CIVIL ENGINEERING DEPARTMENT

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COURSE STRUCTURE AND TOTAL CREDIT REQUIREMENT FOR THE PROGRAM
BACHELOR OF CIVIL ENGINEERING (ZK01)

Total credit required to fulfill for graduation are listed in table below. The duration of study to be completed are 8 semesters. Courses need to be taken are described in the section as below.

COURSE	CREDIT
University Courses: i. University Core Courses ii. University Elective Courses	 24 6
Program Core Courses: i. Program Core Courses ii. Faculty Core Courses	 81 20
Program Elective Course	9
TOTAL CREDIT FOR GRADUATION	**140**

PROGRAM CORE COURSES
BACHELOR OF CIVIL ENGINEERING PROGRAM (ZK01)

LIST OF PROGRAM CORE COURSES (90 CREDITS):

CODE	COURSE	CREDIT	PRE-REQUISITE	
			CODE	STATUS
ECC 3313	Applied Mechanics	3	-	
ECC 3323	Construction Materials and Technology	3	-	
ECC 3333	Mechanics of Materials	3	ECC3313	MP
ECC 3343	Fluid Mechanics	3	-	
ECC 3402	Engineering Geology	2	-	
ECC 3413	Mechanics of Structures	3	ECC3333	MP
ECC 3423	Engineering Hydrology	3	-	
ECC 3432	Graphics and Engineering Drawings	2	-	
ECC 3443	Structural Analysis	3	ECC3413	MT
ECC 3453	Water Supply and Sewerage	3	-	
ECC 3463	Soil Mechanics	3	-	
ECC 3473	Geomatics	3	-	
ECC 3503	Reinforced Concrete Design I	3	ECC3413	MP
ECC 3513	Geotechnics	3	ECC3463	MT
ECC 3523	Highway Engineering	3	-	
ECC 3532	Civil Engineering Project Management	2	-	
ECC 3543	Reinforced Concrete Design II	3	ECC3503	MT
ECC 3553	Hydraulics	3	ECC3343	MT
ECC 3563	Foundation Engineering	3	ECC3513	MT
ECC 3573	Transportation Engineering	3	-	

ECC 3584	Industrial Training	4	-	
ECC 3603	Steel and Timber Structures Design	3	ECC3413	MT
ECC 3613	Environmental Engineering	3	-	
ECC 3622	Infrastructure Design Project (Capstone I)	2	-	
ECC 3632	Final Year Project I	2	-	
ECC 3642	Engineers in Society	2	-	
ECC 3652	Engineering Contract, Estimation and Economics	2	-	
ECC 3662	Structural Design Project (Capstone II)	2	ECC3543 / ECC3603	MT
ECC 3674	Final Year Project II	4	ECC3632	MP

Note: MP – Must Pass; MT – Must Taken

PROGRAM ELECTIVE COURSES
BACHELOR OF CIVIL ENGINEERING PROGRAM (ZK01)

LIST OF PROGRAM ELECTIVE COURSES (9 CREDITS):

CODE	COURSE	CREDIT	PRE-REQUISITE
ECC 3713	Nuclear, Biological and Chemical Contamination	3	-
ECC 3723	Ground Improvement	3	-
ECC 3733	Advanced Highway Engineering	3	-
ECC 3743	Advanced Construction Materials and Technology for Military Application	3	-
ECC 3753	Structure Subject to Blast	3	-
ECC 3763	Integrated Water Resources Management	3	-
ECC 3773	Environmental Hydraulics and Hydrology	3	-
ECC 3783	Introduction to Railways and Tunnels	3	-
ECC 3793	Damage Assessment, Repair and Maintenance of Concrete Structures	3	-
ECC 3803	Introduction to Bridge Engineering	3	-

BACHELOR OF CIVIL ENGINEERING PROGRAM (ZK01)

FIRST YEAR							
SEMESTER 1				SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
UNIVERSITY CORE COURSE							
DUS 3012	Military History	2	-	MPU 3142	Philosophy and Current Issues	2	-
MPU 3132	Appreciation of Ethics and Civilisations	2	-				
LLE 3012	English for Academic Writing	2	-	DUM 3022	Military Leadership	2	-
UNIVERSITY ELECTIVE COURSE							
QK 3XX2/ PLS 3111	Co-curiculum / PALAPES**	2/1**		QK 3XX2/ ALK3112/ PLS3121	Co-curiculum / General Military Training*/ PALAPES**	2/2*/1**	-
FACULTY CORE COURSE							
EFA 3253	Engineering Mathematics I (Calculus III)	3	-	EFA 3213	Engineering Mathematics II (Differential Equation)	3	-
				EEC 3223	Computing I (C and C++)	3	-
PROGRAM CORE COURSE							
ECC 3313	Applied Mechanics	3	-	ECC 3333	Mechanics of Materials	3	+ECC 3313
ECC 3323	Construction Materials and Technology	3	-	ECC 3343	Fluid Mechanics	3	-
EFB 3212	Introduction to Engineering (IR 4.0)	2	-				
TOTAL		**19/17*/18****		TOTAL		**18/18*/17****	

Civillian Student
* Cadet Officer
** PALAPES
\+ Must Pass
\# Must Taken

SECOND YEAR							
SEMESTER 3				SEMESTER 4			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
UNIVERSITY CORE COURSE							
DUS 3022	Introduction to Strategic Studies	2	-	MPU3312 or MPU 3332	Nationhood in World Politics or Fiqh Keutamaan	2	-
DUS 3032	Military Law and Laws of Armed Conflict	2	-	LLE 3032	Al – Ghazali Dialogue : English Communication	2	-
UNIVERSITY ELECTIVE COURSE							
QK 3XX2/ ALK3122/ PLS3131	Co-curiculum / General Military Training*/ PALAPES**	2/2*/1**	-	QKS 3172/ PLS 3141	Unarmed Combat* / PALAPES**	2*/1**	
FACULTY CORE COURSE							
EFA 3243	Engineering Mathematics IIIB (Operations Research and Computer Information Systems)	3	-				
PROGRAM CORE COURSE							
ECC 3402	Engineering Geology	2	-	ECC 3443	Structural Analysis	3	# ECC 3413
ECC 3413	Mechanics of Structures	3	+ECC 3333	ECC 3453	Water Supply and Sewerage	3	-
ECC 3423	Engineering Hydrology	3	-	ECC 3463	Soil Mechanics	3	-
~ ECC 3432	Graphics and Engineering Drawings	2	-	~ ECC 3473	Geomatics	3	-
TOTAL		**19/19*/18****		**TOTAL**		**16/18*/17****	

Civillian Student
* Cadet Officer
** PALAPES
~ Offered in both semester
\+ Must Pass
\# Must Taken

THIRD YEAR							
SEMESTER 5				SEMESTER 6			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
UNIVERSITY CORE COURSE							
LLF3XX1	Foreign Language I	1	-	LLF3XX1	Foreign Language II	1	-
LLA3XX1	Foreign Language I	Audit	-	LLA 3XX1	Foreign Language II	Audit	-
MPU3412 or MPU 3422	Human Movement Science or Community Service	2	-				
UNIVERSITY ELECTIVE COURSE							
PLS 3151	PALAPES**	1**	-	PLS 3161	PALAPES**	1**	-
FACULTY CORE COURSE							
EFA 3223	Engineering Mathematics IV (Statistics)	3	-	EFC 3213	Computing II (Numerical Methods and Engineering Softwares)	3	-
PROGRAM CORE COURSE							
ECC 3503	Reinforced Concrete Design I	3	+ ECC 3413	ECC 3543	Reinforced Concrete Design II	3	# ECC 3503
ECC 3513	Geotechnics	3	# ECC 3463	ECC 3553	Hydraulics	3	# ECC 3343
ECC 3523	Highway Engineering	3	-	ECC 3563	Foundation Engineering	3	# ECC 3513
ECC 3532	Civil Engineering Project Management	2	-	ECC 3573	Transportation Engineering	3	-
TOTAL		**17/17*/18****		**TOTAL**		**16/16*/17****	

Civillian Student
* Cadet Officer
** PALAPES
\+ Must Pass
\# Must Taken

THIRD YEAR			
INTER – SESSION			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
ECC 3584	Industrial Training	4	Passed 60 credit hours
TOTAL		**4**	

FOURTH YEAR							
SEMESTER 7				SEMESTER 8			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
UNIVERSITY CORE COURSE							
				MPU 3212	Basic Entrepreneurship	2	-
PROGRAM CORE COURSE							
ECC 3603	Steel and Timber Structures Design	3	# ECC 3413	ECC 3642	Engineers in Society	2	-
ECC 3613	Environmental Engineering	3	-	ECC 3652	Engineering Contract, Estimation and Economics	2	-
ECC 3622	Infrastructure Design Project (Capstone I)	2	-	ECC 3662	Structural Design Project (Capstone II)	2	# ECC 3543 or # ECC 3603
ECC 3632	Final Year Project I	2	Passed 80 credit hours	ECC 3674	Final Year Project II	4	+ ECC 3632
PROGRAM ELECTIVE COURSE							
ECC 3XX3	Technical Specialization I	3	-	ECC 3XX3	Technical Specialization III	3	-
ECC 3XX3	Technical Specialization II	3	-				
TOTAL		**16/16*/16****		**TOTAL**		**15/15*/15****	

Civillian Student
* Cadet Officer
** PALAPES
\+ Must Pass
\# Must Taken

SYNOPSIS OF CORE COURSE PROGRAM
BACHELOR OF CIVIL ENGINEERING PROGRAM (ZK01)

COURSE CODE : ECC 3313
COURSE NAME : APPLIED MECHANICS
MEKANIK GUNAAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This is a core subject for Civil Engineering students taken in the first year of their programme. It is a continuation of Physics course taken in Foundation Year. Generally, this course is divided into two parts; Static and Dynamic. Static deals with equilibrium of bodies at rest or moving with constant velocity. Students will expose to resolution of forces, equilibrium of a particle, and rigid bodies, centre of gravity and moment of inertia of an area. Meanwhile, in Dynamic, students will explore the accelerated motion of bodies including kinematics and kinetics of particles and rigid bodies. Kinematic of particles is including relationship between displacement, velocity and acceleration against time. On the other hand, Kinetic of particles will expose the concepts of force and acceleration, energy and work and impulse and momentum.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Define and formulate the state of equilibrium of a particle and a rigid body and use the equations of equilibrium to solve problems involving the equilibrium of a particle and of a rigid body applying the concepts of resultant and resolution of forces and the concept of moment of a force and moment of a couple.
2. Analyse effect of friction and to calculate the centre of gravity and centroid of a body, and the moment of inertia of an area.
3. State and describe the relationships between displacement, velocity and acceleration against time and able to use such relationships to solve problems involving motions of a particle. Able to apply Newton's second law of motion to establish relationship between force and acceleration, and can utilise principle of work and energy, and the principle of impulse and momentum to solve problems involving kinetics of particle.

References

1. Hibbeler, R. C. (2012). Engineering Mechanics Statics. 13th Ed. SI. Singapore: Prentice Hall.
2. Hibbeler, R.C. (2012). Engineering Mechanics: Dynamics. S.I. Edition. 13th Ed. Singapore: Prentice Hall.
3. Meriam J.L. & L. G. Kraige (2008). Engineering Mechanics, Vol 1: Statics, 6th Ed. Canada: John Wiley & Sons.
4. Meriam J.L. & L.G. Kraige. (2008). Engineering Mechanics: Dynamics. S.I. Edition. John Wiley & Sons.

COURSE CODE : ECC 3333
COURSE NAME : MECHANICS OF MATERIALS
MEKANIK BAHAN

3 Credit Hours
Pre-requisite : Must have passed Applied Mechanics (ECC 3313)

Course Synopsis

This is core course of Civil Engineering programme. In this course, students will be introduced to the principle of stress and strain occurred when a various type of external and internal load applied within a rigid body extend to members or elements. Further, students will be exposed to the various method to determine the displacement and transformation of stress and strain. Finally students will be taught on critical load for buckling column.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Identify the appropriate formulae to calculate the stress in a uniformly loaded specimen for the following loading configurations: uniaxial tension and compression; torsional loading; direct shear; and bending under statically determine conditions.
2. Determine internal load distributions and draw bending moment diagrams and torque position diagrams for beams and shafts with step change in cross-section.
3. Determine displacement and strain in members with step changes in loading and/or radius given the loading and modulus or loading and stress-strain curve. Students will be able to calculate these displacements for uniaxial tension and compression; torsion.
4. Transform the state of stress at a point in a material to determine principal stresses; maximum shear stress and the orientation of the stress element.
5. Calculate the critical load for the buckling of a pin supported column and determine if the failure mode is compression or buckling.

References

1. Hibbeler, R. C. (2010). Mechanics of Materials. 8th Ed. SI. Singapore: Prentice Hall.
2. Hibbeler, R. C. (2010). Engineering Mechanics Statics. 12th Ed. SI. Singapore: Prentice Hall.
3. Ferdinand P. Beer, E Russell Johnston Jr., & John T. De Wolf. (2002). Mechanics of Materials.3rd Edition: Mc Graw-Hill International Edition.
4. James M. Gere (2000). Mechanics of Materials. 5th Edition: Brooks/Cole Thomson Learning.

COURSE CODE : ECC 3343
COURSE NAME : FLUID MECHANICS
MEKANIK BENDALIR

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course will enable students to understand the fundamental of fluid mechanics in civil Engineering, including fluid static and kinematics. The course also focuses on momentum equation of fluid and its application. Other than that, student will be exposed to the analysis of pipe flow which consist of flow classification and losses in a pipeline system. At the end of this course, student will be able to analyse pipe network system including with the application of pump in the pipeline system.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Identify and describe some Fluid Mechanics theories.
2. Identify and analyse solutions to problems related to Fluid Mechanics.
3. Describe, utilise, and solve problem related to steady flow in pipe networks using quantity balance and head balance methods.
4. Describe, utilise, and solve problem of pumping system.
5. Design and handle laboratory work. Collect, analyse and interpret data. Report laboratory work in fluid mechanics.

References

1. Yunus, A. C., & John M. Cimbala, (2006). Fluid Mechanics: Fundamentals and Applications, Mc Graw Hill.
2. Fatimah, M. N., Faridah, J. S., & G. K. Goh (1991). *Mekanik Bendalir Untuk Kejuruteraan Awam. UTM, Johor: Unit Penerbitan Akademik.*
3. E. John Finnermore, & Joseph B. Franzini, (2006). Fluid Mechanics with Engineering Application, Tenth Edition, McGrawHill.
4. Anthony Esposito (1998). Fluid Mechanics with Applications, Prentice Hall.

COURSE CODE : ECC 3323
COURSE NAME : CONSTRUCTION MATERIALS AND TECHNOLOGY
BAHAN DAN TEKNOLOGI PEMBINAAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course is divided into two parts. The first part will address the types of materials used in the construction industry, meanwhile the second part will expose the element of conceptual design and construction technology. This course also provides students the knowledge and understanding of the principles, concepts and processes of constructing a building.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Recognize the characteristics and properties of different types of construction materials.
2. Explain and identify the usage and application of different types of construction materials in construction industry.
3. Understand site layout, temporary facilities, construction plants and machineries used in the construction sites.
4. List and describe the type of foundation, scaffolding, retaining wall ,and formworks used in construction sites.

References

1. Marotta, Theodore W., Basic Construction Materials, Seventh Edition, Pearson Prentice Hall: New Jersey, 2005.
2. Chudley . R. Advanced Construction Technology, 3Rd Edition. Kuala Lumpur; Addison Wesley Longman Limited, 2002.
3. Neville A.M. & Brook J.J. Concrete Technology. Longman. 1990.

COURSE CODE : ECC 3402
COURSE NAME : ENGINEERING GEOLOGY
KEJURUTERAAN GEOLOGI

2 Credit Hours
Pre-requisite : None

Course Synopsis

This is a fundamental subject that will expose students in understanding to the phenomenon concept of earth formation and discussing on relationship between geology and civil engineering. The topic covered include elements, mineral, rocks properties and rocks formation (i.e. igneous, sedimentary and metamorphic). The geologic time scale, geomorphology and weathering effect on construction activities in rock mass will also be discussed accordingly. Rock mechanics principles and rock classification systems will be exposed to students in designing civil engineering structure in rock mass.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Able to describe fundamental concept of earth formation, the relationship between geology and civil engineering and the importance of geological consideration in civil construction
2. Able to identify and differentiate geological materials such as elements, minerals, formation and composition of igneous, sedimentary and metamorphic rock
3. Able to describe geologic time scale, geomorphology and weathering effect on construction activities in rock mass
4. Able to apply fundamental rock mechanics principles and classification system in designing civil engineering structure in rock mass

References

1. McLean, A. C. (1985). *Geology for Civil Engineer*. E & F N Spon, London.
2. Physical Geology 14th Edition (International Edition) by Charles (Carlos) Plummer, Diane Carlson, Lisa Hammersley (2013), McGraw-Hill, New York.
3. Exploring Geology 3rd Edition (International Edition) by Stephen Reynolds, Julia Johnson, Paul Morin, Chuck Carter (2013), McGraw-Hill, New York.

COURSE CODE : ECC 3413
COURSE NAME : MECHANICS OF STRUCTURES
MEKANIK STRUKTUR

3 Credit Hours
Pre-requisite : Must have passed Mechanics of Materials (ECC 3333)

Course Synopsis

This is a core subject. It will expose the students to the mechanics of structures and fundamental of structural analysis. The topics covered include introduction to structures and loads, analysis of statically determinate structures and trusses, analysis of cables and arches, influence lines, analysis of statically indeterminate structures, analyse deflection and displacement using various methods.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Identify determinacy and stability of structures. Further, analyse statically determinate structures including internal loadings in structural members.
2. Analyse cables and arches, and influence line for statically determinate structures.
3. Analyse statically indeterminate trusses, beam or frame using double integration method, geometrical methods, virtual work method, slope and deflection equations, and moment distribution methods.

References

1. Hibbeler, R. C. (2015). Structural Analysis. 9th Ed. SI. Singapore: Prentice-Hall.
2. McKenzie William M.C. (2013). Engineering Mechanics: Examples in Structural Analysis, Second Edition 2nd edition. CRC Press.
3. Aslam Kassimali (2015). Structural Analysis 5th Edition. SI Edition. CENGAGE Learning
4. Yusof Ahmad (2004). *Teori Struktur. Penerbit UTM*
5. Ghali, A. & A.M. Neville. 1982. Structural Analysis. London: Chapman & Hall

COURSE CODE : ECC 3423
COURSE NAME : ENGINEERING HYDROLOGY
HIDROLOGI KEJURUTERAAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

The course emphasizes hydrology and its application in the field of engineering especially those related to water resources. Interdisciplinary aspects of hydrology that will be introduced and discussed are the understanding of the hydrological processes. These processes are precipitation, evaporation, transpiration, surface runoff, infiltration and interception. Some processes will be discussed in more detail as compared to the others. An introduction to flood estimation will be highlighted together with the basic analysis and concept design in accordance to local guideline of Urban Storm water Management Manual for Malaysia (MSMA). Frequency analysis is the final topic to be discussed in this subject. A brief introduction to the hydrological modelling processes will be introduced as a basic requirement to the understanding to the empirical and numerical modelling concepts.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Describe the basic concepts of hydrological cycle, river basin and application of the water balance.
2. Apply the techniques, skills and use various hydrological data such as rainfall data, river flow measurement data and hydrological losses data.
3. Conceptualize, develop and able to solve hydrological problem such as flood routing, hydrograph analysis, Modified Rational Method, and frequency analysis.
4. Associate the course content to the present hydrologic design Guidelines; Hydrological Procedures (HP) and Urban Storm water Management Manual for Malaysia (MSMA).
5. Work in a team or individually to solve problems and produce written report.

References

1. Martin, W., Robert, K., & Ron, E., (1997). HYDROLOGY: Water Quantity and Quality Control. 2nd Edition. Jon Wiley & Sons, Inc.
2. Victor M. P., (1989). ENGINEERING HYDROLOGY: Principles and Practices. Prentice-Hall, Inc.
3. David C., (2006). Water-Resources Engineering. 2nd Edition. Pearson Education, Inc.
4. Ayob K. Zulkifli Y. & Kawi B., (2007). Hidrologi Asas. Pearson Prentice Hall.

COURSE CODE : ECC 3432
COURSE NAME : GRAPHICS AND ENGINEERING DRAWINGS
LUKISAN KEJURUTERAAN

2 Credit Hours
Pre-requisite : None

Course Synopsis

This course will expose students to knowledge and understanding of fundamental technical drawing. It will cover basic principles of technical drawing such as dimension, scale, type of lines and also orthographic and isometric drawings, and also introduction to computer aided drawing software. Students will also be introduced to architectural and structural drawings so that they will be able to draw, interpret and understand construction and engineering drawings.

Course Learning Outcomes

At the end of this course students are able to:

1. Appreciate technical drawing rules and apply the knowledge using technical drawing instrument.
2. Project and visualize orthographic views, isometric views and oblique views of different objects of various shapes, using technical drawing rules and principles.
3. Comprehend and produce architectural and structural drawing.
4. Work in a group and carry out both architectural and structural drawing project.

References

1. Elsheikh, Ahmed. Introduction to Drawing for Civil Engineers. 1995. McGraw-Hill International.
2. David L. Goetsch. Structural Drafting. 1994. Delmar Publisher Inc.
3. Mark W. Huth. Understanding Construction Drawing. 2005. Thomson Delmar Learning.
4. Yarwood, A. Introduction to AUTOCAD 2008-2D and 3D Design. 2007. Elsevier Ltd.

COURSE CODE : ECC 3443
COURSE NAME : STRUCTURAL ANALYSIS
ANALISIS STRUKTUR

3 Credit Hours
Pre-requisite : Must have taken Mechanics of Structures (ECC 3413)

Course Synopsis

This is a core course which provides a basic understanding to the students on the analysis methods for statically indeterminate structures of beam, frame and truss. These structures can be analysed using flexibility and stiffness matrix approaches. Through this analysis, the reactions, internal shear and moments, deflection, slope and support reaction of the structures can be determined. Besides, this course also covers the fundamental of plastic analysis method for both beam and frame structures. In addition, students also will be introduced to finite element method and experienced to analysing various types of structures by using computer software.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Define and explain the significance of structural analysis in the Civil Engineering context.
2. Analyse beams, frames and trusses using Flexibility method.
3. Analyse beams, frames and trusses using Stiffness method.
4. Analyse beams and frames using Plastic analysis method.
5. Apply the fundamental Finite Elements Method and analyse the structures using computer software.

References

1. R. C. Hibbler (2015). Structural Analysis 9th Edition in SI Units. Prentice Hall.
2. Siti Hawa Hamzah. Ching Hua Go., Siong Wee Lee. (2010). Flexibility Method for Structures. UiTM Press.
3. Aslam Kassimali (2015). Structural Analysis 5th Edition. SI Edition. CENGAGE Learning.
4. Daryl L. Logan (2015). A First Course in the Finite Element Method 6th Edition. International Student Edition. Thomson.
5. Ghali, A., A.M. Neville & T.G. Brown. (2013). Structural Analysis: A Unified Classical and Matrix Approach. 5th Ed. London. CRC Press

COURSE CODE : ECC 3453
COURSE NAME : WATER SUPPLY AND SEWERAGE
BEKALAN AIR DAN PEMBETUNGAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This subject consists of two main branches in Civil Engineering; water supply and sewerage. Water supply consists of hydrologic cycle, water resources determination, water intake, water treatment processes, water quality control and disinfection, and water distribution system. Sewerage consists of wastewater management related regulations, wastewater properties and effects to environment, sewer systems and removal of suspended matter, dissolved organic matter and colloid using physical, chemical and biological processes. It also includes the removal of nutrients and sludge management.

Course Learning Outcomes

At the end of this course students are able to:

1. Understand and describe the basic concepts of chemistry and microbiology related to water supply and sewerage treatment technology.
2. Apply and distinguish the methods commonly used in treating water supply and sewerage.
3. Calculate and design systems of unit operations of water supply and sewerage to achieve the required treatment.
4. Design and handle laboratory work. Collect, analyse and interpret data. Report laboratory work in water supply and sewerage treatment.

References

1. Davis, M. L. and Cornwell, D. A. (2013). Introduction to Environmental Engineering. 5th ed. McGraw Hill.
2. American Water Works Association/American of Society of Civil Engineer (1998). Water Treatment Plant Design. 3rd Ed. McGraw Hill.
3. Hammer, M.J., (1996): Water and Wastewater Technology. 3rd Ed. Prentice-Hall Inc.
4. National Water Services Commission (SPAN), Malaysian Sewerage Industry Guidelines (MSIG)
   Volume II: Sewerage Works Procedures, 2nd ed. 2013
   Volume III: Sewer Networks and Pumping Stations, 3rd Ed., 2009
   Volume IV: Sewage Treatment Plants, 3rd Ed., 2009
   Volume V: Septic Tanks, 3rd ed., 2009

COURSE CODE : ECC 3463
COURSE NAME : SOIL MECHANICS
MEKANIK TANAH

3 Credit Hours
Pre-requisite: None

Course Synopsis

This course is one of the core engineering subjects that will provide solid fundamental knowledge to students about properties and behaviour of soils for geotechnical engineering practice. Topics for the subject are engineering properties of soil, water in soil, shear strength of soil and stresses in soil mass. Students are also required to carry out compulsory laboratory test besides attending lectures and tutorials class.

Course Learning Outcomes

At the end of this course students are able to:

1. Describe the fundamental characteristic of soil such as particle size, distribution and classification, soil composition and relationship, and plasticity.
2. Describe the effect of capillarity in soil, permeability, seepage and solve the problem related to the flow net in a dam structure.
3. Define shear strength of soil, and determine shear strength parameters of soil.
4. Utilise and apply suitable techniques to calculate soil stresses in a soil mass.

References

1. Das, B. M., (2010). Fundamentals of Geotechnical Engineering Seventh Edition, Cencage Learning.
2. J.N. Cernica, (1995), Geotechnical Engineering: Soil Mechanics, John Wiley & Sons.
3. Craig, R. F. (2004*).* Soil Mechanics. Seventh Edition, Spon Press.

COURSE CODE : ECC 3473
COURSE NAME : GEOMATICS
GEOMATIK

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course provides the basic theory and practice of surveying to civil engineering students. Methods of establishing horizontal & vertical controls for construction and design are explained and compared. Detailing for producing site plans, area and volume estimations, road curves geometric design are also discussed. Error analysis and adjustment are described. The concept of field survey automation and the usage of software are explained. Common methods of field producers, bookings and reduction of observations are adopted. Since accuracy of survey work is vital in ensuring designs are exactly positioned, students must be able to analyses errors so that standard accuracies are met. At the end of the course students are expected to be able to plan, execute, compute and analyses surveying works involved in establishing horizontal & vertical controls and producing plans for civil engineering applications, perform area calculations and volume estimation for earthwork activities in civil engineering. Students should demonstrate effective communication and good collaborative skills.

Course Learning Outcomes

At the end of this course students are able to:

1. Recognise the area of surveying and able to perform calculations and checks for determining heights by levelling, horizontal and vertical angles, traverse coordinates, earthworks quantities and etc.
2. Operate survey equipment such as theodolite, total stations and global positioning system (GPS) for field works with confidence.
3. Conduct field works in a team and function responsively within a team by upholding ethics in decision making.

References

1. Uren, J. & W.F Price, 2006. Surveying for Engineers, The Macmillan Press Ltd. & ELBS, London Fourth Edision.
2. McCormac, J.C., 1991. Surveying: Fundamentals, 2nd Ed., Prentice Hall, Englewood Cliffs, New Jersey.
3. Shepperd, F.A., 1981. Advanced Engineering Surveying – Problem & Solution, Edward Arnold, London.

COURSE CODE : ECC 3503
COURSE NAME : REINFORCED CONCRETE DESIGN I
REKABENTUK KONKRIT BERTETULANG I

3 Credit Hours
Pre-requisite : Must have passed Mechanics of Structures (ECC 3413)

Course Synopsis

Reinforced Concrete (RC) Design I is a core civil engineering subject which provides students with the basic theory and design procedures for reinforced concrete structures according to Eurocode 2 (EN 1992). In this course, the syllabus only covers mechanical properties of reinforced concrete, limit state design, analysis of the structure at the ultimate limit state, analysis of the section, shear, torsion, anchorage, curtailment, connections, serviceability, durability and stability. Besides, this course also focuses more on the design of reinforced concrete beams and slabs in various situations. In addition, students have to work in groups and are required to conduct a Reinforced Concrete design project, where they are asked to analyse, design and draw detailed drawing of given structures using manual calculation. This course is a Pre-requisite subject to Reinforced Concrete (RC) Design II.

Course Learning Outcomes

At the end of this course students are able to:

1. Elaborate on basic principles of structural analysis and design, mechanical properties of reinforced concrete, limit state design. Also, analyse reinforced concrete structures at ultimate limit state.
2. Analyse the section, shear, and torsion. Also, identify the requirement of anchorage, curtailment and member connections, serviceability, durability and stability.
3. Analyse, design and produce detailed drawing for reinforced concrete beams and slab.
4. Work in a group and carry out project on various reinforced concrete structures.

References

1. Mosley, B., Bungey, J., & Hulse, R. (2007). Reinforced Concrete Design to Eurocode 2, 6th Ed. Hampshire: Palgrave Macmillan.
2. Martin, L.H. & Purkiss, J.A. (2006). Concrete Design to EN 1992, 2nd Ed. Oxford: Butterworth-Heinemann.
3. British Standard Institution, BS EN 1991-1-1:2002, Eurocode 1– Actions on Structures, BSI, 2002.
4. British Standard Institution, BS EN 1992-1-1:2004. Eurocode 2: Design of Concrete Structures. Part 1-1: General rules and rules for buildings London: BSi.
5. NA to BS EN 1992-1-1:2004**.** UK National Annex to Eurocode 2: Design of Concrete Structures. London: BSi.
6. STANDARDS MALAYSIA. MS EN 1990 (2010). Eurocode: Basis of structural design. MS, 2010 1a. Malaysia National Annex to Eurocode. Malaysian Standards.
7. STANDARDS MALAYSIA. MS EN 1991 (2010). Eurocode 1: Actions on structures. MS, 2010 2a. Malaysia National Annex to Eurocode 1. Malaysian Standards.
8. STANDARDS MALAYSIA. MS EN 1992 (2010). Eurocode 2-Part 1-1: Design of concrete structures- General Rules and Rules for Buildings. MS, 2010 3a. Malaysia National Annex to Eurocode 2. Malaysian Standards.

COURSE CODE : ECC 3513
COURSE NAME : GEOTECHNICS
GEOTEKNIK

3 Credit Hours
Pre-requisite : Must have taken Soil Mechanics (ECC 3462)

Course Synopsis

This course is one of the core engineering subjects that will provide essential understanding to students on principle knowledge in geotechnical engineering field. Topics for the subject are soil compaction, lateral earth pressure and retaining wall, slope stability and soil compressibility. Students are also required to carry out compulsory laboratory test besides attending lectures and tutorials class.

Course Learning Outcomes

At the end of this course students are able to:

1. Describe the fundamental of soil compaction, factors affecting compaction, field and laboratory compaction test and application.
2. Describe and analyse the lateral earth pressure, checking stability of retaining wall structures and applying few methods of analysis.
3. Define concept of slope stability, slope movement and instability, and applying slope stability analysis.
4. Understand compressibility in soil, consolidation and settlement, and apply consolidation concept through understanding on degree and rate of consolidation.

References

1. Das, B. M., (2010), *Principles of Geotechnical Engineering Seventh Edition,* Cengage Learning.
2. J.N. Cernica, (1995), *Geotechnical Engineering: Soil Mechanics*, John Wiley & Sons
3. Craig, R. F. (2004*).* Soil Mechanics. Seventh Edition, Spon Press.

COURSE CODE : ECC 3523
COURSE NAME : HIGHWAY ENGINEERING
KEJURUTERAAN LEBUH RAYA

3 Credit Hours
Pre-requisite : None

Course Synopsis

This is a compulsory course that will expose students to the fundamental theory of Highway Engineering. This course emphasises on highway earthwork, operations and equipment, highway materials, highway drainage, geometric design of roads and furniture, pavement design and highway maintenance and rehabilitation. Students are required to carry out laboratory testing at the highway laboratory besides attending lectures and tutorials. Moreover, students are required to write reports on all laboratory testing, analyse and solve problems related to laboratory testing, assignments and tutorials. Last but not least, students will be exposed to software for road geometric design and they are required to carry out mini projects in groups.

Course Learning Outcomes

At the end of this course students are able to:

1. Identify and distinguish highway earthwork, operations and equipment, and solve problems related to earthwork operations.
2. Describe, identify and compare the highway materials and tests.
3. Recognize, compare and classify types of highway drainage.
4. Analyse and design the geometric of roads and furniture.
5. Analyse, design and recommend the structural thickness of flexible pavement using JKR method and rigid pavement using PCA method.

References

1. Garber, N.J. & Hoel, L.A. (2015). Traffic and Highway Engineering. 5th Ed. Cengage Learning.
2. Arahan Teknik Jalan 5/8 – Manual on Pavement Design. *Jabatan Kerja Raya*.
3. REAM GM2/2002 – A Guide on Geometric Design of Roads. Road Engineering Association Malaysia.
4. Wright, P.H. & Dixon, K.K. 2004. Highway Engineering. 7th. Ed. John Wiley & Sons.

COURSE CODE : ECC 3532
COURSE NAME : CIVIL ENGINEERING PROJECT MANAGEMENT
PENGURUSAN PROJEK KEJURUTERAAN AWAM

2 Credit Hours
Pre-requisite : None

Course Synopsis

The course starts with the project management concept, role of project manager and function of project management from inception until completion. The second part of the course will include the usage of tools available in construction management particularly in the application of planning and scheduling technique using Gantt Chart and network technique. The course will also expose the students to the application of scheduling software available in the market.

Course Learning Outcomes

At the end of this course students are able to:

1. Provide an overview of the construction industry and the role of its players
2. Understand the general concept of project management principles including its organization structure
3. Plan, schedule and control civil engineering projects using various techniques
4. Develop a project work programme using planning tools

References

1. Project Management in Malaysia by Andrew A. L. Tan.
2. Barrie, D.S & Paulson, B.C, Profesional Construction Management, Mc Graw Hill (1999).
3. Harris, F. & Mc Caffer, R, Modern Construction Management, Publishing, London (1995)

COURSE CODE : ECC 3543
COURSE NAME : REINFORCED CONCRETE DESIGN II
REKABENTUK KONRIT BERTETULANG II

3 Credit Hours
Pre-requisite : Must have taken Reinforced Concrete Design I (ECC 3503)

Course Synopsis

Reinforced Concrete (RC) Design II is a core civil engineering subject that exposes students to a wider scope of reinforced concrete design. As a continuation to the Reinforced Concrete Design I, this subject covers analysis and design of foundations, staircases, and retaining walls. Furthermore, students will be introduced to basic principles of prestressed concrete and design procedure of composite construction. Students have to work in groups and are required to conduct a Reinforced Concrete design project, where they are asked to analyse, design and draw detailed drawing of a given structures using manual calculation. Students will also be exposed to function and use of Reinforced Concrete design software. This course is a Pre-requisite subject to Structural Design Project (Capstone II).

Course Learning Outcomes

At the end of this course students are able to:

1. Analyse, design and produce detailed drawing for reinforced concrete foundations, staircase and retaining walls.
2. Describe and explain the basic principles of prestressed concrete and design procedures of composite construction.
3. Work in groups and carry out project on various reinforced concrete structures.

References

1. Mosley, B., Bungey, J., & Hulse, R. 2007. Reinforced Concrete Design to Eurocode 2, 6th Ed. Hampshire: Palgrave Macmillan.
2. Martin, L.H. & Purkiss, J.A. 2006. Concrete Design to EN 1992, 2nd Ed. Oxford: Butterworth-Heinemann.
3. BS EN 1992-1-1:2004. Eurocode 2: Design of Concrete Structures. Part 1-1: General rules and rules for buildings London: BSi.
4. British Standard Institution, BS EN 1991-1-1:2002, Eurocode 1– Actions on Structures, BSI, 2002.
5. British Standard Institution, BS EN 1992-1-1:2004. Eurocode 2: Design of Concrete Structures. Part 1-1: General rules and rules for buildings London: BSi.
6. NA to BS EN 1992-1-1:2004**.** UK National Annex to Eurocode 2: Design of Concrete Structures. London: BSi.
7. STANDARDS MALAYSIA. MS EN 1990 (2010). Eurocode: Basis of structural design. MS, 2010 1a. Malaysia National Annex to Eurocode. Malaysian Standards.
8. STANDARDS MALAYSIA. MS EN 1991 (2010). Eurocode 1: Actions on structures. MS, 2010 2a. Malaysia National Annex to Eurocode 1. Malaysian Standards.
9. STANDARDS MALAYSIA. MS EN 1992 (2010). Eurocode 2-Part 1-1: Design of concrete structures- General Rules and Rules for Buildings MS, 2010 3a. Malaysia National Annex to Eurocode 2. Malaysian Standards.

COURSE CODE : ECC 3553
COURSE NAME : HYDRAULICS
HIDRAULIK

3 Credit Hours
Pre-requisite : Must have taken Fluid Mechanics (ECC 3343)

Course Synopsis

The aim of this course is to give knowledge, understanding and able to design open channel hydraulics (erodible and non-erodible). This course also identifies open channel flow classification, design of channel section dimensions, flow characteristics in open channel, sediment transport. This course also introduces commercial software which is used in open channel design.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Describe characteristics of open channel flow and application of various channel design equations in uniform flow.
2. Calculate and define flow profile in non-uniform flow due to control structures in the channel.
3. Identify and calculate the hydraulic jump occurred in the channel.
4. Calculate and evaluate rapidly and gradually varying flow in open channel.
5. Describe and understand concept of sediment transport in open channel and design using computer's software.
6. Work in a team or individually to solve problems and produce written report.

References

1. Hubert Chanson. 2004. Hydraulics of Open Channel Flow. 2nd Edition. Butterworth-Heinemann.
2. Terry W. Sturn (2001). Open Channel Hydraulics. Mc Graw Hill- Higher Education.
3. Amat Sairin Demun (1997) Hidraulik Saluran Terbuka Dengan Penggunaan Komputer, Penerbitan Universiti Teknologi Malaysia, Skudai Johor.
4. Fatimah, M(1996), *Hidraulik Kejuruteraan Awam, Teori, Masalah dan Penyelesaian, Penerbitan Universiti Teknologi Malaysia, Skudai, Johor.* (Translation of Featherstone, R.E dan Nalluri, C., Civil Engineering Hydraulics – Essential Theory with Worked Examples).

COURSE CODE : ECC 3563
COURSE NAME : FOUNDATION ENGINEERING
KEJURUTERAAN ASAS

3 Credit Hours
Pre-requisite : Must have taken Geotechnics (ECC 3513)

Course Synopsis

In this subject, the application of soil mechanics principles to foundation design will be highlighted. The course covers the following topic: site investigation, shallow foundation, deep foundation, soil dynamic, foundation instrumentations and field testing, and machine foundation.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Identify types of foundation system and foundation stability criteria.
2. Evaluate bearing capacity and settlement, pile capacity and settlement, and carry out geotechnical design for foundation work.
3. Propose appropriate instrumentation techniques for assessment of foundation performance.
4. Relate different methods of site investigation for different site conditions.

References

1. Bujang Kim Huat, Faisal Hj Ali, Hussaini Omar, Haruant Sigh (2006), Foundation Engineering; Design and construction in tropical soil. Taylor & Francis group.
2. Das, B.M (Sixth ed.), Principles of Foundation Engineering, Thomson, California.
3. Tomlinson & Michael, J. (1995), Pile Design and Construction, 6th. Edition. John Wiley and Sons, New York.
4. Bowles, J.E (1996), Foundation Analysis and Design, McGraw Hill International editions.

COURSE CODE : ECC 3573
COURSE NAME : TRANSPORTATION ENGINEERING
KEJURUTERAAN PENGANGKUTAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This is a compulsory course that will expose students to the fundamental theory of Transportation Engineering. The content of the course gives knowledge, understanding and synthesis in major field of transportation engineering. This course emphasizes on traffic engineering studies, traffic flow characteristics, traffic control, traffic management, traffic analysis techniques, transit operation and public transport, parking, transportation safety, transportation system issues and challenges. Students are required to carry out field experiments besides attending lectures and tutorials. Students are required to write reports on all experiments, analyse and solve problems related to experiments, assignments and tutorials. Besides, the students are required to carry out mini project in groups.

Course Learning Outcomes

At the end of this course students are able to:

1. Recognise and distinguish traffic engineering studies; demonstrate and analyse the traffic flow characteristics.
2. Identify, analyse, design and summarize road traffic control and management system.
3. Describe and express the concept of transit operation; prepare, classify and design the public transport and parking facilities.
4. Express the importance of transportation safety, identify the deficiencies in transportation system and recommend countermeasures to overcome the deficiencies in transportation system.

References

1. Garber, N.J. & Hoel, L.A. (2015). Traffic and Highway Engineering. 5th Ed. Cengage Learning.
2. Banks, J.H. 2002. Introduction to Transportation Engineering. 2nd Ed. McGraw-Hill.
3. Kutz, M. Handbook of Transportation Engineering. 2004. McGraw-Hill.
4. Wright, P.H. & Ashford, N.J. 1998. Transportation Engineering: Planning & Design. 4th. Ed. New York: John Wiley.
5. Arahan Teknik Jalan 13/87-Manual on a Guide to the Design of Traffic Signal. Jabatan Kerja Raya.
6. REAM GM2/2002 – A Guide on Geometric Design of Roads, Road Engineering Association Malaysia.

COURSE CODE : ECC 3584
COURSE NAME : INDUSTRIAL TRAINING
LATIHAN INDUSTRI

4 Credit Hours
Pre-requisite : Passed 60 Credits Hours

Course Synopsis

Industrial training exposes students to the real work setting in various industries or military units for 10 weeks. The students are placed in industries or military units that best suit their area of studies. It is an experimental learning that requires the students to learn the process and able to apply their knowledge acquired in actual industrial setting. The knowledge acquire during practical training may be used later in final year class as well as to equip them with sufficient knowledge for their job.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Experience and gain engineering knowledge, which are required in industry and not taught in the lecture rooms.
2. Apply the engineering knowledge taught in the lecture rooms in real industrial situations.
3. Gain experience on engineering procedural work flow management and implementation, technical report writing in engineering works/projects to face real problems in engineering field.
4. Practise responsibilities and code of ethics as engineers.

Reference

Industrial Training Guideline. Industrial Training Committee, Faculty of Engineering, UPNM

COURSE CODE : ECC 3603
COURSE NAME : STEEL AND TIMBER STRUCTURES DESIGN
REKABENTUK STRUKTUR KELULI DAN KAYU

3 Credit Hours
Pre-requisite : Must have taken Mechanics of Structures (ECC 3413)

Course Synopsis

This is a core course. It will expose the students to the analysis and design of steel and timber structures. For the steel design, the topics covered include the advantages and the general concepts of steel constructions, analysis and design of restrained and unrestrained beams, design of tension and compression members, columns with axial load, columns with axial load and bending moment, bolt and weld connections. For timber structures, the topics covered include the design of beams, columns, and compression and tension members of truss.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Describe the steel and timber design concept and elaborate the advantages and disadvantages of steel and timber structures compare to other types of structure.
2. Analyse actions on structure, calculate design loads and analyse structural elements.
3. Design steel & timber structures, i.e. beams, columns, and connections, using current code of practice.
4. Work in a team, to prepare structural design report, drawing plan and structural element detailing, professionally and ethically, and to present it with standard communication skill.

References

1. L.H. Martin & J.A. Purkiss, Structural Design of Steelwork to EN 1993 and EN 1994 3rd Edition, Butterworth-Heinemann, UK, 2008.
2. N.S. Trahair, M.A. Bradford, D.A. Nethercot and L. Gardner, The Behaviour and Design of Steel Structures to EC3 4th Edition, Taylor & Francis, 2009.
3. Mat Lazim Zakaria, *Rekabentuk Struktur Kayu menurut MS 544, Dewan Bahasa dan Pustaka: KL, 1989.*
4. British Standard Institution, BS EN 1991-1-1:2002, Eurocode 1– Actions on Structures, BSI, 2002.
5. British Standard Institution, BS EN 1993-1-1:2005, Eurocode 3–Design of Steel Structures- BSI, 2005.

COURSE CODE : ECC 3613
COURSE NAME : ENVIRONMENTAL ENGINEERING
KEJURUTERAAN ALAM SEKITAR

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course covers broad aspects of environmental pollution and control. Students are exposed to subject matters related to water, air and soil pollution. Sources, effects, engineering control measures and related laws and regulations are discussed. Other topics include solid and hazardous waste management, environmental impact assessment and environmental management system.

Course Learning Outcomes

At the end of this course students are able to:

1. Identify and discuss on pollutants and their effects to environment especially human.
2. Understand some concepts related to pollutant dispersion and self cleansing of environmental system.
3. Identify and make simple design of pollution control methods or equipment.
4. Understand some of the Malaysian laws and regulations pertaining to environmental pollution control and concepts of environmental impact assessment and environmental management system.

References

1. Davis, M.L & Cornwell, D.A, Introduction to Environmental Engineering, 5th Edition, McGraw Hill, (2013).
2. Peavy, H.S, Donald, R.R & George, T, (1985), Environmental Engineering, McGraw Hill, 1985RC & Steel Design.
3. Environmental Quality Act and Regulations (Act 127).

COURSE CODE : ECC 3622
COURSE NAME : INFRASTRUCTURE DESIGN PROJECT (CAPSTONE I)
PROJEK REKABENTUK INFRASTRUKTUR (CAPSTONE I)

2 Credit Hours
Pre-requisite : None

Course Synopsis

This course is tailored to expose and familiarise students to relevant design code requirements for civil engineering/infrastructure works. The subject focuses on the implementation of infrastructure design and technical report writing of the proposed projects. Working in groups, student will simulate design team effort preparing local authorities submission procedures for approval of infrastructure works. The content of this subject covers basic infrastructure such as earthworks design, road and drainage design, water reticulation design, sewerage reticulation design and environmental management pertaining to impact assessment.

Course Learning Outcomes

At the end of this course students are able to:

1. Use code of practice, manual and guidelines to perform earthworks design, sewerage water reticulation design, external water reticulation design, drainage system design and perform EIA report.
2. Work in a project team and produced a technical report on the project.
3. Present information and express idea clearly through oral modes.

References

1. Akta Jalan, Parit and Bangunan 1974.
2. Urban Strom Water Management Manual (MASMA), 2001.
3. MWA Design Guideline for water supply system, 1992.
4. *Arahan Teknik Jalan*.

COURSE CODE : ECC 3632
COURSE NAME : FINAL YEAR PROJECT I
PROJEK TAHUN AKHIR I

2 Credit Hours
Pre-requisite : Passed in Fluid Mechanics (ECC3313), Soil Mechanics (ECC 3463), Construction Materials and Technology (ECC3323), Mechanics of Materials (ECC3333) dan Mechanics of Structures (ECC3413)

Course Synopsis

All students are required to conduct a final year project for 2 semesters before graduating. Students are required to identify problem(s) related to their project, propose solution to the problem(s), and gather relevant information to solve the problem(s). The Final Year Project I introduces the research methodology to students. Students are required to initiate a research on a selected topic in a systematic manner, conduct intensive literature review, propose solution(s) to the problem (s) and write a project proposal. Students are required to present their project proposal.

Course Learning Outcomes

At the end of this course students are able to:

1. Understand, seek and define the research topic, objectives and scope of work.
2. Search information related to research project.
3. Design the project methodology to achieve the expected outcome.
4. Write a proper project proposal report and technical abstract.
5. Present information and express ideas clearly, effectively and confidently through written and oral modes.

References

Students are expected to find their own reference materials.

COURSE CODE : ECC 3642
COURSE NAME : ENGINEERS IN SOCIETY
JURUTERA DALAM MASYARAKAT

2 Credit Hours
Pre-requisite : None

Course Synopsis

The course relates to the subject of Engineers in Society. The course first introduces the student with the roles of engineers in Nation Building, followed by their roles in the organization they work and the society they live in. Next, engineering professionalism including familiarity with the Engineers Act is given. The course then discusses the importance of "Ethics" and the need to adhere to it as well as the expectations of the public towards the engineering profession. At the same time, it highlights the issues of integrity and corruption. Finally, the course exposes students with the importance of environmental preservation and safety at work site.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Understand the role of engineers in the society and nation they live in.
2. Understand engineering professionalism including the Engineers Act and the route to a professional engineers.
3. Appreciate the importance of environmental preservation and ensuring health and safety in every construction project.
4. Be more responsive on the importance of moral values and the need to adhere to ethics as an engineer.
5. Apply the knowledge in ethics and professionalism to resolve problems and issues they encounter in engineering professionalism.

References

1. Arazi Idrus, Shahrin A Sulaiman & Mohd Faris Khamidi.(2010). Engineers in Society. Mc GrawHill, Malaysia.
2. Mike W. Martin Ronald Schinzinger. (2005). Ethics in Engineering. 4th edition: McGraw Hill.
3. Carl Mitham & R. Shannon Duvall.(1999) Engineer's Toolkit. Prentice Hall.
4. Alastair S. Gunn & P. Aarne Vesilind.(2003). The Engineer's Responsibility to Society. Thomson & Brooks/Cole

COURSE CODE : ECC 3652
COURSE NAME : ENGINEERING CONTRACT, ESTIMATION AND ECONOMICS
KONTRAK KEJURUTERAAN, PENTAKSIRAN DAN EKONOMI

2 Credit Hours
Pre-requisite : None

Course Synopsis

This course consists of three parts. The first part will start with an overview of the construction industry and then expose students to the basic knowledge of construction contracts and its management, types of tender, tendering process, preparation of tender documents, and strategies in tendering. Meanwhile, the second part covers the introduction to the methods of estimating and the preparation of the Bill of Quantities for construction project. The third part will expose students to engineering economics.

Course Learning Outcomes

At the end of this course students are able to:

1. Apply the basic knowledge regarding construction tender and contract.
2. Understand cost concept in engineering works.
3. Estimate the cost of building elements and civil engineering works.
4. Do basic calculation in engineering economy.
5. Work in a team or individually to solve problems and produce written report.

References

1. Ir. Harbans Singh K.S.(2002). Engineering and construction contracts management pre-contract award practice. Lexis Nexis.
2. John Murdoch & Will Hughes(1996). Construction contracts laws and management. London E&FN Spon.
3. Ahmad Abdullah & Khairuddin Abd Rashid (2004). *Pengukuran Kuantiti Bangunan.* 2nd Ed. Pearson Prentice Hall.
4. Pratt, D (2004). Fundamentals of Construction Estimating, 2nd Ed. Thomson, Delmar Learning.
5. John A White, Kenneth E Case, Davib B Pratt and Marvin H Agee (2000). Principles of Engineering Economics Analysis, 4th Edition. John Wiley.

COURSE CODE : ECC 3662
COURSE NAME : STRUCTURAL DESIGN PROJECT (CAPSTONE II)
PROJEK REKABENTUK STRUKTUR (CAPSTONE II)

2 Credit Hours
Pre-requisite : Must have taken Reinforced Concrete Design II (ECC 3543) or Steel and Timber Structures Design (ECC 3603)

Course Synopsis

This course is to provide an understanding and skills in designing civil engineering structures. In this course, students will be trained to work effectively in a team and will be able to carry responsibility for individual task. They will also attend lectures given by industry practitioners to expose themselves to real design practice. Furthermore, students will be trained to produce report and present the project with effective communication skill. The students will either continue the project given from previous Capstone I course project, or start from a new requirement, new sketch, or site visit to a new proposed building project.
For Capstone II, students are required to start with preparing the preliminary design concept for a structure. Then to prepare functional and structural layout plan, to analyse and design the structure, and detailing on the structural elements. The students are also required to produce sample take-off sheets, cost estimation and project planning and scheduling.

Course Learning Outcomes

At the end of this course students are able to:

1. Prepare structural design concept base on client requirement including preparing functional and structural layout plan.
2. Analyse and design selected structure including drawing and detailing.
3. Produce sample take-off sheets and performed cost estimation.
4. Professionally prepare full report including plan for project implementation.

References

1. Martin, L.H. & Purkiss, J.A. 2006. Concrete Design to EN 1992, 2nd Ed. Oxford: Butterworth-Heinemann
2. Mosley, B., Bungey, J., & Hulse, R. 2007. Reinforced Concrete Design to Eurocode 2, 6th Ed. Hampshire: Palgrave Macmillan
3. Hibbeler, R.C. 2006. Structural Analysis. 6th. Edition SI. Singapore: Prentice-Hall.
4. British Standard Institution, BS EN 1991-1-1:2002, Eurocode 1– Actions on Structures, BSI, 2002.
5 British Standard Institution, BS EN 1992-1-1:2004. Eurocode 2: Design of Concrete Structures. Part 1-1: General rules and rules for buildings London: BSi.
6 NA to BS EN 1992-1-1:2004**.** UK National Annex to Eurocode 2: Design of Concrete Structures. London: BSi.
7 STANDARDS MALAYSIA. MS EN 1990 (2010). Eurocode: Basis of structural design. MS, 2010 1a. Malaysia National Annex to Eurocode. Malaysian Standards.
8 STANDARDS MALAYSIA. MS EN 1991 (2010). Eurocode 1: Actions on structures. MS, 2010 2a. Malaysia National Annex to Eurocode 1. Malaysian Standards.
9 STANDARDS MALAYSIA. MS EN 1992 (2010). Eurocode 2-Part 1-1: Design of concrete structures- General Rules and Rules for Buildings MS, 2010 3a. Malaysia National Annex to Eurocode 2. Malaysian Standards

COURSE CODE : ECC 3674
COURSE NAME : FINAL YEAR PROJECT II
PROJEK TAHUN AKHIR II

4 Credit Hours
Pre-requisite : Must have passed Final Year Project I (ECC 3632)

Course Synopsis

All students are required to conduct a final year project for 2 semesters before graduating. Students are required to identify problem(s) related to their project, propose solution to the problem(s), and gather relevant information to solve the problem(s). The Final Year Project II is the extension of Final Year Project I. Students are required to complete data collection and analysis, write a dissertation and technical paper. Students are required to present their findings.

Course Learning Outcomes

At the end of this course students are able to:

1. Conduct research in a systematic way.
2. Interpret, analyse, discuss and make conclusion based on the research findings.
3. Write a good thesis and technical paper based on the research.
4. Present information and express ideas clearly, effectively and confidently through written and oral modes.

References

Students are expected to find their own reference materials.

SYNOPSIS OF ELECTIVE COURSE PROGRAM
BACHELOR OF CIVIL ENGINEERING PROGRAM (ZK01)

COURSE CODE : ECC 3713
COURSE NAME : NUCLEAR, BIOLOGICAL AND CHEMICAL CONTAMINATION
PENCEMARAN NUKLEAR, BIOLOGI DAN BAHAN KIMIA

3 Credit Hours
Pre-requisite : None

Course Synopsis

This is an elective course introducing students to nuclear, biological and chemical (NBC) pollution. The pollutants or agents are either planned or accidentally released to the environment. It will discuss on causes and sources, main effects/symptoms of the pollution. It will also discuss on basic methods and procedures of detection, decontamination and protection. Main equipments for detection, protection and decontamination will also be discussed especially for the safety of military personnel or public.

Course Learning Outcomes

At the end of this course students are able to:

1. Describe the properties and concepts of how NBC agents affects human and the environment.
2. Explain and utilise the standard procedures of marking contaminated site and identify the decontamination methods and procedures.
3. Identify and solve problems on basic principles of transmission, dissemination and detection of the agents and the factors affecting the spread.
4. Plan strategies and the steps need to be taken during NBC contamination for self and mass protection.

References

1. Davis, M.L & Cornwell, D.A, Introduction to Environmental Engineering, 5th Edition, McGraw Hill, (2013).
2. Malaysia Environmental Quality Act and Regulations (Act 127).
3. Woodside, G, Hazardous Materials and Hazardous Waste Management.
4. Yadav, M.S, Nuclear Weapons and Explosions, Environmental Impacts and Other Effect.

COURSE CODE : ECC 3733
COURSE NAME : ADVANCE HIGHWAY ENGINEERING
KEJURUTERAAN LEBUHRAYA LANJUTAN ECC 3523

3 Credit Hours
Pre-requisite : None

Course Synopsis

This elective course will expand the students' knowledge in highway engineering. The topics include analysis of pavement stresses, methods of modifying asphalts and application of modified asphalts for military roads, new advances of pavement materials and pavement evaluation and maintenance.

Course Learning Outcomes

At the end of this course, students are able to:

1. Analyze the pavement distresses
2. Identify different types of modified asphalts and its applications.
3. Conduct pavement appraisals.

References

1. Y.H. Huang, (2012) Pavement Analysis and Design. Pearson Prentice Hall.
2. P.H. Wright, K.K. Dixon, (2004). Highway Engineering, John Wiley & Son.
3. Brockenbrough, R.L. (2009). Highway Engineering Handbook. McGraw Hill.

COURSE CODE : ECC 3743
COURSE NAME : ADVANCED CONSTRUCTION MATERIALS AND TECHNOLOGY FOR MILITARY APPLICATION
BAHAN DAN TEKNOLOGI PEMBINAAN LANJUTAN UNTUK APLIKASI KETENTERAAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course is divided into two parts. The first part will address the types of contemporary materials used related to high strength and impact resistance structures, meanwhile the second part will expose the construction technology that's being used in military applications. This course also provides students the knowledge of rapid construction and elaboration of the role of military civil engineer.

Course Learning Outcomes

Upon completion of this course, students are able to:

1. Describe the advance building materials being used in military applications.
2. Describe the advanced construction technology being used in military applications.
3. Evaluate the concept of rapid construction.

References

1. Advance Construction and Building Technology for Society (2012), International Council for Research and Innovation in Building and Construction, Germany, 2012.
2. Roy Chudley and Roger Greeno (2007). Construction Technology, Pearson. Prentice Hall, United Kingdom.
3. Edward Allen and Joseph Iano (2008). Fundamentals of Building Construction Material and Methods.

COURSE CODE : ECC 3753
COURSE NAME : STRUCTURE SUBJECT TO BLAST
STRUKTUR TERDEDAH KEPADA LETUPAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course aims to develop understanding of the explosive law and act in Malaysia, type of military and commercial explosive, explosive storage, safety and also handling procedure, a review of terrorist attack on building, blast phenomena and also blast effect on structure. Besides, students will aso expose to the various blast mitigation technique and procedures.

Course Learning Outcomes

At the end of this course students are able to:

1. Understand explosive related law, type of explosive and application, explosive storage building, blast loading and also blast effect on structure.
2. Work in a project team to produce a report on blast loading and also effect on the building structure.
3. Present information and express the idea clearly through oral modes.

References

1. Smith and Hetherington (1994). Blast and ballistic loading of structures. Oxford: Butterworth-Heinemann. ISBN: 0750620242.
2. Mays and Smith. (1995). Blast effects on buildings: design of building to optimize resistance to blast loading. Thomas Telford. ISBN: 0727720309.
3. Donald O. Dusewnberry (2010). Blast resistance design of building. John Wiley and Sons.

COURSE CODE : ECC 3763
COURSE NAME : INTEGRATED WATER RESOURCES MANAGEMENT
PENGURUSAN SUMBER AIR BERSEPADU

3 Credit Hours
Pre-requisite : None

Course Synopsis

This is an elective course aim to equip students with in-depth knowledge in water resources design and management. This course highlights major water resources management issues with the emphasis on the integration of various management components. While the course contents maintain the technical elements of water resources system and engineering, students are also exposed to the realities of the political, economic, and social settings that influent the decision making process. Upon completion of this course, the students should be able to demonstrate the diverse and complicated issues in water resource management, discuss the need and steps for integrated management approach, analyse and determine viable project options, propose appropriate management strategies, and apply the appropriate techniques and strategies in reservoir planning and design.

Course Learning Outcomes

At the end of this course students are able to:

1. Acquire basic knowledge of water resources management.
2. Describe the major water resources management issues.
3. Select the technical elements of water resources system and engineering.
4. Demonstrate the diverse and complicated issues in water resource management.

References

1. Pedro Martinez-Santos, Maite M. Aldaya, M. Ramón Llamas. Integrated Water Resources Management in the 21st Century: Revisiting the paradigm. CRC Press
2. Adamowski J, Zyla C, Cuenca E, Medema W, Clamen M, Reig P. 2013. Integrated and adaptive water resources planning, management, and governance. Water Resources Publications LLC. Littleton, Colorado, USA.
3. Lenton R. L., Mike Muller (2009). Integrated Water Resources Management in Practice: Management for Development. Earthscan Publishing.

COURSE CODE : ECC 3773
COURSE NAME : ENVIRONMENTAL HYDRAULICS AND HYDROLOGY
HIDRAULIK DAN HIDROLOGI ALAM SEKITAR

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course is designed to expose the students to surface water environmental hydraulics. The fundamentals and principles, which underlie the mathematical modeling techniques used to analyze the quality of surface waters are emphasized. Students will be able to build models from mass balance equations, and will appreciate the related environmental disciplines. After completion of the course, students should be able to apply the numerical models for a selected case study and able to familiar with the multi-disciplinary aspects of an engineering project.

Course Learning Outcomes

At the end of this course students are able to:

1. Acquire basic knowledge of environmental hydraulic and hydrology.
2. Learn the fundamental and principles of mathematical modeling techniques and build models from mass balance equations.
3. Apply the numerical models for a selected case study.

References

1. Andrew Chadwick, John Morfett and Martinn Borthwick (2013). Hydraulics in Civil and Environmental Engineering. CRC Press. Taylor and Francis Group.
2. Ghosh S. N., Desai V. R. (2006). Environmental Hydrology and Hydraulics. CRC Press.
3. Jayawardena A. W. (2014). Environmental and Hydrological Systems Modelling. CRC Press. Taylor and Francis Group.

COURSE CODE : ECC 3813
COURSE NAME : HYDROLOGIC ANALYSIS AND DESIGN
ANALYSIS DAN REKABENTUK HIDROLOGI

3 Credit Hours
Pre-requisite : None

Course Synopsis

The course covers the theoretical aspects and design of urban stormwater drainage system. It is intended to introduce students to the fundamentals of stormwater drainage system design. Methods of hydrologic design, rainfall design, flood estimation, rainfall-runoff relationship and flood routing will be taught. This will involve the planning, analysis, design and management for the quantitative aspect.

Course Learning Outcomes

At the end of this course students are able to:

5. Describe the basic concepts of hydrology process.
6. Explain issues in drainage system management and flood control programs.
7. Design of drainage structures and flood control mechanisms.
8. Incorporate the guidelines in Urban Storm water Management Manual for Malaysia (MSMA) into drainage system design.

References

5. Richard, H. M. (2016). Hydrologic Analysis and Design. 4th ed. Pearson.
6. Chin, A. D. (2013). Water Resources Engineering. 3rd ed. Pearson.
7. Urban Storm Water Management Manual for Malaysia" (2000). Department of Irrigation and Drainage Malaysia. Percetakan Nasional Malaysia Berhad.

COURSE CODE : ECC 3783
COURSE NAME : INTRODUCTION TO RAILWAYS AND TUNNELS
PENGENALAN KEPADA LANDASAN KERETAPI DAN TEROWONG

3 Credit Hours
Pre-requisite : None

Course Synopsis

This elective course introduces students to the necessity of railways and tunnels as an alternative to roads and highway. The topics for railways cover the systems of railways, design of track geometrics, points and crossings, stations and yards. The topic of tunnels include the classification of tunnels, shape of tunnels, methods of tunneling in hard and soft rocks.

Course Learning Outcomes

At the end of this course, students are able to:

1. Identify and distinguish the systems of railways.
2. Design the geometrics of railways.
3. Recognize, compare and classify types of tunnels and methods of tunneling

References

1. Chandra, S., Agarwal, M.M., (2013). Railway Engineering. Oxford University Press.
2. Hay, W.W. (1982). Railroad Engineering. Wiley.
3. Kuesel, T.R., King, E.H., Bickel, J.O., (1996). Tunnel Engineering Handbook. Springer.
4. The British Tunneling Society, (2010). Specification for Tunneling. Thomas Telford Publishing.
5. Upadhyay, A.K., (2016). Transportation Engineering. S.K. Kataria & Sons.

COURSE CODE : ECC 3793
COURSE NAME : DAMAGE ASSESSMENT, REPAIR AND MAINTENANCE OF CONCRETE STRUCTURES
PENILAIAN KEROSAKAN, PEMBAIKAN DAN PENYELENGGARAAN STRUKTUR KONKRIT

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course first introduces students to the subject of concrete durability, and the nature and causes of concrete damage and deterioration. This is followed by methods for structural investigation and damage assessment including the effects on the integrity of the whole structure. Materials and techniques for repair, strengthening, rehabilitation, protection and maintenance are also given. At the end of the course, students are also exposed to the methods of demolition of existing structures.

Course Learning Outcomes

At the end of this course students are able to:

1. Acquire basic knowledge of concrete durability and the process of deterioration.
2. Predict the cause of the damage that has occurred to a concrete member and assess the effect on the structure.
3. Select the appropriate technique for repairing damaged concrete and method of maintenance.
4. Describe techniques of demolishing structures using explosives as well as mechanical means.

References

1. Mays, G.C. Durability of Concrete Structures: Investigation, Repair and Protection. E FN Spon London. 1992.
2. Repair and Strengthening of Concrete Structures. FIP Guide to Good Practice. Thomas Telford, 1991.
3. Puller-Strecker, P. Corrosion Damaged Concrete: Assessment and Repair.Butterwort for CIRIA, London, 1987.

COURSE CODE : ECC 3803
COURSE NAME : INTRODUCTION TO BRIDGE ENGINEERING
PENGENALAN KEPADA KEJURUTERAAN JAMBATAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This elective course introduces students to the basic concepts, theory and procedures for analyzing and designing various bridges' elements based on several code of practice such as British Standard, and Eurocodes. This syllabus covers topics on introduction to basic function, types and arrangement of bridges, general types of bridge loadings, effects temperature and shrinkage, bridge deck analysis, design of substructure. Furthermore, the students will be exposed to design concepts and construction of prestressed concrete bridge, long span bridges (suspension bridges and cable-stayed bridges) and also other two types of bridges military; portable bridges and floating bridges. Besides, students also have to work in group and are required to conduct a mini design project, where they are asked to analyse, and design a given structures using computer software.

Course Learning Outcomes

At the end of this course students are able to:

1. Define and describe the function, types and basic arrangement of bridges, general types of bridge loadings and effects temperature and shrinkage.
2. Identify, calculate and analyse the applied loads on bridge deck based on two code of practice which is British Standard, and Eurocodes. Also, analyse, and design bridge substructure such as abutment and pier.
3. Explain design concepts and construction of prestressed concrete bridge, long span bridges (suspension bridges and cable-stayed bridges) and also other two bridges military; portable bridges and floating bridges.
4. Work in a team, seeking contemporary knowledge to prepare bridge design report, drawing plan and bridge element detailing, professionally and ethically, and to present it with standard communication skill.

References

1. M Imran Rafiq (2009). Bridge Deck Loading and Analysis. University of Surrey, UK.
2. M Imran Rafiq (2009). Prestressed Concrete Bridge Design. University of Surrey, UK.
3. Ryall, M.J.; Parke, G.A.R. & Harding, J.E. (2001). Manual of Bridge Engineering, Published by Thomas Telford, UK.
4. BS 5400-1:1988. Steel, concrete and composite bridges - Part 1: General statement. London: BSi.