hughes, *Principles of Electricity,* 2nd ed., Longmans, 1964.

Hughes, *Fundamentals of Electrical Engineering in MKS Units,* 2nd ed., Longmans, 1963.

Ralph J. Smith, *Circuits, Devices and Systems,* Wiley, 1966.

Lurch, *Electric Circuits,* Wiley, 1963.

REFERENCE BOOKS

Noakes, *Electrical Fundamentals,* HMSO, 1956.

Dover and Chapman, *Electrical Engineering (General),* Longmans, 1956.

McGreevy, *The MKS System of Units,* Pitman, 1953

Langford-Smith, *Radiotron Designers' Handbook, 4th ed.,* AWV, 1963.

2763 Mechanical Engineering I

Lecture	98 hr
Tutorial	48 hr
Laboratory	50 hr
	196 hr

SYLLABUS

Thermodynamics

Fundamental laws of thermodynamics. Thermal properties of gases and vapours. Introduction to heat transfer. Engine testing, indicators, loading devices and instruments. Internal combustion engines, ideal cycles, performance and construction. Steam power plant, ideal and practical performance, turbines and engines. Air compressors, gas turbines.

Fluid Mechanics

Physical properties of fluids, fluid statics. Momentum and angular momentum principle; Bernoulli equation, general energy equation. Laminar and turbulent flow. Reynolds Number, pipe flow. Introduction to hydraulic machines.

Dynamics of Machines

Dynamics of a particle and rigid body. Problems involving combined translational and rotational motion. Friction, belts, clutches. Mechanisms; instantaneous and vector velocity diagrams; acceleration diagrams. Inertia torque. Balancing of rotating masses. Gear trains.

LABORATORY

Hours allocated to laboratory work in all second year engineering subjects will be integrated to form a continuous series of laboratory periods in which cadets will acquire further experience in instrumentation and measurement and will study the properties of metals, ceramics and plastics.

ANNUAL EXAMINATION

Three 2-hour papers.

TEXTBOOKS

Swanson, *Engineering Dynamics,* Edinburgh U.P., 1963.
Spalding and Cole, *Engineering Thermodynamics,* Arnold, 1964.
Walshaw and Jobson, *Mechanics of Fluids,* Longmans, 1962.
Bevan, *The Theory of Machines,* Longmans, 1959.

REFERENCE BOOKS

Van Wylen, *Thermodynamics,* Wiley.
Walshaw, *Thermodynamics for Engineers,* Longmans.
Hsu, *Heat Transfer.*
Van Wylen, G. J., and Sonntag, R. E., *Fundamentals of Classical Thermodynamics,* Wiley, 1965.
Vennard, *Elementary Fluid Mechanics,* Wiley, 1961.
Streeter, *Fluid Mechanics,* McGraw-Hill, 1962.
Giles, *Theory and Problems of Fluid Mechanics and Hydraulics,* Schaum, 1962.
Addison, *Treatise on Applied Hydraulics,* Chapman and Hall, 1964.
Mabie and Ocvirk, *Mechanism and Dynamics of Machinery,* Wiley, 1963.
Hirschhorn, *Kinematics and Dynamics of Plane Mechanisms,* McGraw-Hill, 1962.
Richmond, A. F., *Problems in Heat Engines,* Arnold, 1960.
Solberg, Cromer, Spalding, *Thermal Engineering,* Wiley, 1960.
Green, *Theory of Machines,* Blackie, 1960.

2765 Mechanical Engineering IE

Lectures	50 hr
Laboratory/Tutorial	50 hr
	100 hr

SYLLABUS

Thermodynamics

Fundamental laws of thermodynamics. Thermal properties of gases and vapours. Introduction to heat transfer. Engine testing, indicators, loading devices and instruments. Internal combustion engines, ideal cycles, performance and construction. Air compressors, gas turbines.

Fluid Mechanics

Physical properties of fluids, fluid statics. Momentum and angular momentum principle; Bernouilli equation, general energy equation. Laminar and turbulent flow. Reynold's Number, pipe flow. Introduction to hydraulic machines.

LABORATORY

Experimental work will be carried out to consolidate and supplement lecture material.

Cadets will be expected to reach a professional engineering standard in report writing by applying the principles discussed in Technical Communications.

ANNUAL EXAMINATION

Two 2-hour papers.

TEXTBOOKS

Spalding and Cole, *Engineering Thermodynamics,* Arnold, 1964.
Walshaw and Jobson, *Mechanics of Fluids,* Longmans, 1962

REFERENCE BOOKS

Richmond, A. F., *Problems in Heat Engines,* Arnold, 1960.
Solberg, Cromer, Spalding, *Thermal Engineering,* Wiley, 1960.

3725 Civil Engineering IIA

Lecture	124 hr
Tutorial/Practical	46 hr
Design Office	93 hr
	263 hr

Structural Analysis and Design

SYLLABUS (84 lectures; 31 tutorial/practical) (See also 3727 Lab.)

Types of loads on structures, safety factors, codes of practice. Design of structural elements in steel, timber, reinforced concrete, pre-stressed concrete, connections.

Types of reactions, equilibrium, stability, determinancy, types of trusses. Joints, sections, graphical analysis. Strain energy. Analysis of indeterminate structures. Castigliano, least work, theorem of three moments, slope deflection, moment distribution, matrix methods of structural analysis. Approximate methods, portal method, cantilever method, assumed shear distribution in frames.

Deflection of structures, virtual work, Castigliano, moment area, W. Williot-Mohr method, Maxwell's reciprocal theorem, influence lines.

Arches, cables, suspension bridges.

Ultimate design in concrete. Plastic design. Model analysis of structures—applications, model design, methods of analysis, photo-elasticity, brittle coatings, general case of plane stress, rosettes.

EXAMINATION

Two 3-hour papers.

Civil Engineering Design Office

SYLLABUS (93 hours)

A series of design projects relating to the work of Civil Engineering IIA and IIB in the design and preparation of detailed drawings for structures in timber, concrete, steel and earth. Road location and design. Application of computers to engineering design.

23587/70—6

EXAMINATION

Design office work will be assessed as a major part of the year's work in Civil Engineering.

Engineering Construction

SYLLABUS (40 lectures; 15 tutorial/practical)

Construction plant and equipment; compressed air services, drilling, earthmoving, tunnelling and blasting, hoisting and conveying, piledriving, etc.; aggregate and concrete plant. Principles of construction administration; evolution of management; objectives of management; principles of organisation; motivation and communication; project management. The role of government and local government authorities. An introduction to construction planning and scheduling; cost control and cost accounting; tenders and the preparation of estimates; scheduling of operations; linear programming, critical path and PERT techniques; contracts and specifications. Setting out using conventional survey methods.

EXAMINATION

One 3-hour paper.

TEXTBOOKS

See after Civil Engineering IIB.

3727 Civil Engineering IIB

Lecture	131 hr
Tutorial/Practical	126 hr
	257 hr

Civil Engineering Materials

SYLLABUS

Soil Engineering (40 lectures; 15 tutorial)

Soil moisture, pressure, drainage. Shear strength, effective stress, failure theories, footings, consolidation and settlement. Stability of slopes. Lateral earth pressure. Retaining walls.

Concrete Technology (8 lectures)

Components, aggregate quality and selection, properties, mix design, handling, curing, placing, testing, light-weight aggregates, air entrainment, reinforcing, pre-stressing.

Timber (8 lectures)

Properties and influence on design, factors affecting strength, the potential of timber, modern developments in the use of timber.

Other Materials (15 lectures)

Structural steel, H.T. steel, special steels. Bricks, mortars, building stones. Road-making materials, aggregates, concrete roads, bitumen pavements, asphaltic concrete, hot mixes. Structural aluminium, polymers, plastics.

LABORATORY (71 hours)

Examination of concrete properties, design and testing of mixes, comparison of plain, reinforced and pre-stressed beams.

Soil sampling, limit tests, coarse and fine analyses, compression, shear, consolidation, triaxial, compaction and CBR, permeability, vane test, active and passive pressure, bearing, stability of slopes, stabilisation, flow nets, piping.

Timber in bending and compression.

Laboratory experiments related to the lecture content of 3725 Civil Engineering IIA.

EXAMINATION

Two 3-hour papers.

Water and Public Health Engineering

SYLLABUS (60 lectures; 40 tutorial/practical)

Hydraulic model theory, scale effect. Pipe networks, water hammer. Channel flow, steady non-uniform flow, backwater curves, hydraulic jump, unsteady flow, waves, flood routing. Flow measurement. Hydraulic machinery, characteristic curves, cavitation. Sediment theory, introduction to critical tractive stress and regime theories. Design of stable channels in alluvium. Hydrodynamics, equations of continuity, motion and vorticity, ϕ, ψ functions. Laplace equations.

Hydrological cycle, precipitation, evaporation, groundwater hydrology, streamflow, streamgauging, instrumentation, data analysis, hydrographs, flood estimation, yield and storage.

Principles of water treatment, principles of sewage treatment, principles of irrigation.

Water resources problems with introduction to systems approach and economic evaluation.

Examples of applied water engineering.

EXAMINATION

Two 3-hour papers.

Civil Engineering IIA and IIB

TEXTBOOKS

Antill and Ryan, *Civil Engineering Construction,* Angus and Robertson.

Antill, *Civil Engineering Management,* 1st ed., Angus & Robertson, 1970.

Antill and Woodhead, *Critical Path Methods in Construction Practice,* Wiley 1965

Grant and Ireson, *Engineering Economy,* 4th ed., Ronald Press, 1960.

H.M.S.O., *The Star Almanac for Land Surveyors.* 1971

Chamber's Seven-Figure Mathematical Tables.

REFERENCE

G. A. Taylor, *Managerial and Engineering Economy,* Van Nostrand.

Relevant Standards and Codes.

Gaylord and Gaylord, *Design of Steel Structures,* McGraw-Hill, 1957.

Norris and Wilbur, *Elementary Structural Analysis,* McGraw-Hill, 1960.

Grinter, *Elementary Structural Analysis and Design,* Macmillan, 1965.

Cowan and Smith, *Design in Reinforced Concrete,* Angus & Robertson, 1963.

Pearson, Kloot and Boyd, *Timber Engineering Design Handbook,* Jacaranda, C.S.I.R.O. 1964.

Ferguson, *Reinforced Concrete Fundamentals,* 2nd ed., Wiley, 1965.

Grinter, *Theory of Modern Structures,* Abridged, ed., Macmillan, NY 1950.

Akroyd, *Laboratory Testing in Soil Engineering,* Soil Mechanics Ltd, 1957.

D.S.I.R., *Soil Mechanics for Road Engineers,* H.M.S.O., 1961.

Terzaghi, *Theoretical Soil Mechanics,* Wiley, 1959.

Wu, *Soil Mechanics,* Allyn and Bacon, 1966.

Rouse, *Engineering Hydraulics,* Wiley, 1961.

Linsley and Franzini, *Water Resources Engineering,* McGraw-Hill, 1964.

Bolton and Klein, *Sewage Treatment, Basic Principles and Trends,* Butterworth, 1961.

Mackie, *Astronomy for Surveyors,* Griffin, London, 6th ed.

REFERENCE BOOKS

Capper and Cassie, *Mechanics of Engineering Soils,* Spon, 1963.

Urquhart, *Civil Engineering Handbook,* McGraw-Hill, 1959.

Emmon, Allison, Stauffer, Thiel, *Geology,* McGraw-Hill, 1960.

Schultz, Cleaves, *Geology in Engineering,* Wiley, 1958.

Dunham, *Theory and Practice of Reinforced Concrete,* 3rd ed., McGraw-Hill, Kogakusha, 1953.

Stewart, *Practical Design of Simple Steel Structures,* Vols. 1 and 2, Constable, 1957.

Grinter, *Design of Modern Steel Structures,* Macmillan, N.Y., 1941.

Mills, *The Theory of Structures,* Macmillan, London, 1965.

McGuire, *Steel Structures,* Prentice-Hall, 1968.

Application of Geology in Engineering Practice, Geol. Soc. of America, N.Y., 1950.

O'Neill, *Fundamentals of Estimating and Construction Cost Control,* Tait, 1966.

Davis, *Handbook of Applied Hydraulics,* 2nd ed., McGraw-Hill.

Babbit, Doland, Cleasby, *Water Supply Engineering,* 6th ed., McGraw Hill.

Babbit and Baumann, *Sewerage and Sewage Treatment,* 8th ed., Wiley, 1965.

Houk, *Irrigation Engineering,* Vols. 1 and 2, Wiley, 1956.

Clark, *Plane and Geodetic Surveying for Engineers,* Vols 1, and 2, 5th ed., Constable, 1958.

Boileau, *Traverse Tables,* 17th ed., Nisbet.

Chow, *Open Channel Hydraulics,* McGraw-Hill, 1959.

Taylor, *Concrete Technology and Practice,* Angus & Robertson, 2nd ed., 1967.

Vallentine, *Hydrodynamics,* 2nd ed., Butterworth, 1967.

Fair and Geyer, *Elements of Water Supply and Waste Water Disposal,* Wiley, 1954.

3741 Electrical Technology

Lecture	44 hr
Tutorial	40 hr
Laboratory	40 hr
	124 hr

SYLLABUS

1. *Simple Circuit Theory:* Kirchhoff's laws, alternating current theory, use of operator 'j', phasor diagrams, resonance, power-factor improvement, belanced three-phase star and delta systems.

2. *Measuring Instruments:* Moving coil, moving-iron and dynamometer instruments, energy meter (one type), hot-wire and electrostatic instruments, Wheatstone bridge, potentiometer, simple applications of vacuum-tube voltmeter and cathoderay oscillograph.

3. *Revision of Electrical Materials:* Conductors, insulators, dielectrics, and magnetic alloys.

4. *D.C. Machines:* Principle of machine illustrated by Gramme-ring armature with reference only to drum windings. E.M.F. and torque equations. Effects of armature reaction. Commutating poles. Characteristics and uses of shunt, series and compound generators and motors.

5. *Synchronous Machines:* Salient-pole and cylindrical rotor types. Simple stator windings. E.M.F. equation. Production of rotating magnetic field. Regulation of synchrnous generator. Paralleling of synchronous machines leading to simple exposition of synchronous motor operation.

6. *Transformers:* Construction and E.M.F. equation. Leakage reactance. Regulation and efficiency. Qualitative treatment of auto and instrument transformers.

7. *Induction Motors:* Single and three-phase. Torque equation. Types of rotor. Methods of starting and speed control.

8. *Miscellaneous Machines:* Qualitative treatment of universal motors, shaded-pole motors, repulsion motors, hysteresis motors and static rectifiers.

9. *Electronic Amplifiers:* Simple valve and transistor amplifiers. Principles of amplification. The R-C amplifier and its frequency response. Tuned amplifiers. Feedback. Example of simple oscillator.

10. *Radio Receivers:* Frequency changing, amplitude modulation and demodulation. Block diagram of complete superheterodyne receiver.

11. *Electrical Servo Components:* Split-field d.c. motor, two-phase induction and hysteresis motor, synchros, magnetic amplifier (very brief reference), tacho-generators, transducers, rotary amplifiers.

12. *Simple Electrical Control Systems:* Demonstrations of speed control, position control and others if time permits.

13. *Illumination:* Review of modern types of lamps. Simple calculations.

ANNUAL EXAMINATION

One 3-hour paper.

TEXTBOOKS

Morley and Hughes, *Principles of Electricity,* 2nd ed., Longmans, 1964.

Hughes, E., *Fundamentals of Electrical Engineering,* 2nd ed., Longmans, 1963.

Fitzgerald and Higginbotham, *Basic Electrical Engineering,* 2nd ed., McGraw-Hill, 1957.

Zeines, B., *Principles of Applied Electronics,* Wiley, 1963.

REFERENCE BOOKS

West, J. C., *Servomechanisms,* E.U.P., 1953.

3747 Electrical Engineering II

Lectures	175 hr
Laboratory/Tutorial	175 hr
	350 hr

SYLLABUS

Systems and Circuit Theory

Steady-state, transient and three-phase circuits. Network topology and matrix methods, state equations. Analysis of feedback systems. Distributed parameter systems.

Machines and Transformers

The principles of steady-state operation and an introduction to the transient operation of transformers and rotating machines used for the conversion of energy. Included in the course will be single and three-phase transformers, synchronous and asynchronous machines, direct current machines and metadynes.

Electronic Circuits and Signal Processing

Characteristics of transistors and other active devices. Small signal amplifiers, wide-band, direct-coupled, tuned. Regulated power supplies. Wave-shaping circuits, typical logic circuits, gates. Power amplifiers, classes A, B and C. Oscillators, sinewave and limit cycle. Demodulation. Introduction to aerials and propagation. Modulation, need and types. Simple radio transmitter and receiver. Rectifiers and inverters, single and polyphase.

Computers

Programming, setting up and scaling problems on an analogue computer. The components of an analogue computer and their organisation into a computing system.

Number systems, codes, bi-stable devices, gates resistors, counters, code generators, addition, subtraction, multiplication and division. Implementation of designs in the laboratory using integrated circuits.

The components of a digital computer and their organisation into a computing system. Programming, numerical analysis.

Electron Physics and Devices

Band theory of solids as required by an engineer to enable him to understand the operation of solid-state devices. Surfaces and contacts. Junction, homogeneous and field-effect solid-state devices, including monolothic and thin film circuits. Vacuum and discharge tubes. Lasers.

TEXTBOOKS

Angelo, E. J., *Electronics: BJT's, FET's and Microcircuits,* McGraw-Hill, 1969.

Glazier and Lamont, *Transmission and Propagation,* H.M.S.O., 1958.

Skilling, H. H., *Electrical Engineering Circuits,* Wiley, 1965.

Digital Equipment Corporation, *Introduction to Programming,* 1968.

Fitzgerald and Kingsley, *Electric Machinery,* 2nd ed., McGraw-Hill, 1961.

REFERENCE BOOKS

Brosan and Hayden, *Advanced Electrical Power and Machines,* Pitman, 1966.

Cotton, H., *Electrical Technology,* 7th ed., Pitman, 1957.

Gray and Campbell, *Electronic Principles, Physics, Models and Circuits,* Wiley, 1969.

Ryder, *Electronic Fundamentals and Applications,* Pitman, 1965.

Korn and Korn, *Electronic Analog and Hybrid Computers,* McGraw-Hill, 1964.

3749 Electrical Engineering III

Lecture	75 hr
Laboratory/Tutorial	75 hr
	150 hr

Various courses are offered so that students may specialise in different aspects of electrical engineering. The list may be varied from time to time.

Each course will consist of 37½ hours lectures plus 37½ hours laboratory/tutorial work.

Each student will choose two courses from the list, the choice being subject to approval by the Head of Department. With limited numbers of students the choice in any one year would need to be restricted.

LIST OF SUBJECTS

5741 Circuits, Signals and Information Theory
5743 Electronics
5745 Machines and Power
5747 Automatic Control
5749 Optimal Control
5751 Antennas, Propagation and Guided Waves
5753 Communication Electronics
5755 Communication Systems

SYLLABUSES

5741 *Circuits, Signals and Information Theory*

Circuit theory and network synthesis. Signal analysis and transmission through networks, including theory of noise and stochastic signals. This includes time frequency and mixed domain presentation; transients and other signals; correlation, convolution, etc.; statistical properties of signals; applications. Information theory of discrete systems including coding and encoding of patterns. Information theory of continuous systems. Mathematical theory of signal detection, including an introduction to decision theory. Signal and system analysis in the light of information theory.

5743 *Electronics*

Topics in this course include: An introduction to modern filter theory; pulse spectra. Amplifiers: wide band, compensation; direct coupled, operational amplifiers, regulators. Pulse and digital circuits: semi-conductor switches; emitter coupled multivibrators; blocking oscillators: Integrated circuits: non-linear and linear; use in systems. Power converters: Polyphase rectifiers, controlled rectifiers; high voltage convertors, invertors. Semiconductor controls: motor controls, firing circuits, etc. Reliability engineering: calculation of MTBF; statistical and worst case design; environmental and operating stresses.

5745 *Machines and Power*

Revision of three-phase circuit theory, power measurement, machine inductances.

Cross-field d.c. machines. Thyristor speed control. Acceleration braking.

Polyphase and single-phase induction motors—speed control by rotor injection and stator frequency control—acceleration and braking.

Synchronous generators and motors, cylindrical and salient poles, locus diagrams, transients, faults, motor pull-in, hunting.

Transmission line parameters, symmetrical components, transformers, steady-state system calculations for balanced and fault conditions.

Load and frequency control of a single machine, steady-state and transient stability.

5747 *Automatic Control*

Principles and techniques applicable to the analysis and design of feedback control systems encountered in industrial processes. Frequency transform and state space methods for compensation and stability analysis of single-input single-output linear systems. Extension to include some common nonlinearities. Optimum design including identification of process parameters by both on- and off-line methods.

5749 *Computer Control*

The principles of plant modelling, parameter estimation, and optimal control in the computer control of complex processes. The mathematical representation of physical processes. Analogue, digital and hybrid simulation of physical processes. Concepts basic to optimisation. Parameter and state estimation in linear systems by regression methods. Parameter and state estimation in linear and nonlinear systems using parameter influence coefficients. Optimal control theory. Adjoint variable techniques applied to parameter and state estimation. The implementation of optimal control.

5751 *Antennas, Propagation and Guided Waves*

Retarded potentials, the fields due to a current element, Poynting's vector, wave impedance of space. Linear antennas, current distribution, radiation resistance directional characteristics. Effects of ground. Antenna arrays, antenna network theorems, polar diagrams of arrays, gain, directivity and bandwidth. Aperture antennas. Radio wave propagation. Surface, ground, direct and reflected waves. Ionospheric propagation, tropospheric scatter propagation.

Guided Waves: transmission line theory included losses, dispersion matching and solution of problems. Types of transmission lines including coaxial lines, microstrip, triplate, surface wave lines, etc.

Waveguides: theory of rectangular and circular waveguides: attenuation, dispersion and discussion on waveguide practice. Microwave circuits including discussion on irises, corners, tees, directional couplers, hybrids, transformers, etc.; non-reciprocal devices; cavities and other resonant structures. Discussion of modern microwave sources.

5753 *Communication Electronics*

Signal Processing and Techniques: modulation principles and techniques, DSB, SSB, FM, PM, pulse modulation circuits. Demodulation. Bandwidth, signal to noise ratio, noise factor.

Turned power amplifiers, lumped tuned circuits, distributed tuned circuits. Devices: properties and circuits of small-signal amplifiers. Noise and high-frequency performance of passive and active devices and circuits. Parametric amplifiers. Quantum electronic devices, e.g., masers and lasers. Semi-conductor bulk-effect devices: microwave high-power vacuum-device amplifiers.

5755 *Communication Systems*

Sound systems: psychoacoustics, loudness, pitch, masking, binaural effects, characteristics of speech, bandwidth and intelligibility. Sound sources, piston radiator, exponential horn. Acoustic and mechanical equivalent circuits, transducers. Introduction to room acoustics. Telephone, telegraph and data systems: General principles, multiplexing, carrier systems, Code, speech and data transmission, telemetry, facsimile. Television systems: physiological aspects of television, television standards, colour systems, transmitters, receivers. Radar: principles of pulse and C.W. radar, distance and direction measuring equipment for navigation and surveying.

3765 Mechanical Engineering II

Lecture	100 hr
Tutorial and Laboratory	75 hr
Design Office	75 hr
	250 hr

Applied Thermodynamics

SYLLABUS ($1\frac{1}{2}$-$1\frac{1}{2}$)

Theory of heat transfer under steady conditions. Practical applications. Further study of theoretical cycles and combustion. Reciprocating and rotating machines. Military applications including gas turbines, rocket motors, air compressors, nuclear power plants, fuel cells and the energy depot concept. Refrigeration, heat pump, air-conditioning, desalination.

EXAMINATION

One 3-hour paper.

Fluid Mechanics

SYLLABUS ($1\frac{1}{2}$-$1\frac{1}{2}$)

Mechanics of incompressible and compressible fluids, general equations of motion, flow through orifices and nozzles; critical pressure ratio, stagnation quantities. Military applications of fluids under pressure, particularly air, oil and water.

EXAMINATION

One 3-hour paper.

Design

SYLLABUS (1–3)

Analysis and design of mechanical components. Methods of rational design and optimisation. Design of rotating and reciprocating machinery. Gear design. Design of simple pressure vessels and structural components. Design for interchangeable manufacture. Limits and fits. Principles of gauging. Tolerance selection. Geometrical analysis. Brief introduction to systems design.

DESIGN OFFICE

Students will be required to carry out one or two major design projects to which they will apply their knowledge of engineering materials, applied mechanics, theory of machines, fluid mechanics and thermodynamics in addition to the topics of the design lecture courses. Marks awarded for completed projects will be included in the assessment of the year's work.

EXAMINATION

One 3-hour paper.

Experimental Engineering

SYLLABUS

An integrated series of laboratory exercises and projects to which all staff members concerned with lecture courses will contribute.

Further study of instrumentation and methods of measurement. The techniques of recording and analysing large quantities of data will be introduced.

Cadets will be expected to reach a professional engineering standard in report writing by applying the principles discussed in Technical Communication.

VISITS TO MANUFACTURING AND RESEARCH CENTRES

Important aspects of the lecture courses will be illustrated by visits, in which members of the staff will participate, to suitable industrial and research centres.

EXAMINATION

All practical work and reports will be assessed. Students who reach the required standard will be excused a practical examination. Written papers listed elsewhere may include questions on the laboratory work. Marks awarded for laboratory reports will be included in the assessment of the year's work.

TEXTBOOKS

Slaymaker, R. R., *Mechanical Design and Analysis,* Wiley, 1959.
Prandtl, *Essentials of Fluid Dynamics,* Blackie, 1963.
Reynolds, W. C., *Thermodynamics,* McGraw-Hill, 1965.

3767 Mechanical Engineering III

Lecture	125 hr
Tutorial and Laboratory	125 hr
	250 hr

Dynamics of Machines

SYLLABUS (1–1)

Further study of kinematics and applications to plane mechanisms. Hydro-dynamic and boundary lubrication of sliding pads and journal bearings. Theory and applications of air bearings. Selected dynamical topics involved in the design of high-speed machines, e.g., balancing of rotors, inertia forces in reciprocating parts, free and forced vibrations, critical speeds of shafts, vibration isolation, noise measurement, reduction and isolation.

Instrumentation and Control

SYLLABUS (2–1)

Theory of Control

Concept or feed back referred to linear control systems. Definitions and terminology. Open loop systems and inherent regulation. Discontinuous control. Manual control. Control actions as functions of error and of measured and desired values. Process transfer functions. Transient response to changes in desired value and of load. Harmonic analysis with use of Nyquist and Bode diagrams. Stability criteria. Stabilising elements.

Principles of Instrumentation

Concepts of measurement to specific degrees of accuracy. Static and dynamic measurements and their influence on instrument design. Calibration and causes of errors. Effects of friction in instrument movements. Linear equation of motion of indicating and/or recording instruments with inertia and damping friction. Mathematical relationships between damped and undamped natural frequency, damping ratio, damping factor, settling time. Response to time-variant inputs such as constant velocity and acceleration, and simple harmonic. Transient and steady-state response.

Measurement Techniques

Methods of measuring, and recording as a function of time, the following physical quantities:

Length. Weight, volume and density of fluids, and gases. Fluid and gas pressure.

Temperature. Fluid level. Rate of flow of fluids and gases in pipes. Linear and angular speed. Acceleration. Linear speed of fluids and gases in pipes.

Transmission of positional data. Uses of a gyroscope to measure angular displacements in space, and their rates of change.

Control System Elements

Mode of operation of hydraulic, pneumatic and electrical components. Servo amplifiers and motors (including effects of gearing between motor and load). Process controllers, regulating valves and positioners. Transducers. Comparison elements. Position and rate gyroscopes.

Stress Analysis

SYLLABUS (1–1)

Revision of stress and strain at a point. Stress-strain relationships: equations of two-dimensional theory of elasticity. Experimental methods of stress and strain analysis: theory and applications of strain gauges, brittle coatings, photoelasticity, models, and analogue methods.

Materials

SYLLABUS (2–1)

Further study of materials science, and of present and potential applications of materials in military weapons and equipment.

ANNUAL EXAMINATION

Three 2-hour papers.

TEXTBOOKS

Hardie, A. M., *Elements of Feedback and Control,* Oxford U.P., 1964.
Lee, G. H., *An Introduction to Experimental Stress Analysis,* Wiley, 1950.
Green, *Theory of Machines,* 3rd ed., Blackie, 1959.
Brick, Gordon and Phillips, *Structure and Properties of Alloys,* McGraw-Hill, 1965.
Uhlig, *Corrosion and Corrosion Control,* Wiley, 1964.
Timoshenko and Goudier, *Theory of Elasticity,* 2nd ed., McGraw-Hill, 1951.
Clark, D. S. and Varney, W. R., *Physical Metallurgy for Engineers,* Van Nostrand, 2nd ed., 1969.

REFERENCE BOOKS

Michell, *Lubrication,* Blackie, 1950.
Merrit, *Gears,* 3rd ed., Pitman, 1954.
Church, *Mechanical Vibrations,* 2nd ed., Wiley, 1963.

Furrer, *Room and Building Acoustics and Noise Abatement,* Butterworth, 1964.
Grassman and Powell, *Gas Lubricated Bearings,* Butterworth, 1964.
Steeds, *Mechanics of Road Vehicles,* Iliffe, 1960.
Taylor, P. O., *Servo Mechanisms,* Longmans, 1960.
Bevan, *The Theory of Machines,* 3rd ed., Longmans, 1959.
Palmgren, *Ball and Roller Bearing Engineering,* 3rd ed., S.K.F., 1959.
McClintock, F. A. and Argon, A. S., *Mechanical Behaviour of Materials,* Addison-Wesley, 1966.
Grassman and Powell, *Gas Lubricated Bearings,* Butterworth, 1964.
Steeds, *Mechanics of Road Vehicles,* Iliffe, 1960.

3769 Technical Communication

Lectures	25 hr
Laboratory/Tutorial	25 hr
	50 hr

SYLLABUS

A review of oral, written and graphical methods of conveying technical information in relation to the nature of the topic. Methods of preparing and presenting technical lectures and engineering reports in their various forms. Reproduction and storage of printed, duplicated and graphical material. Systems of information retrieval: library searching; computerised data storage; personal libraries.

EXAMINATION

Assessment of year's work.

TEXTBOOKS

Sir Ernest Gowers, *The Complete Plain Words,* Penguin (Pelican 1962).
Treble and Vallins, *An A.B.C. of English Usage,* Oxford.
Kresner, *Secondary Spelling,* Horwitz-Grahame.
The Concise Oxford Dictionary, Oxford University Press.
Nelson, J. R., *Writing the Technical Report,* McGraw-Hill, 1947.
The Institution of Engineers, Australia, *The Preparation and Submission of Technical Papers.*

REFERENCE BOOKS

Fowler, H., *Modern English Usage,* Oxford, Clarendon Press, 1947.
Carey, R. J. P., *Finding and Using Technical Information,* Edward Arnold, London, 1966.
Rathbone, R. R., *Communicating Technical Information,* Reading, Mass., Addison-Wesley, 1966.

Department of Government and Economics

23587/70—7

1625 Government I

Lectures and Tutorials 84 hr

SCOPE

An introduction to the subject, with particular reference to democratic government in Britain, and Australia.

SYLLABUS

1. *Britain:* including constitution, parliament, cabinet, elections, parties.

2. *Australia:* Federal and State governments: federal relations, elections, parties, pressure groups; administration and the Public Service.

TEXTBOOKS

Carter, G. M. and Herz, J. H., *Government and Politics in the Twentieth Century,* Thames & Hudson, 1961.

Jennings, I., *The Queen's Government,* Pelican, 1964.

Blondel, J., *Voters, Parties and Leaders,* Pelican, 1966.

Taylor, E., *The House of Commons at Work,* 6th ed., Pelican, 1965.

Moodie, G. C., *The Government of Great Britain,* Methuen, 1965.

Stankiewicz, W. J., *Crisis in British Government,* Collier, 1967.

Birch, A. H., *The British System of Government,* Allen & Unwin, 1967.

Mayer, H., *Australian Politics: A Reader,* Cheshire, 1967.

Mayer, H., *Australian Politics: A Second Reader,* Cheshire, 1969.

Menzies, R., *Central Power in the Australian Commonwealth,* Cassell, 1968.

Spann, R. N., *Public Administration in Australia,* N.S.W. Government Printer, 1964.

Crisp, L. F., *Australian National Government,* Longmans, 1965.

Rejai, M., *Democracy,* Atherton, 1967.

Macpherson, C. B., *The Real World of Democracy Clarendon, 1966.*

REFERENCE BOOKS

Beer, S. H., *Modern British Politics,* Faber & Faber, 1965.

MacIntosh, J. P., *The British Cabinet,* 2nd ed., Methuen, 1962.

Dicey, A. V., *Law of the Constitution,* 10th ed., Macmillan, 1962.

Hughes, C. A. (ed.), *Readings in Australian Government,* University of Queensland Press, 1968.

Overacker, L., *Australian Political Parties in a Changing Society,* Cheshire, 1968.

Jupp, J., *Australian Political Parties,* M.U.P., 1968.

2625 Government II

Lectures and Tutorials 84 hr

SYLLABUS

A study of the development, form and practice of the political systems of:

1. U.S.A.
2. U.S.S.R.
3. China

TEXTBOOKS

Raymond, E., *The Soviet State,* Macmillan, 1968.
Carew Hunt, R. N., *The Theory and Practice of Communism,* rev. ed., Bles, 1962.
Hazard, J. N., *The Soviet System of Government,* Chicago, 1965.
Schaffer, H. G., *The Soviet System in Theory and Practice,* Appleton Century, 1965.
Meyer, A. G., *Communism,* Random House, 1967.
Meyer, A. G., *The Soviet Political System,* Random House, 1965.
Dallin, A. and Larson, T. B., *Soviet Politics since Khruschev,* Spectrum, 1968.
Lewis, J. W., *Major Doctrines of Communist China,* Norton, 1964.
Lewis, J. W., *Leadership in Communist China,* Cornell, 1966.
Houn, F. W., *Short History of Chinese Communism,* Prentice-Hall, 1967.
Latourette, K. S., *China,* Prentice-Hall, 1965.
Riker, W. H., *Democracy in the United States,* 2nd ed., Collier, 1965.
Rossiter, C., *Parties and Politics in America,* Cornell, 1966.
White, T. H., *The Making of the President, 1964,* Cape, 1965.
Warren, S. (ed.), *The American President,* Prentice-Hall, 1967.
de Grazia, A., *Congress: The First Branch of Government,* Anchor, 1967.

REFERENCE BOOKS

Churchward, L. G., *Contemporary Soviet Government,* Routledge & Kegan Paul, 1968.
Adams, R. (ed.), *Contemporary China,* Pantheon, 1966.
MacFarquhar (ed.), *China Under Mao,* M.I.T., 1966.
Fainsod, M., *How Russia is Ruled,* 2nd ed., Harvard, 1963.
Schapiro, L., *The Government and Politics of the Soviet Union,* 2nd ed., H.U.L., 1967, paperback.
Berman, H. J., *Justice in the U.S.S.R.,* rev. ed., Vintage Books, 1963, paperback.
Young, W. H. (ed.), *Ogg and Ray's Essentials of American Government,* 10th ed., Appleton-Century-Crafts, 1969.
Burns, J. M. and Peltason, J. W., *Government by the People,* 6th ed., Prentice-Hall, 1966.

3627 Government III

Lectures and Tutorials 84 hr

PRE-REQUISITE

The completion of Government I and II or the completion of Government I and History I and II.

OUTLINE OF COURSE

Part I: Theory; The Central Balance, European International Relations; The U.N.

(a) Some theoretical concepts: sovereignty, nationalism, power, community, alliance. The 'realist' theory of international relations and its critics. Constraint, negotiation, legal regulation, limited and total war.

(b) U.S.-Soviet relations since 1945.

(c) Eastern Europe since 1945.

(d) Western Europe since 1945 with special reference to the German problem.

(e) The U.N. and the control of armaments.

Part II: Asian International Relations and Foreign Policy

(a) Asia in world politics: the policies of the Great Powers—the U.S., the Soviet Union and China.

(b) Japan, India and the significance of the forces of non-alignment.

(c) Southeast Asia with special reference to the Indonesian-Malaysian area.

(d) Australian foreign and defence policies since the second world war.

TEXTBOOKS

Morgenthau, H. J., *Politics Among Nations,* Knopf, 1968.

Claude, I. L., *Power and International Relations,* Random House, 1965.

Robertson, C. L., *International Relations since World War II,* John Wiley, 1966.

Fifield, R.A., *Southeast Asia in United States Foreign Policy,* Praeger, 1963.

Millar, T. B., *Australian Foreign Policy,* Angus & Robertson, 1968.

REFERENCE BOOKS

Aron, R., *Peace and War,* Weidenfeld and Nicolson, 1966.

Deutsch, K. W., *The Analysis of International Relations,* Prentice-Hall, 1968.

Fliess, P. J., *International Relations in the Bipolar World,* Random House, 1968.

Claude, I. L., *Swords into Plowshares. The Problems and Progress of International Organisations,* Random House, 1964.

Mendel, D., *American Foreign Policy in a Polycentric World,* Dickinson, 1968.

McNeal, R. H. (ed.), *International Relations Among Communists,* Prentice-Hall, 1967.

Levi, W., *The Challenge of World Politics in South and Southeast Asia,* Prentice-Hall, 1968.

1609 Economics I

Lectures 84 hr
Tutorials 28 hr

SYLLABUS

1. Analysis of the pricing mechanism: the differing types of economy; demand, supply and markets; the basis of demand, consumption and marginal utility, the demand curve; concept of production; brief analysis of supply, combination of factors, variable returns to inputs, costs; demand, supply and price.

2. National product, national income and national expenditure; their meaning and significance; elementary social accounting.

3. Theory of income determination in closed and open systems.

4. Money and banking in the context of macroeconomics.

5. The Balance of Trade, significance for economic policy.

6. The aims of economic policy.

TEXTBOOKS

Government Printer, *National Income and Expenditure,* latest issue.

Downing, R. I., *National Income and Social Accounts,* 9th ed., Melbourne U.P., 1965.

Ferguson, C. E., and Kreps, J. M., *Principles of Economics,* 2nd ed., Holt, Rinehart & Winston, 1965.

The Reserve Bank of Australia, 1966.

Harcourt, G. C., Karmel, P. H. and Wallace, R. H., *Economic Activity,* Cambridge U.P., 1967.

Lipsey, R. G., *An Introduction to Positive Economics,* 2nd ed., Weidenfeld and Nicolson, 1966.

Samuelson, P. A., Hancock, K. and Wallace, R., *Economics, Australian Edition,* McGraw-Hill, 1970.

REFERENCE BOOKS

Kurihara, K. K., *Monetary Theory and Public Policy,* Allen & Unwin, 1965.
Brooman, F. S., *Macroeconomics,* Allen & Unwin, 1962.
Stonier, A. W. and Hague, D. C., *A Textbook of Economic Theory,* 2nd ed., Longmans, 1961.
Arndt, H. W. and Corden, W. M., *The Australian Economy: A Volume of Readings,* Cheshire, 1963.
Leftwich, R. H., *The Price System and Resource Allocation,* revised ed., Macmillan, 1961.
Sirkin, G., *Introduction to Macroeconomic Theory,* revised ed., Irwin, 1965.
Arndt, H. W. and Harris, C. P., *The Australian Trading Banks,* 3rd ed., Cheshire, 1965.

2605 Economics II

Lectures 84 hr
Tutorials 28 hr

SYLLABUS

1. International economics: theory of comparative advantage, terms of trade, exchange rates, balance of payments, principles of international trade policy, international investment and aid, the balance of payments problem. Problems of Australia's external trade and payments.

2. Theory of the firm; costs, revenue and equilibrium; perfect competition, monopoly, oligopoly, monopsony; pricing policies; efficiency of the private enterprise system; problems of nationalised industry.

3. The structure of Australian industry; problems of ownership, control, capital raising, overseas remittance of dividends.

4. Theory of distribution with emphasis on wage determination.

5. Economic Policy: economic fluctuations and growth, inflation; monetary, fiscal and auxiliary policies including a study of public finance in the Australian context.

TEXTBOOKS

Karmel, P. H., and Brunt, M., *The Structure of the Australian Economy,* Cheshire, 1962.
Samuelson, P. A., Hancock, K., and Wallace, R., *Economics, Australian Edition,* McGraw-Hill, 1970.
Stonier, A. W., and Hague, D. C., *A Textbook of Economic Theory,* 2nd ed., Longmans, 1961.

Kindleberger, C. P., *International Economics,* 3rd ed., Irwin, 1965.
Staley, C. E., *International Economics,* Prentice-Hall, 1970.
Ferguson, C. E., and Kreps, J. M., *Principles of Economics,* 2nd ed., Holt, Rinehart & Winston, 1965.
Clark, J. J., *The New Economics of National Defense,* Random House, 1966.
Nevile, J. W., *Fiscal Policy in Australia: Theory and Practice,* Cheshire, 1970.

REFERENCE BOOKS

Caves, R., *American Industry: Structure, Conduct, Performance* Prentice-Hall, 1964.
Dorfman, R., *The Price System,* Prentice-Hall, 1964.
Scitovsky, T., *Welfare and Competition,* Allen & Unwin, 1964.
Robinson, E. A. G., *Monopoly,* Cambridge U.P., 1963.
Kenen, P. B., *International Economics,* Prentice-Hall, 1964.
Backman, J., et al, *War and Defense Economics,* Rinehart, 1952.

3609 Economics III

Lectures 84 hr
Tutorials 28 hr

SYLLABUS

1. Economic development: development problems of both advanced and under-developed countries, with emphasis on the latter.

2. International monetary economics: international monetary organisation, the transfer problem, international liquidity, capital movements.

3. Comparative economic systems: laissez-faire capitalism, regulated capitalism, market socialism, socialist directive centralised planning; labour, allocation of resources, price determination, investment, consumption, foreign trade; problems of economic relations between different social systems.

TEXTBOOKS

Spiegelglas, S. and Welsh, C. J., *Economic Development: Challenge and Promise,* Prentice-Hall, 1970.
Bhagwati, J., *The Economics of Underdeveloped Countries,* World U.L., 1966.
Machlup, F., *Remaking the World's Monetary System,* Johns Hopkins, 1968.
Halm, G. N., *Economic Systems. A Comparative Analysis,* 3rd ed., Holt, Rinehart & Winston, 1968.
Wilczynski, J., *The Economics of Socialism,* George Allen & Unwin, 1970.

REFERENCE BOOKS

Meier, G. M., *Leading Issues in Development Economics,* Oxford U.P., 1964.
Myint, H., *The Economics of Developing Countries,* Hutchinson, 1964.
Meier, G. M., and Baldwin, R. E., *Economic Development: Theory, History, Policy,* Wiley, 1963.
Hirschmann, A. O., *The Strategy of Economic Development,* Yale, 1965.
Perkins, J. O. N., *International Policy for the World Economy,* George Allen & Unwin, 1969.
Fellner, W. et al, *Maintaining and Restoring Balance in International Payments,* Princeton, 1966.
Feinstein, C. H. (ed.), *Socialism, Capitalism and Economic Growth,* Cambridge U.P., 1967.
Grossman, G., *Economic Systems,* Prentice-Hall, 1967.
Gruchy, A. G., *Comparative Economic Systems,* Houghton Mifflin, 1966.
Snavely, W. P., *Theory of Economic Systems,* Merrill, 1969,
Turgeon, L., *The Contrasting Economies,* revd. ed., Allyn & Bacon, 1969.

1651 Geography I

Lectures 84 hr
Tutorial and Laboratory 28 hr

SCOPE

The course provides a study of the various elements of the natural environment, of world population problems, and of the principles of resource-utilisation for peace and war purposes. It is designed to serve both as a self-contained study and as a basis for more advanced work.

SYLLABUS

Part I: Physical Geography

(a) Weather and climate
(b) Hydrologic cycle and water balance
(c) Land forms—elementary geomorphology
(d) Concept of an ecosystem
(e) Land assessment

Part II: Human Geography

(a) The first section considers the perception and utilisation of the resource-base by different societies:
    (i) The concept of a resource: the naturally provided and man-produced resources; population as a resource and as resource-requiring.

(ii) Pressure on resources: policy to assess and develop a nation's domestic resources; policy to obtain access to foreign resources.

(iii) Differing national and regional employment patterns; land-labour-capital complementarity and substitutability; labour and capital intensities; productivity and living standards.

(b) The second section investigates the world's more important types of economic activity with particular emphasis on the theory behind their spatial distribution:

(i) Food and industrial crop production—subsistence production patterns; commercial production—principles of agricultural location, the main types of farm economy, their differing environmental and other controls. World nutrition and related health problems.

(ii) Mining, manufacturing, and tertiary industry: elements of location theory. Application to strategic materials, industries and urban agglomerations, with case studies from the world's major urban-industrial regions.

(iii) Economic, political and strategic aspects of world transport and trade.

TEXTBOOKS

Trewartha, G. T., Robinson, A. H. and Hammond, E. H. *Elements of Geography,* 5th ed., McGraw-Hill, 1967.

Hills, E. S., *Physiography of Victoria,* Whitcombe & Tombs, 1946.

Hare, F. K., *The Restless Atmosphere,* Hutchinson, 1967.

Tweedie, A. D., *Water and the World,* Nelson, 1967.

Alexander, J. W., *Economic Geography,* Prentice-Hall, 1964.

Rutherford, J., Logan, M. I. and Missen, G. J., *New Viewpoints in Economic Geography,* Martindale Press, 1966.

Dicken, S. N. and Pitts, F. R., *Introduction to Human Geography,* Ginn Blaisdell, 1963.

Zelinsky, W., *A Prologue to Population Geography,* Prentice-Hall, 1966.

Ginsburg, N., *Atlas of Economic Development,* Chicago, 1961.

Lewis, C. and Campbell, J. D. (eds.), *The Oxford Atlas,* Oxford U.P., 1965.

Oxford Economic Atlas of the World, 3rd ed., Oxford U.P., 1965.

2651 Geography II

Lectures 84 hr
Tutorial and Laboratory 28 hr

SCOPE

The course includes studies of environments of particular interest to Australia, an introduction to the geography of transportation and to political geography. Aspects of military geography are considered in the treatment.

SYLLABUS

Part I Environment Studies

The following regions will be studied:

South-eastern Australia—temperate environment.
Northern Australia—savanna environment.
South-east Asia—monsoonal environment.
South-west Pacific, with relevance to New Guinea—humid tropical environment.
Inter-zonal relationships.

For each environment, a study of the following:

Physical base: weather and climate; landforms and soils; vegetation.
Human resources: population structure and distribution; settlement types; cultural patterns.
Primary production: agricultural structure, production and potential; mineral output.
Secondary and tertiary production: industrial patterns; transport and trade; problems of economic development. International trade and aid.

Part II Geography of Transportation

A study of the principal means of passenger, freight and power transport: principles of route planning, junction and terminus requirements; modes of operation; freight structures; capacity, time, reliability and vulnerability aspects; co-ordination of media.

Part III Political Geography

The nation, the state, frontiers and boundaries, the territorial sea and air space.

Core areas, capitals, political and administrative subdivisions of territory.

The resource-bases of national power.

The geographical basis of international affairs; political problems concerning resources, trade, transportation and international routes; the aftermath of empires; the geography of international organisation for defence and for economic development.

Appraisal of global strategic views.

TEXTBOOKS

Trewartha, G., Robinson, A. H., and Hammond, E. H., *Fundamentals of Physical Geography,* 2nd ed., McGraw-Hill, 1967.

Dicken, S. N., and Pitts, F. R., *Introduction to Human Geography,* Ginn Blaisdell, 1963.

Rutherford, J., Logan, M. I., and Missen, G. J., *New Viewpoints in Economic Geography,* Martindale Press, 1966.

Rose, A. J., *Patterns of Cities,* Nelson Paperback, 1968.

C.S.I.R.O., *The Australian Environment,* 3rd ed., Melbourne U.P., 1960.

Andrews, J., *Australian Resources and their Utilisation,* Sydney U.

Gourou, P., *The Tropical World,* 4th ed , Longmans, 1966.

Lee, D. A. K , *Climate and Economic Development in the Tropics,* Harper, 1957.

Fisher, C. A., *South-East Asia,* 2nd ed., Methuen, 1964.

Howlett, D., *A Geography of Papua and New Guinea,* Nelson Paperback, 1967.

Taaffe, E. J., and Gauthier, H. J., *Geography of Transportation,* Prentice-Hall.

Cole, J. P., *Geography of World Affairs,* 3rd ed., Pelican, 1963.

Pounds, N. J. G., *Political Geography,* McGraw-Hill, 1963.

Prescott, J. R. V., *Geography of Frontiers and Boundaries,* Hutchinson, 1965.

Peltier, L. C., and Pearcy, G. E., *Military Geography,* Van Nostrand, 1966.

Hall, D. G. E., *Atlas of South-East Asia,* Macmillan, 1964.

Lewis, C., and Campbell, J. D. (eds), *The Oxford Atlas,* Oxford U.P., 1963.

Department of History

1405 History I

Lectures 56 hr
Tutorials 28 hr

The course comprises a study of European and American history during the period 1748–1877.

Introduction:

A brief examination of general trends since the Renaissance and Reformation.

Part I—1748–1787:

The eighteenth-century monarchies with particular reference to France; the *Philosophes* and the intellectual revolution in Europe; the significance of the Seven Years War; the American Revolution and its impact on Europe; the origins of the Industrial Revolution and the French Revolution.

Part II—1787–1815:

The fall of the French Monarchy and the establishment of the French Republic; the French Revolutionary Wars and the rise of Napoleon; the significance of the Consulate and the impact of the Napoleonic conquests on Europe; the principles of Napoleonic warfare and the generalship of Napoleon and Wellington; Federation and the rise of political parties in the United States.

Part III—1815–1849:

Political and social trends in Britain and France 1815–1848; Liberalism and Socialism; the growth of the United States and the long-term causes of the American Civil War; the revolutions of 1848.

Part IV—1850–1877:

The coming of the American Civil War, the strategy of the war and Reconstruction; the character of the French Second Empire; Bismarck and the rise of Prussia; Moltke and the Prussian General Staff; the origins and significance of the Franco-Prussian War.

RECOMMENDED TEXTS

Anderson, M. S., *Europe in the Eighteenth Century,* Longmans, London, 1963.

Craig, G. A., *Europe Since 1815,* Holt, New York, 1966

Current, R. N., and others, *American History: A Survey,* Alfred A. Knopf, New York, 1965.

Dalton, B. J., *Origins of the American Civil War,* Cheshire, Melbourne, 1967.

Ropp, T., *War in the Modern World,* Duke U.P., Durham, 1959.

Rudé, G., *Revolutionary Europe 1783–1815,* Collins, London, 1967.

Stambrook, F. G., *European Nationalism in the Nineteenth Century,* Cheshire, Melbourne, 1969

Tierney, B. and others, *Great Issues in Western Civilization,* Vol. II, Random House, New York, 1967.

Turner, L. C. F., *The American Civil War and Reconstruction 1861–1877,* Cheshire, Melbourne, 1971.

2407 History II

Lectures 58 hr
Tutorials 29 hr

The course comprises a study of European and American history during the period 1871–1962, with some consideration of major problems of Asian and African history during the period.

Part I—1871–1902

Political and social trends in Britain, France and Germany; social and economic changes in Russia and the United States; the modernisation of Japan; the growth of diplomatic and military rivalries between the European powers; the impact of Europe on Asia and Africa.

Part II—1902–1919

The Russo-Japanese War; the causes of the Russian revolutions of 1905 and 1917; the origins of the war of 1914; the strategy and politics of the First World War; the collapse of the German and Austrian empires; the Paris peace settlement; the Russian Civil War; the Chinese Revolution and the impact of the First World War on Asia.

Part III—1920–1939

Problems of post-war Europe and the U.S.A.; the Great Depression; the Stalin regime; the Chinese Civil War and the development of Sino-Japanese conflict; the rise of Fascism and Nazism; the Spanish Civil War; Hitler's policies and the outbreak of the Second World War.

Part IV—1939–1950

The technique of the Blitzkrieg and Hitler's conquests 1939–41; the German invasion of Russia; the strategy of the Pacific War 1942–45; the collapse of the Nazi Empire; the beginnings of the Cold War; the Communist conquest of China.

Part V—1950–1962

The Cold War and containment—Korea, Indo-China and Vietnam; the emerging nations of Asia and Africa; nuclear weapons and the balance of power; the regime of Mao Tse Tung; the Cuban crisis 1962.

RECOMMENDED TEXTS

Cobban, A., *A History of Modern France,* Vol. II, Pelican, London, 1965.

Craig, G. A., *Europe Since 1815,* Holt, New York, 1966.

Current, R. N. and others, *American History: A Survey,* Alfred A. Knopf, New York, 1965.

Gathorne-Hardy, G. M., *A Short History of International Affairs 1920–1939,* Oxford U.P., London Revised ed., 1964.

Michael, F. H. and Taylor, G. E., *The Far East in the Modern World,* revised ed., Methuen, London, 1964.

O'Neill, R. J., *General Giap—Politician and Strategist,* Cassell, Melbourne, 1969.

Pinson, K. S., *Modern Germany,* Macmillan, New York, 1967.

Ropp, T., *War in the Modern World,* Duke U.P., 1959.

Tierney, B., and others, *Great Issues in Western Civilization,* Vol. II, Random House, New York, 1967.

Turner, L. C. F., *The First World War,* Cheshire, Melbourne, 1967.

Turner, L. C. F., *The Coming of the First World War,* Cheshire, Melbourne, 1968.

Turner, L. C. F., *Origins of the First World War,* Arnold, London, 1970.

Young Hum Kim, *Twenty Years of Crisis: The Cold War Era,* Prentice-Hall, Englewood N.J., 1968.

3407 History III

Lecture 58 hr
Tutorial 29 hr

The course is divided into two sections—the Second World War and 20th Century Australia.

Part I

Campaigns of the Second World War with particular reference to North-West Europe 1944–45.

Part II

Political and social trends in Australia 1901–1966 and Australia's foreign relations during the period.

Australian participation in the two World Wars.

RECOMMENDED TEXTS

Part I

Fuller, J. F. C., *The Decisive Battles of the Western World,* Eyre & Spottiswoode, London, 1954–56.
Ropp, T., *War in the Modern World,* Duke U.P., Durham N.C., 1959.
Wilmot, C., *The Struggle for Europe,* Collins, London, 1965.
Young, P., *World War 1939–1945,* Barker, London, 1966.

Part II

Alexander, F., *Australia Since Federation,* Nelson, Melbourne, 1967.
Bean, C. E. W., *Anzac to Amiens,* Australian War Memorial, Canberra, 1961.
Esthus, R. A., *From Enmity to Alliance,* Melbourne University Press, 1965.
Hasluck, P. M. C., *The Government and the People, 1939–41,* Australian War Memorial, Canberra, 1967, reprint.
Louis, L. and Turner, I. (eds), *The Depression of the 1930s,* Cassell, Melbourne, 1968.
Turner, L. C. F., *Australia Since the Camera,* Vol. III. *The Great War 1914–1918,* Cheshire, Melbourne, 1970.
Watt, A., *The Evolution of Australian Foreign Policy, 1938–1965,* Cambridge University Press, 1967.

1413 History C

Lectures and Tutorials 84 hr

An Arts course designed for students studying for a Science degree.

The course comprises a study of politics and war in the 19th and 20th centuries.

Part I

A broad survey of:

The characteristics of 19th century Liberalism, Nationalism and Socialism; the impact of the First World War and Russian Revolution; the character of Fascist and Nazi regimes; the origins and significance of the Second World War; the Cold War and the rise of the Neutralist bloc; problems of emergent Afro-Asian powers; Australia's relations with Asia 1945–60.

Part II

A broad study of military theory and strategy in the 19th and 20th centuries.

Attention will be paid to:

(a) Napoleonic strategy; the American Civil War; Moltke and the rise of the Prussian General Staff.

(b) Military theories of the 20th Century; the strategy of the First and Second World Wars; Revolutionary warfare in Asia.

(c) Study in depth of a campaign, i.e.: The Western Desert, May–October 1942.

RECOMMENDED TEXTS

Part I

Benns, F. L., *Europe Since 1914 in its World Setting,* 8th ed., Appleton-Centrury-Crofts, New York, 1954.

Brecher, M., *The New States of Asia,* O.U.P., London, 1963.

Gelber, H. G., *The Coming of the Second World War,* Cheshire, Melbourne, 1967.

Hudson, G. F., *The Hard and Bitter Peace : World Politics since 1945,* Pall Mall, London, 1966.

Michael, F. H., and Taylor, G. E., *The Far East in the Modern World,* rev. ed., Methuen, London, 1964.

Thomson, D., *Europe Since Napoleon,* Longmans, London, 1966.

Turner, L. C. F., *The Coming of the First World War,* Cheshire, Melbourne, 1968.

Part II

Earle, E. M. (ed.), *Makers of Modern Strategy,* Princeton U.P., Princeton, 1943.

Falls, C., *A Hundred Years of War,* Duckworth, London, 1961.

Howard, M. (ed.), *The Theory and Practice of War,* Cassell, London, 1965.

Ropp, T., *War in the Modern World,* Duke U.P., Durham, 1966.

Turner, L. C. F., *The First World War,* Cheshire, Melbourne, 1970.

Turner, L. C. F., *The American Civil War and Reconstruction 1861–1877,* Cheshire, Melbourne, 1971.

Department of Language & Literature

1507 English I

A course of 84 lectures, with tutorials, on Modern Literature: (i) poetry since Yeats; (ii) drama since Ibsen; (iii) fiction since Joyce.

TEXTS

(i) M. Mack, L. Dean and W. Frost (edd.), *Modern Poetry*
Ibsen, *The Wild Duck*
Shaw, *Man and Superman*
O'Casey, *Juno and the Paycock*
Ionesco, *The Chairs*
Brecht, *Mother Courage*
Eliot, *The Cocktail Party*
Pinter, *The Caretaker*
O'Neill, *The Emperor Jones; Long Day's Journey into Night*
Williams, *A Streetcar Named Desire*
Miller, *Death of a Salesman*

(ii) Joyce, *Portrait of the Artist as a Young Man*
Greene, *The Power and the Glory*
Waugh, *Sword of Honour*
White, *Riders in the Chariot*
Fitzgerald, *The Great Gatsby*
Faulkner, *The Sound and the Fury; Go Down, Moses*
Malamud, *The Assistant*
Ellison, *Invisible Man*

REFERENCE BOOKS

Allen, W., *Tradition and Dream,* Penguin.
Cunliffe, M., *The Literature of the United States,* Penguin.
Dutton, G. (ed.), *The Literature of Australia,* Penguin.
Ford, B. (ed.), *The Modern Age,* Penguin.

2507 English II

A course of 84 lectures, with tutorials, on Romantic and Realist Literature: (i) poetry from Blake to Hopkins; (ii) English fiction, principally of the nineteenth century; (iii) American and Continental fiction.

TEXTS

(i) Blake, *Selected Poems* (ed. Bateson)
Wordsworth (ed. Butt)
Coleridge (ed. Colmer)
Keats (ed. Sharrock)
Tennyson (ed. Millgate)

Browning (ed. Allott)
Arnold (ed. Watt)
Hopkins (ed. Story)
Matthiessen, F. O. (ed.), *Oxford Book of American Verse*

(ii) Scott, *The Heart of Midlothian*
Jane Austen, *Northanger Abbey*
Dickens, *Bleak House*
George Eliot, *Middlemarch*
James, *The American; The Europeans*
Conrad, *Nostromo*
Hardy, *Tess of the d'Urbervilles; Far from the Madding Crowd*

(iii) Cooper, *The Deerslayer*
Hawthorne, *The Scarlet Letter; The Celestial Railroad and Other Stories*
Melville, *Moby Dick; Billy Budd and Other Tales*
Twain, *Huckleberry Finn; The Mysterious Stranger and Other Stories*
Tolstoy, *Anna Karenina*
Dostoevsky, *Crime and Punishment*
Flaubert, *Madame Bovary*
Proust, *Swann's Way*

REFERENCE BOOKS

Allen, W., *The English Novel,* Penguin
Cunliffe, M., *The Literature of the United States,* Penguin.
Ford, B. (ed.), *From Blake to Byron,* Penguin.
Ford, B. (ed.), *From Dickens to Hardy,* Penguin.

3507 English III

A course of 84 lectures, with tutorials, on Renaissance, Baroque and Neo-Classical Literature: (i) Tragedy; (ii) Comedy; (iii) Epic; (iv) Romance; (v) Satire; (vi) The Rise of the Novel; (vii) Metaphysical Poetry. Lectures will pay special attention to, but will not be confined to: Shakespeare, Marlowe, Jonson; Spenser, Milton, Dryden, Pope; Donne; Swift, Johnson, and Fielding.

1551 English Language

A course of 28 lectures, with tutorials, on the use and history of the English language, both written and spoken.

TEXTS

Brooks, C., and Warren, R. P., *The Fundamentals of Good Writing,* Dobson.
Barber, C. L., *The Story of Language,* Pan.
Ramson, W. S. (ed.), *English Transported,* A.N.U. Press.

1521 English A

A course of 28 lectures, with tutorials, on the use of English (both written and spoken) as a means of communication, with some attention to technical and scientific writing.

TEXTS

Brooks, C. and Warren, R. P., *The Fundamentals of Good Writing,* Dobson.
Barber, C. L., *The Story of Language,* Pan.
Ramson, W. S. (ed.), *English Transported,* A.N.U. Press.

2521 English B

A course of 28 lectures on modern poetry, drama and fiction.

TEXTS

M. Mack, L. Dean and W. Frost (edd.), *Modern Poetry.*
O'Neill, *The Emperor Jones; Long Day's Journey Into Night.*
Williams, *A Streetcar Named Desire.*
Miller, *Death of a Salesman.*
Crane, *The Red Badge of Courage.*
Hemingway, *The Sun Also Rises.*
Snow, *The New Men.*

Department of Mathematics

1105 Mathematics I

Lectures	140 hr
Tutorials	56 hr
	196 hr

PRE-REQUISITE

A pass in Mathematics at the first or second level full course in New South Wales, or the equivalent as prescribed for the Faculties of Applied Science and Science.

OUTLINE OF COURSE

(a) *Calculus and Analysis*

Functions, graphs, limits, continuity. Cartesian and polar co-ordinates in the plane. Differential calculus for functions of a single real variable, usual applications. The elementary functions and properties. The concept of an integral, and application to geometrical and physical contexts, including improper and infinite integrals. Techniques of integration. Sum of series, introduction to convergence, power series for elementary functions.

(b) *Vectors*

Vector quantities and their algebra, including scalar, vector and triple products. Applications to include vector geometry of lines and planes.

(c) *Complex Numbers*

Algebra, geometry of z-plane, de Moivre's theorem and applications. Complex functions of a single real variable and their calculus. The exponential form e^{it}. Parametric equations for plane curves, applications.

(d) *Introduction to Modern Algebra*

Examples of fields, ordered fields, group structure, set notation, Boolean algebra.

(e) *Linear Algebra*

Systems of equations, vector spaces, matrix notation, determinants.

(f) *Differential Equations*

Ordinary differential equations of first order and first degree, applications.

(g) *Digital Computing*

EXAMINATIONS

Annual examinations prescribed by the Department, together with tests and assignments during the year.

RECOMMENDED TEXTS

Hille, E., and Salas, S., *First Year Calculus,* Blaisdell, 1968.

Spiegel, M. R., *Theory and Problems of Vector Analysis,* Schaum Publishing Co., New York, 1959.

Green, S. L., *Introduction to Differential Equations,* University Tutorial Press, 1961.

Blatt, John M., *Basic Fortran IV Programming,* Computer Systems, Sydney, 1969.

REFERENCE BOOKS

Macbeath, A. M., *Elementary Vector Algebra,* Oxford University Press, 1964.

Thomas, G. B., *Calculus and Analytical Geometry,* Addison-Wesley.

Birkoff and McLane, *Survey of Modern Algebra,* Macmillan, New York.

Courant, R., *Differential and Integral Calculus,* Vol. I., Blackie & Sons.

2103 Mathematics II

Lectures	112 hr
Tutorials	84 hr
	196 hr

OUTLINE OF COURSE

(a) *Calculus and Analysis*

Mean value theorems, Taylor's theorems. Convergence of series, power series. Taylor expansion, operations with power series. Differential calculus for functions of several variables, Jacobians, transformations, spherical and cylindrical polar co-ordinates, composite functions. Taylor series for functions of several variables, critical points, constrained maxima and minima. Total differentials, conditions for exact differential, implicit functions. Line, area, volume, and surface integrals, usual applications, change of variable in multiple integrals.

(b) *Vectors and Vector Fields*

Scalar fields, directional derivative, level surfaces, gradient, divergence, curl, physical interpretation, potential, curvilinear co-ordinates, Gauss' and Stokes' theorems. Vector differential calculus, and application to Newtonian dynamics.

(c) *Statistical Methods and Numerical Methods*

Elementary probability, practice in basic statistical procedures, introduction to numerical methods.

(d) *Introduction to Matrix Algebra*

Special types of matrices, inversion of matrices, eigenvalues, applications.

(e) *Elementary Functions of a Complex Variable*

(f) *Ordinary Differential Equations*

Linear with constant co-efficients, Cauchy equations, operator methods, reduction of order, variation of parameters, applications to vibrations and circuits, series solutions, introduction to Laplace transforms and initial value problems.

(g) *Partial Differential Equations*

Fourier series, Bessel and Legendre functions, solution of partial differential equations by separation of variables.

EXAMINATIONS

Annual examinations prescribed by the Department, together with tests and assignments during the year.

RECOMMENDED TEXTS

Protter and Morrey, *Modern Mathematical Analysis,* Addison-Wesley, 1964.

Kreyzig, E., *Advanced Engineering Mathematics,* Wiley and Sons, 1964.

Lambe and Tranter, *Differential Equations for Engineers and Scientists,* E.U.P., 1961.

Stephenson, *Mathematical Methods for Science Students,* Longmans, 1961.

REFERENCE BOOKS

Hildebrand, F. B., *Advanced Calculus for Applications,* Prentice-Hall, 1963.

Walpole, R. E., *Introduction to Statistics,* Macmillan, New York, 1968.

Miller, K. S., *Partial Differential Equations in Engineering Problems,* Prentice-Hall, 1959.

Jaeger, J. C., *An Introduction to Applied Mathematics,* Clarendon Press, 1956.

Sokolnikoff and Redheffer, *Mathematics of Physics and Modern Engineering,* McGraw-Hill, 1966.

Beckett and Hurt, *Numerical Calculations and Algorithms,* McGraw-Hill, 1967.

Gaskell, R. E., *Engineering Mathematics,* Staples Press, 1960.

2113 Mathematics II

Lectures	112 hr
Tutorials	56 hr
	168 hr

OUTLINE OF COURSE

(a) *Calculus and Analysis*

Infinite series, mean value theorems, Taylor series. Functions of several variables, multiple integrals, curves and surfaces.

(b) *Differential Equations*

First order ordinary differential equations, linear differential equations with constant co-efficients, series solutions.

(c) *Linear Algebra*

Matrix algebra, vector spaces, applications to quadratic forms and three dimensional geometry.

(d) *Introduction to Statistics*

Probability, treatment of data, random variable, distributions, sampling theory, estimation theory, hypothesis testing, regression and correlation, analysis of variation.

EXAMINATIONS

Annual examinations prescribed by the Department, together with tests and assignments during the year.

RECOMMENDED TEXTS

Protter and Morrey, *Modern Mathematical Analysis,* Addison, Wesley, 1964.

Green, S. L., *Introduction to Differential Equations,* University Tutorial Press, 1961.

Hohn, F. E., *Elementary Matrix Algebra,* 2nd ed., Macmillan Co., New York 1964.

Walpole, R. E., *Introduction to Statistics,* Macmillan Co., New York 1968.

2173 Mathematics II

Lectures	84 hr
Tutorials	28 hr
	112 hr

SCOPE

A service mathematics course for Mechanical and Civil Engineers. Additional lectures and tutorials are given in conjunction with this course as part of the course for 2711 Mechanics and Computations.

OUTLINE OF COURSE

(a) *Calculus and Analysis*

Mean value theorems, Taylor's theorem. Convergence of series, power series, Taylor series operations with power series, application to compilation of tables and evaluation of definite integrals.

Differential calculus of functions of several variables, curves and surfaces. Taylor series, critical points, differentials, conditions for exact differential, implicit functions, plane polar, spherical, and cylindrical co-ordinates.

Line, area, volume, surface integrals with application to volumes, mass distributions, moments of inertia, work, energy fluid flow, heat transfer.

(b) *Vectors and Vector Fields*

Scalar and vector fields, level surfaces, directional derivatives, gradient, conservative fields and potential divergence and curl, Stokes' and Gauss' theorems.

(c) *Differential Equations*

Ordinary linear with constant coefficients and applications.

(d) *Statistics*

Processing errors, statistical data, elementary statistical methods.

(e) *Linear programming*

Introduction to elementary techniques.

EXAMINATIONS

Annual examinations prescribed by the Department, together with tests and assignments during the year.

RECOMMENDED TEXTS

Green, *Introduction to Differential Equations,* Uni.Tut. Press, 1961.

Sokolnikoff, *Higher Mathematics for Engineers,* McGraw-Hill, 1941.

Spiegel, *Applied Differential Equations,* Prentice-Hall, 1958.

Spiegel, *Vector Analysis,* Schaum Outline Series, 1959.

REFERENCE BOOKS

Cuming and Anson, *Mathematics and Statistics for Technologists,* Heywood, 1966.

Gaskell, *Engineering Mathematics,* Staples, 1960.

Heading, *Mathematical Methods in Science and Engineering,* E. Arnold, 1963.

Massey and Kestelman, *Ancillary Mathematics,* Pitman, 1964.

3103 Mathematics III

Lectures	196 hr
Tutorials	168 hr
Study periods	112 hr
	476 hr

OUTLINE OF COURSE

Topics amounting to *twelve units* will be selected from the following list. Each topic will count for *two units* and some of them will be arranged so that the first half can be taken as a *one unit* topic.

(a) Mathematical methods.
(b) Mathematical statistics and probability theory.
(c) Operations research.
(d) Fluid dynamics.
(e) Newtonian dynamics, exterior ballistics and special relativity.
(f) Integral transforms.
(g) Matrices and linear algebra.
(h) Boundary value problems.
(i) Complex variable.
(j) Theory of elasticity.
(k) Calculus of variations.
(l) Maxwell's equations.
(m) Numerical analysis.
(n) Computing techniques.

EXAMINATIONS

Annual examinations prescribed by the Department, together with tests and assignments during the year.

3103A Mathematics IIIA

OUTLINE OF COURSE

Topics amounting to *four units* will be selected from the list appearing under 3103 Mathematics III.

3103B Mathematics IIIB

OUTLINE OF COURSE

Topics amounting to *one, two or three units* (depending on the number of units selected in 3203B Physics IIIB or 3303 Chemistry IIIB) will be selected from the list appearing under 3103 Mathematics III.

Department of Physics

1203 Physics I

Lectures	84 hr
Practical	84 hr
Tutorials	28 hr
	196 hr

General Physics

The definition, and scope, of physics. Physical quantities, systems of units, dimensional analysis. Kinematics, Newton's laws of motion. Kepler's laws. Newton's law of gravitation, gravitational field. Impulse and momentum, conservation. Work, energy, power, conservation of energy. Collisions. Simple harmonic motion. Rotational dynamics, moment of inertia, radius of gyration, conservation of angular momentum, precession.

Properties of Matter

Hydrostatics. Pressure, barometry. Hydrodynamics, Bernoulli's theorem. Viscosity. Surface tension. Elasticity, elastic moduli, Poisson's ratio.

Heat

Temperature, thermometry. Heat capacity. First law of thermodynamics. Calorimetry. Atomic heat of solids. Kinetic theory. Non-ideal gases. Van der Waal's equation. Isotherms. Conduction and radiation of heat. Pyrometers.

Wave Motion and Optics

Progressive and stationary waves. Superposition of waves. Doppler effect. Resonance. Huygen's principle. Reflection, refraction, interference and diffraction of waves. Electromagnetic spectrum. Polarisation.

Electricity and Magnetism

Gauss' theorem. Electric intensity and induction. Capacitance. Electromagnetism. Biot-Savart and Ampere's laws. Force on moving charge and on conductor. Torque on coil. D.C. instruments. Electromagnetic induction. Faraday's and Lenz' Laws, self and mutual inductance, magnetic materials. D.C. circuits, Kirchoff's rules, measurement of resistance and of potential difference. Growth and decay of current.

Atomic and Nuclear Physics

Measurement of specific charge and absolute charge. Natura and artificial radioactivity. Quantum properties of radiation. The Bohr atom. Wave properties of matter. The uncertainty principle. The neutron. Nuclear fission and fusion.

RECOMMENDED TEXTS

Weidner and Sells, *Elementary Classical Physics,* Vols. I and II, Allyn & Bacon, 1965.

REFERENCE BOOKS

Halliday and Resnick, *Physics for Students of Science and Engineering,* Wiley, 1967.

Weidner and Sells, *Elementary Modern Physics,* Allyn & Bacon, 1960.

Richards, Sears, Wehr and Zemansky, *Modern University Physics,* Addison-Wesley, 1960.

Alonso and Finn, *Fundamental University Physics,* Addison-Wesley, 1967.

2203 Physics II

Lectures	112 hr
Tutorials/Practical	112 hr
	224 hr

Thermodynamics, Kinetic Theory of Gases and Statistical Mechanics

Thermodynamics variables and the state of a system. Laws of thermodynamics. Kelvin temperature scale. Entropy. Thermodynamic functions and relations. Phase change. Reversible cell. Adiabatic demagnetisation. Distribution of molecular velocities. Maxwell-Boltzmann statistics. Fermi-Dirac statistics and Bose-Einstein statistics.

Waves and Matter

Harmonic oscillations. Coupled vibrations. Vibrations in solids, specific heat, Einstein model. Wave motion, group velocity, vibrations and waves in continuous and discontinuous media, crystal structure and binding energy, interaction of acoustic, electro-magnetic, and particle waves with regular structures, diffraction, Bragg relationship, resolving power.

Electricity and Magnetism

Electrostatics. Dielectric media. Magnetic effects of steady currents. Electromagnetic induction. Maxwell's electromagnetic equations. Plane electromagnetic waves. Magnetic materials. Linear electric circuits: transient response to step excitation, steady state response to harmonic excitation, amplifiers.

Introduction to Relativity: Atomic and Nuclear Physics

Relativity. Photoelectric effect. The origin of spectra. Excitation and absorption. Wave mechanics. Schrodinger equation. Uncertainty principle. Quantum states. X-ray spectra. Radioactivity, detectors, nuclear spectra. Nuclear reactions.

RECOMMENDED TEXT

Constant, *Theoretical Physics* (Thermodynamics, Electromagnetism, Waves, and Particles), Addison-Wesley, 1958.

Duffin, *Electricity and Magnetism,* McGraw-Hill, 1965.

Semat, *Introduction to Atomic and Nuclear Physics,* Rinehart, 1960.

Resnick, *Introduction to Special Relativity,* Wiley, 1968.

Kittel, *Elementary Solid State Physics,* Wiley, 1964.

Halliday, *Introductory Nuclear Physics,* 2nd ed., Wiley, 1955.

REFERENCE BOOKS

Kaplan, *Nuclear Physics,* Addison-Wesley, 1963.

Richtmeyer, Kennard and Lauritsen, *Introduction to Modern Physics,* McGraw-Hill, 1955.

Sears, *Thermodynamics, The Kinetic Theory of Gases and Statistical Mechanics,* Addison-Wesley, 1953.

Livesey, *Atomic and Nuclear Physics,* Blaisdell, 1966.

Scott, *The Physics of Electricity and Magnetism,* Wiley, 1966.

Feynman, *Lectures on Physics,* Vol. II, Addison-Wesley, 1964.

Eisberg, *Fundamentals of Modern Physics,* Wiley, 1961.

Sears, *Mechanics, Wave Motion and Heat,* Addison-Wesley, 1958.

Morse, *Thermal Physics,* Benjamin, 1964.

Weidner and Sells, *Elementary Modern Physics,* Allyn & Bacon, 1960.

Bitter, *Currents, Fields and Particles,* Chapman and Hall, 1957.

Harnwell, *Principles of Electricity and Electromagnetism,* McGraw-Hill, 1949.

3203 Physics III

Lectures	140 hr
Laboratory	336 hr
	476 hr

OUTLINE OF COURSE

Topics amounting to *twelve units* will be selected from the following list. Topic (a) counts for *three units*, topics (b), (c) and (o) for *two units* each, and each of the remainder for *one unit*.

(a) Electromagnetic theory.
(b) Quantum mechanics.
(c) Physics of the solid state.
(d) Statistical mechanics.
(e) Special theory of relativity.
(f) Electron physics.

(g) Circuit theory.
(h) Computer technology.
(i) Magnetic materials.
(j) Spectroscopy.
(k) Nuclear physics.
(l) Particle physics.
(m) Plasma physics.
(n) Ionospheric physics.
(o) Computing techniques.

3203A Physics IIIA

OUTLINE OF COURSE

Topics amounting to *four units* will be selected from the list appearing under 3203 Physics III.

3203B Physics IIIB

OUTLINE OF COURSE

Topics amounting to *one, two or three units* (depending on the number of units selected from 3303B Chemistry IIIB and 3103B Mathematics IIIB) will be selected from the list appearing under 3203 Physics III.

1805 Science IA

Lectures	112 hr
Demonstration/Tutorials	56 hr
	168 hr

This subject is presented by the Departments of Chemistry and Physics.

SYLLABUS

1. Properties of gaseous, liquid and solid systems; colligative properties of solutions; colloids; equilibrium in chemical reactions; thermochemistry; electrochemistry; redox reactions. Electronic structures of atoms and molecules; principles of chemical combination; crystal chemistry. The periodic table of the elements; comparative chemistry of selected groups of elements; nature and chemical applications of radioactivity. Reactions and structure of organic compounds.

2. Particles in motion, Newtonian mechanics, relativity. Properties of matter and the nature of heat. Waves; simple harmonic motion, characteristics of waves, electromagnetic waves, behaviour characteristics of waves, the laws of optics, optical instruments. Electricity and magnetism. Quantum mechanics; black body radiation, the photoelectric effect, the X-ray spectrum; Compton effect; wave properties of moving particles; probability and uncertainty; the nature of an atom. Nuclear physics; radioactivity, nuclear reactions, nuclear structure. Fission, fusion.

3. The nature and history of science, scientific method, science and technology, research and development. Technology in industry.

RECOMMENDED TEXTS

Sienko and Plane, *Chemistry*, 3rd ed., McGraw-Hill, 1966.

Topson and Vaughan, *Organic Chemistry,* Whitcombe and Tombs, 1962.

K. R. Atkins, *Physics,* Wiley, 1965.

REFERENCE BOOKS

Gamow and Cleveland, *Physics, Foundations and Frontiers,* Prentice Hall, 1960.

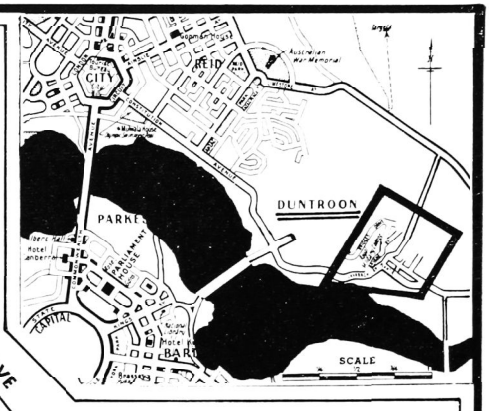
J. A. Ripley, *The Elements and Structure of the Physical Sciences,* Wiley, 1964.

Holton and Roller, *Foundations of Modern Physical Science,* Addison-Wesley, 1958.

Holton, *Introduction to the Concepts and Theories in Physical Science,* Addison-Wesley, 1953.

ROYAL MILITARY COLLEGE

DUNTROON



TO CITY - FAIRBAIRN AVE

ROAD

GOLF COURSE

HARRISON ROAD

CAMPBELL

CHAPEL

ROBERT

TO MT PLEASANT

PARADE GROUND

DUNTROON HOUSE

LAVARACK ROAD

JUBILEE RD

PLANT

ROAD

GOLF COURSE

TO CITY

MORSHEAD DRIVE

MOLONGLO RIVER

TO AIRPORT

LEGEND

1. RMC headquarters, library and military instruction block
2. Headquarters Corps of Staff Cadets
3. Cadets mess and living quarters
4. Engineering and physics laboratories
5. Computer block
6. Chemistry laboratories
7. Anzac block
8. RMC hospital
9. Cinema
10. Commandants residence
11. Golf club house
12. Sergeants mess
13. Swimming pool
14. Tennis courts
15. Officers mess