MSc/PG Diploma

in

Building Services Engineering

Student Handbook

2018/2019

Departments of Civil, Electrical and Mechanical Engineeering

Faculty of Engineering

University of Moratuwa

Sri Lanka

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1 Introduction

This Postgraduate taught course is jointly conducted by the Civil, Electrical and Mechanical Engineering Departments of University of Moratuwa. It aims to provide an advanced knowledge in a variety of technological areas related to building services focusing on the development of skills in design and operation of building services while enabling to embark on research.

The lectures are carried out by expert members of academic staff and the industry. Our aim is to educate industrially orientated professionals with firm theoretical understanding and profound expertise in the field of building services engineering. This course is accredited by the Chartered Institution of Building Services Engineers (CIBSE), UK.

2 Eligibility Criteria

Eligibility and Performance criteria No. 49/A/ME/MSE:2014, framed under clause 6.3 of the By-Law No. 49:2013, and to be generally used in advertising the course. The selection of students to the Postgraduate Diplomas will be made jointly by the Departments of Civil, Electrical and Mechanical Engineering, in accordance with the following extended eligibility requirements, approved by the Senate.

1. The Degree of Bachelor of The Science of Engineering of the University of Moratuwa in Civil, Mechanical, or Electrical Engineering specialty and minimum 1 year experience in the field of Building Services Engineering, as approved by the Senate
   or
2. Any other Engineering degree of at least four year duration from a recognized university in Civil, Electrical or Mechanical Engineering specialty and minimum 1 year experience in the field of Building Services Engineering, as may be approved by the Senate
   or
3. Any other Engineering degree of at least three year duration in Civil, Electrical or Mechanical Engineering specialty from a recognized university, with minimum of two years experience in the field of Building Services Engineering, as may be approved by the Senate
   or
4. Any recognized category of membership of a recognized Engineering Professional Institute with at least 3 years of relevant experience, after obtaining the professional qualification as may be approved by the Senate.

3 Course duration

PG Diploma: 1 year Part Time (Fridays and Saturdays) for three terms

- Term duration is 18 weeks which comprise of 14 Academic, 2 Study Leave, 2 Exam weeks

MSc Degree: 2 years Part Time

- 1 year PG Diploma + 1 Year Research Project

Only the students who complete the requirements of the PG Diploma are eligible to carryout research towards the MSc degree.

4 Scheme of Evaluation

4.1 Participation in the Academic Programme

- 80% attendance is required in lectures, as specified under clause 4.1.1(a) of the By-Law.
- Participation is compulsory in assignments, as specified under clause 4.1.1(b) of the By-Law.
- Undertaking research in a specific area is compulsory, as specified in clause 4.1.1(c) of the By-Law.
- The Masters Degree Programme is expected to be completed in the normal duration(2 years), but may go on till the permitted duration of study without the need of an extension as specified under section 5 of the By-Law.
- It is the responsibility of the student to obtain an extension to the permitted duration, through the Head of Department. Such requests to extend the duration will be taken, considering the progress of the student at the time of request.
- Prior approval must be obtained in writing from the University, with the necessary documentation, for leave of absence (as defined by the Senate). Only such leave will be considered for any official purpose, such as considering a subsequent attempt as a first attempt.
- Only approved leave obtained on medical grounds will normally be considered by the Senate in extending the maximum duration of study.

4.2 Award of Subject Grades

See Table 1 for the award of subject grades.

Table 1: Award of Subject Grades

Benchmark Percentage	Grade	Grade Point	Description
85 and above	A+	4.2	
75 to 84	A	4.0	Excellent
70 to 74	A-	3.7	
65 to 69	B+	3.3	
60 to 64	B	3.0	Good
55 to 59	B-	2.7	
50 to 54	C+	2.3	Pass
	I	0.0	Incomplete
	F	0.0	Fail
	N	—	Academic concession

4.3 Calculation of Grade Point Average

- The Grade Point Average (GPA) is calculated based on the summation of Grade Points earned for all modules registered for credit (except those awarded with academic concession or withdrawn) weighted according to number of credits, as follows.

$$GPA = \frac{\sum n_i \times g_i}{\sum n_i}$$

  Where, n_i is the number of credits for the i^{th} module and g_i is the grade points earned for that module.

- The GPA is rounded to the nearest second decimal place and reported on the transcript.
- Eligibility for the award of PG Diploma in Building Services Engineering with an overall GPA not less than 2.5.

4.4 Evaluation and Grading

- The performance of each student in each module will be evaluated by continuous assessment (CA) and end-of-semester examination (WE).
- The CA component in a module normally carries a weightage of not less than 30% and not more than 60% of the total marks.
- The continuous assessment of a student may be based on a specified combination of assignments including coursework, project work, design project work, laboratory work, tutorials, field trips, field camps, quizzes, presentations, term papers and participation in the course activities.
- Each Candidate should obtain at least 40% from each of CA and WE components to obtain a pass grade for a module.
- Grade C+ or above is required to earn credit for and pass a module.
- A student failing to reach 40% in one of CA or WE components receives an incomplete grade I, and is required to repeat only the failed component/s as a repeat candidate to complete the module.
- A student obtaining at least 40% in each of CA and WE components but fails to pass a module receives an incomplete grade I, and is required to repeat either of the component as a repeat candidate to complete the module.
- A student failing to reach 40% in both CA and WE components receives an F grade, and must repeat both components in order to upgrade the result.
- The grades F or I can be improved up to a C+ grade and considered for calculating the GPA. Students who wish to upgrade need to complete their examinations and obtain the upgraded grade before the relevant final board of examiners after the graduation requirements are met.
- The grade achieved for each module will be entered on the student's permanent record in the registry. The grade at the first attempt or the improved grade earned at a subsequent attempt, if any, will be recorded.

- Except when an Academic Concession has been granted, the highest grade obtainable at a repeat attempt is the grade "C+" and it will be used for calculating Grade Point Average (GPA).
- Grade N signifies an Academic Concession granted, in the event a student is unable to sit for the WE component due to illness or other compelling reason accepted by the Senate. In such instances the student must make an appeal, with supporting documents, to the Senate through the Director Postgraduate Studies for an Academic concession.
- Letter grades based on the Grade point system and corresponding description, as illustrated in the above Table will be used to express the performance at each module. Benchmark percentages are given for the guidance of the examiner and may be changed upwards or downwards by the moderator in consultation with the examiner.
- If a student is unsuccessful in any subject or component, s/he may be re-examined and this shall normally be at the next holding of the examination(s)/ assessment(s). No postponement shall be allowed without prior approval of the Senate.

4.5 Evaluation of the MSc Research Project

- Examination of dissertation, evaluation of the seminar and oral examination of the candidate by a panel of examiners.
- The grading for the research project will be A+, A, A-, B+, B, B-, C+, I, F. All pass grades carry 15 credits for the research project.

4.6 Pass in the PG Diploma

Minimum of 40 Credits is required. With passes for compulsory modules.

4.7 Pass in the MSc

Minimum of 60 Credits is required (i.e Minimum 40 Credits from PG Diploma + Compulsory 20 Credits from MSc Research Project).

4.8 Release of Results

Subject to confirmation by the Senate, results of a candidate shall be released after the Board of Examiners meeting, unless the Board of Examiners recommends withholding of the results for specific reasons.

4.9 Date of Award

The effective date of the MSc shall be the first day of the month after the successful completion of the PG Diploma and the MSc Research Project, with obtaining the minimum credit requirement for the course.

5 Curriculum

Students have to register for the modules on the first two days of each term. All lectures, tutorials, assignments, laboratory work, seminars etc. will normally be conducted on Fridays and Saturdays and evaluated both on a continuous and end term basis. The successful completion of the first year will enable the student to earn the Postgraduate Diploma in Building Services Engineering. Students who have registered for the degree of Master of Science, on the successful completion of a Research Project in the second year will receive the MSc degree in Building Services Engineering.

Table 2: Curriculum of PG Diploma in Building Services Engineering

Code	Module Title	Category	Credits	Norm	Evaluation	
					WE	CA
Term 01						
ME5501	Heat Transfer and Applications	C	5		60%	40%
EE5501	Lighting and Visual Comfort	C	5	10	70%	30%
CE5502	Piped Services	E	3		70%	30%
CE5503	Sustainable Built Environment	E	3	3	70%	30%
total for Term 01				13		
Term 02						
ME5502	Air Conditioning and Ventilation	C	5		50%	50%
EE5502	Ancillary Services of Modern Buildings	C	5	10	70%	30%
EE5504	Electrical Components and Integration	E	3		70%	30%
CE5505	Project management	E	3	3	70%	30%
total for Term 02				13		
Term 03						
CE5501	Building Services and Management of Facilities	C	5		70%	30%
EE5503	Building Acoustics	C	5		70%	30%
ME5599	Project on Building Services	C	4	14	0%	100%
ME5503	Energy and Controls	O	3		70%	30%
CE5504	Contracts and Procurement	O	3	0	70%	30%
total for Term 03				14		

Table 3: Curriculum for MSc Research Project

Code	**Module Title**	**Credits**	**Type**	**Evaluation**	
				WE	CA
ME6509	Research Project	60	C		100%

Table 4: Legend

WE=	Written Exam
CA=	Continuous Assessment
C=	Compulsory
E=	Elective
1 Credit =	01 hour of Lectures or 02 hours of tutorial/lab per week per term

6 Outline Syllabi

6.1 Outline syllabi of PG Diploma and MSc

Table 5: ME5501: Heat Transfer and Applications

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
ME5501	Heat Transfer and Applications	5	C	60%	40%

Objective:
To provide a broad understanding of heat receiving, transfer and storage aspects of buildings.

Learning Outcomes:
Ability to mathematically explain all the aspects related to heat transfer, select most appropriate building elements and systems for higher energy efficiency and effective performance.

Outline: Heat Transfer modes(Conduction, Convection and Radiation and by means of Air Movement), Thermal Resistance, U values, Thermal Transmittance of a Simple Building, thermal bridging, Heat Gains/Losses from Buildings, Specific Heat Capacity, Boilers, Hot water Systems Design, Heating Systems and Equipment (Radiators, Convectors, Fan Convectors, Radiant Panels), Solar Radiation, Sol-air Temperature, Heat Transmission through Walls/ Glasses, Shading, Conduction - Analytical techniques, Finite Difference Techniques, Graphical techniques, Conduction Shape Factor, Boiling Modes of Liquids, Pool Boiling, Influence of Nucleation Sites, Power Requirements for Boiling, Calculation of Critical Heat Flux, Unsteady heat Transfer, Fourier's Law, Finite Difference Solutions to Fourier's Equation, Air-material Boundary, Inter-material Boundary Condition, Cavity Interface, Electric and Hydraulic Analogs, Steady State Conduction through Cylindrical Layers, Multiple Layer Pipe walls, Effects of Insulation Thickness, Heat Exchangers and Performance, Fin Effectiveness and Overall Coefficient

Table 6: EE5503: Building Acoustics

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
EE5503	Building Acoustics	5	C	70%	30%

Objective:

To provide an in depth knowledge on acoustics related to buildings/ building services from basics and developing to cover design, installation, health and environmental aspects.

Learning Outcomes:

Ability to understand the basics of sound transmission,
design noise control systems taking into account regulatory, health and environmental aspects.

Outline: Acoustic Waves, Pure Tones, Complex Tones, Octave Band Frequencies, Acoustic Sources, Noise Sources Outdoors, Basics of Sound Transmission, Relationship between Power and SPL, Decibel calculations, Room Acoustics, Surface Absorption, Reverberation Time, Sound Reduction Index (SRI), Factors governing SRI, Practical Considerations, Surface Directivity, Acoustic Screening, Duct Borne Noise, Sources of Noise, Attenuation, Estimating the Noise in a Room, Vibration, Isolation and Control, Vibration Isolation, Excitation of a floor, Air Conditioning Noise Control, Generator Noise Control, Floating Foundations, Sound Masking, Health Aspects, Temporary Threshold Shift, Permanent Threshold Shift, Codes and Regulations, Noise Nuisance and Environmental Aspects, Noise Pollution Control

Table 7: CE5502: Piped Services

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
CE5502	Piped Services	3	E	70%	30%

Objective:

To provide an indepth knowledge on aspects of piped services including Fluids, Plumbing,Sanitation and Fire Protection

Learning Outcomes:

Ability to select and design most appropriate plumbing and drainage installations for different building aplications.

Outline: Fluid Flow, Fluid Mechanics in Building Services Systems, Equations of continuity of Mass and flow Momentum, Steady Flow Energy Equation and applications, Steady and Unsteady Flow, Mass and Volumetric Flow, Cross Sectional Flow Velocity Profiles, Determination of Volumetric Flow Rate via Pitot Tube, Computer Modelling, Flow between Two Reservoirs open to Atmosphere, Darcy's Equation, Friction factor, Hydraulic Mean Depth, Flow in Open Channels, Chezy Equation, Effects of Friction on Flow Conditions, Reynolds Number, Separation Losses, Colebrook-White Equation, Duct Sizing, Incompressible Steady Flow in Duct Networks, Series/ Parallel/ Closed Looped Duct Systems, Fan /System pressure Relationships, Fan/Pump and System matching, Dimensional Analysis, Applications, Dimensionless groups and Fan Laws, Fan/ Pump Characteristics, Similarity applied to System Modeling, Froude, Mach and Weber Numbers, Pressure, Stress and Force Coefficients, Down Flows on Vertical Stacks, Pipe Network Analysis, Hardy Cross Method, Ventilation and Airborne Contamination, Ventilation Rates/ Requirements, Decay Equation and Applications, Loading Units, Distribution Systems, Pump Selection, Drainage and Vent Systems, Pressure Fluctuations, Discharge Units, Stack Sizing, Fire Hydrant and Hose reel systems, Types of Hydrants, Portable Fire Extinguishers, Piped Gas Installations

Table 8: CE5503: Sustainable Built Environment

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
CE5503	Sustainable Built Environment	3	E	70%	30%

Objective:

To provide a knowledge on architectural, structural, renewable energy and sustainability aspects and the certification protocols that ensure built environment sustainability

Learning Outcomes:

Ability to incorporate renewable energy and sustainability aspects appropriately from conceptual stage of building through construction, operation and maintenance processes

Outline: The Design Team, Principles of Green Buildings, Neighborhood design considerations, Energy efficiency and the built environment, Noise Considerations,Use of Daylight, CIBSE Method of Window Design, Maximizing the Use of Daylight, Renewable Energy Sources and Applications, Rain water Harvesting, Water Resources Management, Solid Waste Disposal, Incinerators, Compost Yards, Reed Bed Systems, Ground Water Extraction and its Impact on Environment, Water Treatment, Sewer and Waste Water Treatment, Sustainable building certification protocols (LEED and BREEAM), Impediments to built environmental sustainability

Table 9: ME5502: Air Conditioning and Ventilation

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
ME5502	Air Conditioning and Ventilation	5	C	50%	50%

Objective:
To provide a broad knowledge in the field of Air Conditioning and Ventilation starting from design to the practical aspects of installations and maintenance

Learning Outcomes:
Ability to explain basic concepts and different types of systems and their related performance,
explain aspects of thermal comfort and indoor air quality,
design air conditioning systems taking into account the thermal comfort, energy, indoor air quality and economical aspects

Outline: Thermal Comfort, Indoor and Outdoor Design Criteria, Factors affecting Thermal Comfort, Metabolism, Thermal Indices, Resultant Temperature, External Heat gains (Solar Gains, Heat gain Through wall and Roofs, Transmission Gain through Glass, Infiltration), Internal Heat Gains (Gains from Occupants, Lighting Gains, Gains from Electrical Equipment, Diversity factors, Psychrometry (Psychrometric Chart, Air and water Vapour Mixtures, Psychrometric Processes used in Air Conditioning, Sensible and Latent Heat Loads, Control of Room Conditions, Use of Extract and Fresh Air Mixtures, Humidification and Dehumidification, Heat Load Calculations (CIBSE/ ASHRAE/ Carrier), Selection of Systems/ Equipment, Unitary Systems, All Air Systems, Air Water Systems, Individual/ Central systems, Vapour Compression Cycle, Absorption Cycle, Heat Rejection Equipment, Refrigeration and Heat rejection, Evaporators, Condensers, Cooling Towers, Installation, Testing and Commissioning, Ventilation requirements, Infiltration Calculations, Type of Systems, Selection of Equipment, Testing and commissioning

Table 10: CE5501: Building Services and Management of Facilities

Code	**Module Title**	**Credits**	**Type**	**Evaluation**	
				WE	CA
CE5501	Building Services and Management of Facilities	5	C	70%	30%

Objective:
To provide a sound knowledge of latest developments in the field of building/ facilities maintenance and management

Learning Outcomes:
Ability to draft policies and formulate programmes/ schedules for effective, energy efficient management of facilities/ building services.

Outline: Requirement, Historical Development, Energy Efficiency, Factors contributing to Energy Efficiency, Understanding the Building, Overview of the Design Intent, Assessing the Current Status and Documentation, Ways of Measurement, Bench Marking, Energy Policy, Purchasing Policy, Maintenance Policy, Organizational Structures, Responsibilities and Reporting, Roles and Activities, Obtaining Resources, Sub-Contracting/ Outsourcing, Contract/ Direct Labour, Occupant's Involvement, Motivation and Training, Occupant Satisfaction, Maintenance Aspects, Monitoring and Control, Financial Indicators

Table 11: EE5504: Electrical Components and Integration

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
EE5504	Electrical Components and Integration	3	E	70%	30%

Objective:

To provide an indepth knowledge on electrical power generation and distribution related to buildings including regulatory, energy and safety aspects

Learning Outcomes:

Ability to carryout a complete electrical power distribution system for a building taking into account all regulatory, energy and safety aspects.

Outline:HT Supply (11kV/33kV), Transformers, 400V Distribution, Standby Supplies, Codes and Standards, Nature of Generation, Transmission and Distribution Systems, AC Sinusoidal Circuits, manipulation of Complex Quantities, Power in Single and Multi Phase AC Circuits, Reactive and Real Power, Power Factor Correction, Control Systems and Cubicles, CHP Systems, Batteries, Plant Cells, Valve Regulated Sealed Gas Recombination Cells, Battery Performance and Capacities, Cell Construction, Recharge Characteristics, UPS, Dynamic and Static Systems, Transformers- Theory, Losses, Regulation, Parallel Operation, Load Sharing, Switchgear(HV), Supply Industry Standards/ Regulations, Electricity Pricing, Demand Profiling, Sheddable Loads, Load Estimating, System Voltage and Supply Arrangements, Metering, Earthing Systems, Neutral Earthing, Fault Calculations, Equipment Reactances, Impedance and fault Levels, Protection: Zoning, Over Current and Earth fault, Relay Types, Unit Feeder and Transformer Protection, Protective Conductors, Earthing and Sizing, Supplementary Equi-potential Bonding, Protection against Direct and Indirect Contact, Switchgear (LV), Protection against Over-current, Breaking Capacity of Fuses and circuit Breakers, Application of Circuit Protective Devices, Discrimination, Location of Protective Devices, Circuit Conductor Sizing, Voltage Drop, Testing and Inspection

Table 12: CE5505: Project Management

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
CE5505	Project Management	3	E	70%	30%

Objective:

To provide a complete overview of project and quality management aspects in building projects

Learning Outcomes:

Ability to :-perform as a Project Manager in the design team

:-control and monitor progress of building services projects.

Outline: What is Project Management, Project Management Structures, Dedicated Project Structure, Task Structures, Philosophy and Organization of Project Management, Planning, RIBA Plan of Work, Monitoring and Control, Management Cost and Control System (MCCS), Work Breakdown Structure (WBS), Pricing, Estimating and Cost Control, Cost and Progress Controlling Indices (ACWP, BCWP, BCWS, VAC...etc.), The Critical path - How is it done?, Use of Computers for Project Management, How can Project Management help?, Post-Contract Documentation, Customer and Management Reporting, Arbitration, Adjudication and Litigation, Resolution of Disputes

Table 13: EE5502: Ancillary Services of Modern Buildings

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
EE5502	Ancillary Services of Modern Buildings	5	C	70%	30%

Objective:
To provide a broad understanding on the ancillary services in buildings covering all the modern aspets and technology

Learning Outcomes:
Ability to select and design most appropriate ancillary systems for buildings considering latest technology updates

Outline: Types of Fire Detection Systems, Smoke Detectors Heat Detectors, Control Panels, Codes and Standards, Fire Rated Cabling, Special Installations, Automatic Suppression Systems, Applications, Data Transmission, Cabling Options (Fibre Optic, Muli-pair...etc.), Patch Panels and Switchgear, Types of Systems, Structured Cabling Systems, CCTV and Security Systems, Types of Applications, Components involved, Types of Communication/ Telephone Systems and Applications, PABXs, Phones, other Equipment and Switchgear, Broad Band Access, Satellite Communications, MATV Systems, Lifts and Escalators, Electric, Hydraulic and other applications, Control Systems

Table 14: EE5501: Lighting and Visual Comfort

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
EE5501	Lighting and Visual Comfort	5	C	70%	30%

Objective:
To provide a broad knowledge on lighting systems, both artificial and natural, including concepts, Codes, Standards and practical aspects

Learning Outcomes:
Ability to :-complete lighting calculations for buildings
:-design systems maximizing the use of natural light for higher energy efficiency.

Outline: Solid Angle, Luminous Flux and Intensity, Illuminance/Luminance, Reflectance, Inverse Square Law, Cosine Law, Law of Additivity, Light, Vision and Visual Effects of Lighting (The Structure of Eye, The Operation of the Visual System, Visual Acuity, Contrast Sensitivity, Glare, Visula Performance, Building Lighting Requirements), Lighting Design (Point by Point and Lumen Methods, Utilization Factors, Uplighting, Computer Modelling, Glare Index Calculation and CIE Unified Glare Rating, CIBSE Guide), Lighting Equipment: Lamps (Incandecent, Discharge, Lamp Life, Lumen Output, Colour, Appearance and Rendering, Efficacy and Related Factors), Luminaires (Functions, CIE Classification System, Light Output Ratios, Optical Control, Standards and safety, Specialist Luminaires for use in spaces with VDTs), Daylight-Source, CIE Overcast Sky Condition, Availability, Daylight Factor, Components, Calculation Methods, Use of Models in an Artificial Sky, Site Planning and Layout Factors, Sunlight- (Source, Solar Geometry, Sunpath, Shadow Angle Protractors and Masks, Annual Sunlight Hours, Models, Recommended Sunlight Occurrence, Site Planning and Layout Factors), Lighting Energy and Controls (Energy use, Components, Installed Power Density, Planned Maintenance, Operating Hours, Switching Control, Daylight Linked, Constant Lux and Occupancy Linked Control, Levels of Control and Economics)

Table 15: ME5503: Energy and Controls

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
ME5503	Energy and Controls	3	E	70%	30%

Objective:

To provide a sound practical knowledge on energy and controls aspects related to building services, covering all modern developments and technologies

Learning Outcomes:

Ability to :-explain the methods of estimating energy use in different sectors

:-explain the basic aspects related energy conservation and related energy management

:-quantify/ assess energy requirements of buildings

:-use appropriate controls for energy management.

Outline: Energy Management, Cost Effectiveness, Energy Audits, Energy Flows in Buildings, Energy Survey, Survey Appraisal, Measurement and Instrumentation, Data Loggers, U-Value Measurements, Measurement of Relative Humidity, Solar Radiation and Air Flow, Accuracy and Errors, Control techniques, Heating Control, Open and Close Loop Systems, Optimizers, Lighting Controls, Boilers, Condensing Boilers, Heat Pumps, Building Management Systems (BMS) and Development, Heat Exchangers, Thermal Wheels, Ventilation heat Recovery, CHPs, CHP Sizing and Cost savings, CHP Interface with Buildings, BMS Hardware, BMS Configurations, Types of Outputs, Communication, Electrical Load Management, Calculation of Cost Benefits and Appraisal, Appraisal methods (PBP, ARR, NPV, IRR), Annual Heating Energy Consumption, Total Loss Coefficient, Degree days

Table 16: Module outline of CE5504: Contracts and Procurement

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
CE5504	Contracts and Procurement	3	E	70%	30%

Objective:
To provide a sound knowledge on contract and procurement procedures for effective management and control of contracts

Learning Outcomes:
Ability to carryout contract procedures completely for effective, efficient management of contracts

Outline: Codes and Standards, Type of Contracts, Forms of Contract, Collection of Data, Pre-Contract Meetings, Post-Contract Meetings, Arbitration, Adjudication and Litigation, Types of Tenders, Tender Processes, Tender Documentation, Specifications, Pricing and Estimating, Turn Key Projects

Table 17: Module outline of ME5599: Project on Building Services

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
ME5599	Project on Building Services	4	C	0%	100%

Objective:
To provide basic training on problem solving in building services sector where the students are encouraged to find and review information on their own and to present the findings as a detailed report.

Learning Outcomes:
Ability to carry out a literature review on their own to identify a gap in the knowledge base related to building services engineering paying attention to the important attributes and approaches of solving problems

Outline: literature review, research gap, problem formulation

Table 18: Module outline of ME6509: Research project

Code	Module Title	Credits	Type	Evaluation	
				WE	CA
ME6509	Research Project	15	C		100%

Objective:
To provide a sound knowledge on problem solving in building services sector making contributions to the current knowledge base through research

Learning Outcomes:
Ability to :-identify a specific problem in a real life situation to be analysed and solved using the knowledge of engineering science and practical skills
:-select an innovative and most effective solution among alternatives
:-impart original thinking to contribute to the world of knowledge
:-develop capacity to appreciate and undertake research in pursuit of further studies

Outline: literature review, research gap, problem formulation, aim, objectives, methodology, data collection, analysis, results, discussion ,contribution to knowledge, future directions and conclusion

6.2 Guideline for ME5599 and ME6509

It is preffered the chosen research project for ME6509 is a continuation of the literature review carried out in ME5599. On completion of both the ME5599 and ME6509 all the project related submissions (i.e. abstract, project proposal, literature review and the final report/thesis) should be handed over to the course coordinator in both the soft (written to a CD) and printed formats. Deadlines for submissions will be announced in due course. The submitted reports/thesis should not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people, or otherwise, are fully acknowledged in accordance with the standard referencing practices.

7 Course Fees

Table 19: Course Fees

Component	**Amount**
Tuition Fees	
PG Diploma	Rs: 275,000.00
MSc (an additional)	Rs: 75,000.00
Every Subsequent Year	Rs: 30,000.00
Registration Fees	
1st Year	Rs: 2,000.00
2nd Year	Rs: 2,000.00
Subsequent Year	Rs: 2,000.00
Assessment Fees	
Normal	Rs: 500.00
Repeat	Rs: 1,000.00
Per each module	Rs: 100.00
Library Deposit	
Normal Deposit/book (up to 6 books)	Rs: 2,500.00
Deposit with Guarantee (for 6 books)	Rs: 7,500.00
Concessionary Deposit(for 2 books)	Rs: 2,500.00

8 Timetable for Intake 5, Year 2018/2019

Table 20: Timetable 2018/2019*

Term 1 ***(Duration: 14 Weeks)***			
Time	**Friday**	**Time**	**Saturday**
08:30-12:30	CE5503 Sustainable Built Environment	08:30-12:30	EE5501 Lighting and Visual Comfort
13:30-17:30	ME5501 Heat Transfer and Applications	13:30-17:30	CE5502 Piped Services
Term 2 ***(Duration: 14 Weeks)***			
Time	**Friday**	**Time**	**Saturday**
08:30-12:30	ME5502 Air Conditioning and Ventilation	08:30-12:30	EE5504 Electrical Components and Integration
13:30-17:30	EE5502 Ancillary Services of Modern Buildings	13:30-17:30	CE5505 Project Management
Term 3 ***(Duration: 14 Weeks)***			
Time	**Friday**	**Time**	**Saturday**
08:30-12:30	ME5503 Energy and Controls	08:30-12:30	EE5503 Building Acoustics
13:30-17:30	CE5501 Building Services and Management of Facilities	13:30-17:30	CE5504 Contracts and Procurement

*Time table may change

9 Resource Persons

Table 21: Resource Persons

Name	Designation	Department	Contact Details
Programme Coordinator and ME-Module coordinator			
Dr. MMID Manthilake	Senior Lecturer	ME	inoka@mech.mrt.ac.lk
EE-Module Coordinator			
Dr. KTMU Hemapala	Senior Lecturer	EE	udayanga@elect.mrt.ac.lk
CE-Module Coordinator			
Dr. K Gamage	Senior Lecturer	CE	kgamamge@uom.lk
Lecturers			
Dr. N Perera	Senior Lecturer	Archi.	nareinperera@gmail.com
Prof. ND Gunawardane	Senior Lecturer	CE	ndg@uom.lk
Mr. AHR Rathnasooriya	Senior Lecturer	CE	ahrr@civil.mrt.ac.lk
Mrs. LPJP Premaratne	Senior Lecturer	EE	janaki@elect.mrt.ac.lk
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Prof. RA Attalage	Professor	ME	dinu@mech.mrt.ac.lk
Prof. KKCK Perera	Professor	ME	kapila@mech.mrt.ac.lk
Dr. AGT Sugathapala	Senior Lecturer	ME	thusitha@mech.mrt.ac.lk
Dr. RACP Ranasinghe	Senior Lecturer	ME	chathura@mech.mrt.ac.lk
Dr. MA Wijewardane	Senior Lecturer	ME	anusha@mech.mrt.ac.lk
Dr. JGAS Jayasekara	Senior Lecturer	ME	saliya@uom.lk
Dr. T Lalitharathne	Senior Lecturer	ME	thilina@mech.mrt.ac.lk

Table 22: Abbreviations

Archi	Department of Architecture
CE	Department of Civil Engineering
EE	Department of Electrical Engineering
ME	Department of Mechanical Engineering