SCHOOL OF CIVIL ENGINEERING

1. INTRODUCTION

The School of Civil Engineering was established in 1989. It is now a modern multi-school and has a record of providing undergraduate and graduate research opportunities in a very wide range of topics across the spectrum of civil engineering activities. It has been widely recognised for the high quality of its product and services. The School produces graduates in civil engineering who are competent, creative and highly dedicated who contribute to the human capital development both in government agencies and in the private sector. The School formally implemented the Outcome Based Education system (OBE) in the 2006/2007 academic session to fulfill the Engineering Accreditation Council (EAC) requirements for undergraduate engineering programmes in Malaysia and to enhance the teaching and learning experience at the school.

The School of Civil Engineering is active in both basic and applied research as well as in consultancy. Most of the research is funded by government agencies and industries which are in accordance with the status of USM as one of the Research-Intensive Universities in the country. The School also receives many international students in its graduate programmes (Ph.D. and M.Sc. by research). It's M.Sc. by mixed-mode in Structural Engineering, Environmental Engineering and Sustainable River Management is quite popular with students nationally and internationally.

The School is backed by experienced faculty members (most of them with Ph.D) and supported by well-equipped laboratories with state-of-the-art facilities, fully networked computers, and highly trained personnel. The School is also actively engaged by the industry in the areas of testing for structures and materials, field and laboratory water quality monitoring, air and noise pollution measurement, environmental impact assessment, transport planning, traffic impact assessment, and geotechnical evaluation.

2. PHILOSOPHY AND OBJECTIVES

The School of Civil Engineering aims to provide quality undergraduate education in the country. This entails providing all students the opportunity for a broad-based educational experience and enabling students to address complex civil engineering problems comprehensively. In addition, the school seeks to provide students with the fundamentals necessary for their advancement in the profession in response to changing technology and societal needs and expectations. Additionally, the school intends to prepare and foster the intellectual interest needed for graduate studies and research. These objectives are being reflected in the mission statement of the School of Civil Engineering as follows:-

"To nurture and sustain excellence in delivering comprehensive education, imparting knowledge, exploring frontiers of technology, and providing services to the industry and community, at the local and international levels, by applying the most advanced knowledge and leading expertise, creating innovative ventures, being truthful and upholding USM's motto "We Lead".

The School of Civil Engineering has formally adopted the Outcome Based Educational process to achieve specified outcomes towards preparing future

engineers. The educational structures and curriculum in the Bachelor of Civil Engineering programme at USM are designed to help students achieve these capabilities and qualities. To ensure this, a Continual Quality Improvement (CQI) is established within the education system. OBE is an essential requirement for Malaysia to become full-signatory member of a multinational agreement for the mutual recognition of engineering degrees, i.e. The Washington Accord (WA) in producing engineers who are ready for practice in the international scene.

The Bachelor of Civil Engineering Programme has put in place the following accreditation requirements:-

1. Published Program Educational Objectives (PEO) that is consistent with the mission of the institution;
2. A set of Programme Outcomes (PO) and an assessment process to demonstrate that the outcomes are being measured
3. A curriculum and processes that ensure the achievement of these objectives and outcomes; and
4. A system of ongoing evaluation that demonstrates achievement of these objectives and outcomes by using the results for Continual Quality Improvement (CQI).

Program Educational Objectives [PEO] are statements that describe the expected accomplishments of graduates during the first several years following graduation. The program educational objectives are consistent with the vision and mission of the Universiti Sains Malaysia as shown:

1. To produce graduates who have the proficiency and ability to apply knowledge of mathematics, science and engineering to identify, formulate, and solve civil engineering problems.
2. To produce graduates with fundamental and diverse civil engineering education who can adapt to new technologies, and have ability to apply techniques, skills and modern engineering tools necessary for engineering practice.
3. To produce graduates with multi-disciplinary teamwork and leadership skills, as well as proficiency in written and oral communication to assure effective presentation of technical and social issues.
4. To produce graduates who understand civil engineering practice issues, professional and ethical responsibility, contemporary issues, and impact of engineering solutions in a global and societal context.
5. To produce graduates who are able and recognize the need to engage in life-long learning for further personal and professional growth and development through self study, continuing education, or graduate study.

Program Outcomes are the abilities that are measurable at the successful end of a student's academic program in the Bachelor in Civil Engineering at the Universiti Sains Malaysia. Performance skills and abilities are emphasized throughout the 4-year undergraduate study in order to prepare students to be successful engineers by fulfilling the following outcomes:-

1. Graduates have the proficiency in and the ability to apply the principles of engineering knowledge, mathematics and science in the analysis of civil engineering and related fields.
2. Graduates have the ability to acquire in-depth technical competence in civil engineering
3. Graduates have the ability to identify and solve civil engineering problems
4. Graduates have the ability to design civil engineering systems, components or processes to meet the needs and demands of the profession
5. Graduates have the ability to function effectively both as individuals and in a group in the capacity of a leader or a team member
6. Graduates have the ability to consider social, economic, technological, and environmental aspects to solve civil engineering problems professionally and ethically
7. Graduates have the ability to communicate effectively in conveying and disseminating knowledge.
8. Graduates have the ability to use the techniques, skills and appropriate engineering methods and tools necessary for sustainable development
9. Graduates can demonstrate an awareness of the need to stay abreast with the latest knowledge and understand contemporary issues in civil engineering
10. Graduates have the potential to continue the professional development and advancement through life-long learning.
11. Graduate have sufficient management skills to stay competitive in the global market

Course outcomes (CO) are statements of what students know and can do as a result of completing their respective courses of study. All courses offered in the civil engineering programme are designed with CO's to quantify teaching and learning assessment, as well as our quality assurance.

3. GRADUATE STUDIES AND RESEARCH PROGRAMMES

The School of Civil Engineering provides the opportunities to those who are interested to further their studies to the higher degree's level. Higher degree's programme offers the opportunities to graduates who are qualified to enhance their knowledge in any areas of their interest. Students will be exposed to research techniques and methodologies, which will indirectly contribute towards knowledge expansion and development. Higher degree's courses which award Masters Degree of Science (MSc) and Doctor of Philosophy (PhD) can be undertaken through either full time or part time modes. At present, master degree's programme is offered both by mix-mode and research modes. The School of Civil Engineering offers two modes of graduate programme as follows:

Master of Science and Doctor of Philosophy by Research

Graduate students in the research mode may choose any topic in their specific area of study. They will be under the supervision of a main supervisor or co-supervisor. In some cases, field supervisors are appointed by the university to assist the

graduate. At the end of their study, the students have to submit at thesis to be examined. The graduate may be required to pursue prerequisite courses (if necessary) with or before undertaking the research activities. Applications and registration for research-based programmes are open throughout the year. The research can be undertaken on both a full-time and part-time basis.

Master of Science by Mixed-mode

The mixed-mode programmed (coursework and research) is a structured programme whereby students are required to attend lectures, sit for examinations, write a dissertation and be orally examined. The programme is run based on a semester system and offered in full-time basis. Minimum duration is 1 year. However, the actual duration for graduation is very much dependent on the initiative and performance of individual candidates. The title of the research project will be mutually agreed upon between the candidate and his/her supervisor. For the award of the Master degree, a candidate has to accumulate 40 units (including dissertation).

Degree Offered

The school offers the MSc. Degree Programmes by Mixed Mode (full time) in the following areas.

Master of Science in Structural Engineering
Master of Science in Environmental Engineering
Master of Science in Sustainable River Management

Applicants for courses leading to the award of a Master's degree should possess a Bachelor degree in Civil Engineering or related areas (equivalent to a CGPA 2.75) from a recognized university. A candidate with lower CGPA could be considered for admission based on relevant research and job experiences.

Applicants for admission to PhD programme should possess a M.Sc. degree from a recognized university or equivalent qualifications acceptable to the Senate of this University. In exceptional cases, the Senate may admit those in possession of a good Bachelor's degree.

Research areas

The school may supervise research in the following areas:

Environmental Engineering
Landfill Technology, Compositing, Water and Wastewater Treatment, Industrial Wastewater Treatment, Solid Waste Management, Environmental Impact Assessment (EIA), Air Quality & Water Quality Studies, Sludge Management, Noise Pollution Control, Water Quality Modeling

Geotechnical Engineering
Slope Stability (Soil/rock), Soil Improvement, Reinforced Soil, Landslide Risk Management and Application of Geosynthetics, Rock Mechanics, Blasting &

Vibrations, Foundation Engineering, Land Reclamation & Rehabilitation, Geotechnical Assessment, Piling Vibrations

Water Resources Engineering
Water Supply, Urban Storm water Management, Hydrological Modeling, Flood Forecasting, River Engineering, GIS Application in water Resources, Land Use Hydrology, Urban Hydrology, Sediment Transport, Modeling of Pump Station, Ecohydrology

Transportation & Highway Engineering
Pavement Engineering, Asphalt Technology, Traffic Engineering, Road Safety, Intelligent Transport System, Public Transport Studies, Highway Capacity Studies, Travel Behavior Studies, Sustainable Transport

Structural Engineering
Concrete Technology, Masonry Engineering, Concrete Repair Materials and Techniques, Wind Engineering, Earthquake Engineering, Timber Engineering, Tensioned Structures, Shell & Spatial Structures, Computational Mechanics and Advanced Structural Analysis

Geomatic and Management
Monitoring Systems, Global Positioning System (GPS), Spatial Decision Support System (GIS), Geo- Information Science (GIS), Digital Mapping and Imaging, Engineering Survey, Spatial Statistics, Stress Management, Emotional Intelligence and Engineering Entrepreneurship

4. LABORATORY FACILITIES

The School of Civil Engineering provides complete laboratory facilities to produce civil engineers that are highly knowledgeable and innovative. Besides academic staffs who are experts in their respective fields of specialization, this school is supported by able technicians manning eleven engineering laboratories. The laboratories facilities in the school are the:-

- Strength of Materials Laboratory
- Concrete Laboratory
- Heavy Structures Laboratory
- Environmental Engineering Laboratory
- Geomatic Engineering Laboratory
- Hydraulic Laboratory
- Hydrology Laboratory
- Geotechnical Laboratory
- Highway and Traffic Laboratory
- Computer Laboratories
- Drawing Laboratory

5. WORK PROSPECT

Civil Engineering graduates have a wide job prospect in both government agencies and private sectors. Job prospect include as:-

- Consultants
- Contractors
- Developer
- Entrepreneur
- Managerial
- Educator

The career specialisation may be in one or few of the following:-

- Infrastructure Engineer
- Structural Engineer
- Geotechnical Engineer
- Road/Highway Engineer
- Water Resources Engineer
- Environmental Engineer
- Transportation Engineer

6. HEADS OF ADMINISTRATION AND ACADEMIC STAFF

Assoc. Prof. Dr. Ahmad Farhan Mohd. Sadullah
DEAN

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Deputy Dean
Academic and Student Development

Prof. Dr. Hamidi Abdul Aziz
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Dr. Megat Azmi Megat Johari
Academic Program Chairman
Structural and Physical

Assoc. Prof. Dr. Fauziah Ahmad
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7. BACHELOR OF CIVIL ENGINEERING PROGRAMME

7.1 PROGRAM OUTCOME METRICES

The program outcome assessment matrix provides a concise summary on how the program outcomes are assessed and how the courses are designed to raise the attainment level of relevant outcomes.

Code	Course	Emphasis to the Programme Outcomes**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EAA110	Civil Engineering Drawing	2	0	2	2	1	0	0	0	1	3	0
EAS152	Strength of Materials	2	2	1	1	0	0	0	0	0	0	0
EAS181	Concrete Technology	1	2	1	2	0	0	0	0	0	0	0
EUP222	Engineers in Society*	0	0	1	2	1	3	2	0	3	1	3
EAK263	Geomatic Engineering*	3	1	2	1	2	1	2	2	1	1	1
EAS253	Theory of Structures*	3	2	2	1	1	0	0	0	0	0	0
EAH221	Fluid Mechanics for Civil Engineers*	2	2	2	0	0	0	0	0	0	0	0
EAA204	Structures and Strength of Materials Laboratory*	2	1	1	0	2	0	1	0	0	0	0
EAH225	Hydraulics	3	2	1	0	0	0	0	0	0	0	0
EAG245	Soil Mechanics	3	3	3	1	0	0	0	0	0	0	0
EAP215	Water Supply and Treatment Engineering	2	2	2	1	1	1	1	1	2	1	0
EAS254	Structural Analysis	2	2	2	0	0	0	0	0	0	0	0
EAA203	Concrete and Fluid Mechanics Laboratory	3	2	2	0	2	0	1	0	0	0	0
EAA273	Civil Engineering Practice	2	1	2	1	1	1	1	1	1	1	0
EUT201	Thinking Techniques	3	3	3	3	1	3	1	3	3	2	1
EAG345	Geotechnical Analysis*	3	3	3	2	1	1	1	2	1	0	0

EAP313	Wastewater Engineering*	3	3	2	1	1	2	1	2	2	1	0
EAS353	Reinforced Concrete Structure Design I*	2	2	2	2	2	1	1	1	1	1	1
EAA305	Hydraulic, Geotechnical and Environmental Laboratory*	2	1	1	3	1	1	1	2	1	1	0
EAL334	Highway Engineering*	1	2	2	3	1	1	1	2	1	1	0
EAA384	Construction Technology*	1	2	1	0	0	1	0	1	1	1	0
EAG346	Geotechnical Engineering Design	3	3	3	3	3	3	3	2	2	2	2
EAH325	Engineering Hydrology	3	2	2	2	0	2	0	2	0	0	0
EAS354	Timber Structural and Steel Design	2	2	2	2	1	1	2	0	1	1	0
EAA304	Geotechnical, Highway and Transportation Laboratory	3	2	1	2	3	1	3	1	2	2	0
EAL335	Transportation and Traffic Engineering	2	2	2	2	2	2	2	2	2	0	1
EAA371	Industrial Training	1	2	2	2	1	2	1	1	1	1	1
EAA393 [Elective]	Computational and Problem Solving in Civil Engineering	2	2	1	1	1	1	2	0	2	0	0
EAS355 [Elective]	Advanced Concrete Technology	2	2	3	0	0	0	0	1	0	0	0
EUP301 [Elective]	Engineering Management	0	0	0	3	2	3	1	0	2	2	3
EAS483	Construction Management*	3	0	0	0	3	3	2	2	2	2	3
EAS453	Reinforced Concrete Structure Design II*	2	2	1	1	1	2	1	1	2	2	0
EAA493	Integrated Design Project*	3	3	3	2	2	3	2	3	2	3	3

Compulsory Elective												
EAP411	Solid Waste Management and EIA*	2	2	2	1	1	2	2	2	2	1	1
Choice Electives												
EAH416	River Conservation and Rehabilitation*	3	3	3	3	3	3	3	3	2	3	3
EAK465	Geographical Information System*	1	1	2	2	3	2	1	2	1	1	1
EAP412	Environmental Studies	2	2	2	1	2	2	1	2	2	1	0
Specialized Electives												
EAH 422	Advance Water Resources Engineering*	3	2	2	2	0	2	0	1	0	0	1
EAG442	Advance Geotechnical Engineering*	3	3	3	3	2	2	2	2	2	2	2
EAA492	Final Year Project	3	3	3	3	1	3	1	3	3	2	1
Choice Electives												
EAS452	Pre-stressed Concrete Design	2	2	2	2	2	1	0	1	1	1	0
EUM213	Operational Research	2	0	2	0	0	1	0	0	0	0	0
Specialized Electives												
EAS454	Advanced Structural Engineering	3	2	3	1	3	1	3	2	2	2	3
EAK462	Advance Geomatic Engineering	1	1	2	2	3	2	1	2	1	1	1
EAL432	Advanced Transportation and Highway Engineering	2	2	2	2	2	2	2	2	2	2	1

*** Courses in the second semester**

Level of Emphasis:

0	Very Little or No Emphasis	**1**	Some Emphasis	**2**	Moderate Emphasis	**3**	Strong Emphasis

****Program Outcomes for Bachelor in Civil Engineering:**

1.	Graduates have the proficiency in and the ability to apply the principles of engineering knowledge, mathematics and science in the analysis of civil engineering and related fields.
2.	Graduates have the ability to acquire in-depth technical competence in civil engineering
3.	Graduates have the ability to identify and solve civil engineering problems
4.	Graduates have ability to design civil engineering systems, components or processes to meet the needs and demands of the profession
5.	Graduates have the ability to function effectively both as individuals and in a group in the capacity of a leader or a team member
6.	Graduates have the ability to consider social, economic, technological, and environmental aspects to solve civil engineering problems professionally and ethically
7.	Graduates have the ability to communicate effectively in conveying and disseminating knowledge.
8.	Graduates have the ability to use the techniques, skills and appropriate engineering methods and tools necessary for sustainable development
9.	Graduates will demonstrate an awareness of the need to stay abreast with the latest knowledge and understand contemporary issues in civil engineering
10.	Graduates have the potential to continue the professional development and advancement through life-long learning.
11.	Graduate possesses sufficient management skills to stay competitive in the global market

7.2 THE CURRICULUM FOR BACHELOR OF CIVIL ENGINEERING

7.2.1 Level 100

			Unit		
			Total	Lecture	Lab
Semester I					
EUM	111/4	Engineering Mathematics	4	4	0
EBS	101/3	Engineering Geology	3	3	0
EBB	113/3	Engineering Materials	3	3	0
EMM	101/3	Engineering Mechanics	3	3	0
EEU	101/2	Computer Programming	2	0	2
			15	13	2
SEMESTER BREAK					
Semester II					
EUM	112/4	Numerical Methods & Engineering Statistics	4	4	0
EAS	152/3	Strength of Materials	3	3	0
EEU	104/3	Electrical Technology	3	3	0
EAA	110/2	Civil Engineering drawing	2	0	2
EAS	181/2	Concrete Technology	2	2	0
			14	12	2

7.2.2 Level 200

			Unit		
			Total	Lecture	Lab
Semester I					
EUP	222/3	Engineers in Society	3	3	0
EAK	263/4	Geomatic Engineering	4	4	0
EAS	253/3	Theory of Structures	3	3	0
EAH	221/3	Fluid Mechanics for Civil Engineers	3	3	0
EAA	204/2	Structures and Strength of Materials Laboratory	2	0	2
			15	13	2
SEMESTER BREAK					
Semester II					
EAS	254/3	Structural Analysis	3	3	0
EAG	245/3	Soil Mechanics	3	3	0
EAH	225/3	Hydraulics	3	3	0
EAP	215/3	Water Supply and Water Treatment Engineering	3	3	0
EAA	203/2	Concrete, Structures and Fluid Mechanics Laboratory	2	0	2
			14	12	2
LONG BREAK					
EAA	273/2	Civil Engineering Practices	2	0	2

7.2.3 Level 300

			Unit		
			Total	Lecture	Lab
Semester I					
EAG	345/3	Geotechnical Analysis	3	3	0
EAP	313/2	Waste Water Engineering	2	2	0
EAS	353/3	Reinforced Concrete Structure Design I	3	3	1
EAA	305/2	Hydraulics, Geotechnical & Environmental Eng. Laboratory	2	0	2
EAL	334/4	Highway Engineering	4	4	0
EAA	384/2	Construction Technology	2	2	0
			16	13	3
SEMESTER BREAK					
Semester II					
EAG	346/2	Geotechnical Design	2	2	0
EAH	325/3	Engineering Hydrology	3	3	0
EAS	354/3	Timber and Steel Structure Design	3	3	0
EAA	304/2	Geotechnical, Highway & Traffic Engineering Lab.	2	0	2
EAL	335/4	Transportation and Traffic Engineering	4	4	0
			14	12	2
Choice Elective ***(Choose one only)***					
EAS	355/2	Advanced Concrete Technology	2	0	2
EAA	393/2	Computational Problem Solving in Civil Engineering	2	0	2
LONG BREAK					
EAA	371/5	Industrial Training	5	0	5

7.2.4 Level 400

			Unit		
			Total	Lecture	Lab
Semester I					
EAA	483/2	Construction Management	2	2	0
EAA	453/2	Reinforced Concrete Structure Design II	2	1	1
EAA	493/3	Integrated Design Project	3	0	3
			7	3	4
Compulsory Elective					
EAP	411/3	EIA & Solid Waste Management	3	3	0
Choice Elective ***(Choose one only)***					
EAK	416/2	River Conservation and Rehabilitation	2	2	0
or					
EAK	465/2	Geographical Information System	2	2	0
Specialised Elective ***(Choose one only)***					
Water Resources Engineering					
EAH	422/4	Advanced Water Resources Engineering	4	4	0
or					
Geotechnical Engineering					
EAG	442/4	Advanced Geotechnical Engineering	4	4	0
SEMESTER BREAK					

Semester II					
EAA	492/6	Final Year Project	6	0	6
Choice Elective *(Choose one only)*					
EAS	453/2	Pre-stressed Concrete Design	2	2	0
or					
EUM	213/3	Operational Research	3	3	0
Specialised Elective *(Choose one only)*					
Environmental Engineering					
EAP	412/4	Environmental Studies	4	4	0
or					
Transportation & Highway Engineering					
EAL	432/4	Advanced Transportation and Highway Engineering	4	4	0
or					
Structural Engineering					
EAS	454/4	Advanced Structural Engineering	4	4	0
or					
Geomatic Engineering					
EAK	462/4	Advanced Geomatic Engineering	4	3	1

CURRICULUM STRUCTURE – BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FOUR YEAR PROGRAMME [OBE]

Type	Category	LEVEL 100				LEVEL 200				LEVEL 300				LEVEL 400			
		SEMESTER 1	SEMESTER BREAK	SEMESTER 2	SEMESTER BREAK	SEMESTER 1	SEMESTER BREAK	SEMESTER 2	EAA273 CIVIL ENGINEERING PRACTICE	SEMESTER 1	SEMESTER BREAK	SEMESTER 2	EAA371 INDUSTRIAL TRAINNING FOR 10 WEEK	SEMESTER 1	SEMESTER BREAK	SEMESTER 2	
CORE	Engineering Core	EUM 111/4 Engineering Mathematics		EUM 112/4 Numerical Methods & Eng. Statistics		EAS 253/3 Theory of Structures		EAS 254/3 Structural Analysis		EAS 353/3 Reinforced Concrete Structural Design I		EAS 354/3 Timber and Steel Structural Design		EAA 453/2 Reinforced Concrete Structural Design II		EAA 492/6 Final Year Project	
		EBS 101/3 Engineering Geology		EEU 104/3 Electrical Technology		EAH 221/3 Fluid Mechanics for Civil Engineers		EAH 225/3 Hydraulics		EAL 334/4 Highway Engineering		EAL 335/4 Transportation and Highway Engineering		EAA 483/2 Construction Management			
		EBB 113/3 Engineering Materials		EAS 152/3 Strength of Materials		EAK 263/4 Geomatic Engineering		EAP 215/3 Water Supply & Water Treatment Eng.		EAP 313/2 Waste Water Engineering		EAH 325/3 Engineering Hydrology		EAA 493/3 Integrated Design Project			
		EMM 101/3 Engineering Mechanics		EAS 181/2 Concrete Technology		EUP 222/3 Engineers in Society		EAG 245/3 Soil Mechanics		EAG 345/3 Geotechnical Analysis		EAG 346/2 Geotechnical Design					
		EEU 101/2 Computer Programming								EAA 384/2 Construction Technology							
	Labs.			EAA 110/2 Civil Eng. Drawing		EAA 204/2 Structure and Strength of Materials Laboratory		EAA 203/2 Concrete, Structure & Fluid Mechanics Laboratory		EAA 305/2 Hydraulics, Geotechnical & Environmental Eng. Laboratory		EAA 304/2 Geotechnical, Highway & Traffic Eng. Laboratory					
		15		14		15		14	2	16		14	5	7		6	108
University Requirement				Malay Language [LKM] (2 unit)		English [LSP] (4 unit)		HTU 223/2 Asia & Islamic Civilisation		Co-Curriculum/Options [WSC] (3 unit)		Analysis/Skill [EUT] (2 unit)					15
				WUS 101/2 Core Entrepreneurship				SHE 101/2 Ethnic Study									
ELECTIVE	Compulsory													EAP 411/3 EIA & Soil Waste Management			3
	Choice											EAS 355/2 Advanced Concrete Technology		EAK 465/2 Geographical Information System		EUM 213/3 Operational Research	5
												EAA 393/2 Computational Problem Solving in Civil Eng.		EAH 416/2 River Conservation & Rehabilitation		EAS 453/2 Pre-Stressed Concrete Design	
	Program															EAS 454/4 Advanced Structural Engineering*	4
														EAH 422/4 Advanced Water Resources Eng.*			
																EAL 432/4 Advanced Transportation & Highway Eng.*	
																EAP 412/4 Environmental Studies*	
														EAG 442/4 Advanced Geotechnical Eng.*			
																EAK 462/4 Advanced Geomatic Engineering*	
																Total Electives	12
																Total Units for Graduation	135

* Program Elective [choose one] Choice Elective – Combine Total of 5 Units

8. SYNOPSIS FOR BACHELOR OF CIVIL ENGINEERING PROGRAM

CORE COURSES

EUM 111/4 Engineering Mathematics
Synopsis Refer to synopsis of the School of Electrical and Electronic Engineering

EBS 101/3 Engineering Geology
Synopsis Refer to synopsis of the School of Material & Mineral Resources Engineering

EBB 113/3 Engineering Materials
Synopsis Refer to synopsis of the School of Material & Mineral Resources Engineering

EEU 101/2 Computer Programming
Synopsis Refer to synopsis of the School of Electrical & Electronic Engineering

EUM 112/4 Numerical Method and Engineering Statistics
Synopsis Refer to synopsis of the School of Electrical & Electronic Engineering

EEU 104/3 Electrical Technology
Synopsis Refer to synopsis of the School of Electrical & Electronic Engineering

EMM 101/3 Engineering Mechanics
Synopsis Refer to synopsis of the School of Mechanical Engineering

EAS 152/3 Strength of Materials

Course Objectives To equip students with basic knowledge about fundamental principles that governs the strength and stiffness of deformable bodies.

Course Outcomes

- Able to compute normal, direct shear and bearing stresses
- Able to compute stress and elongation for axially loaded bars
- Able to determine shear stress and angle of twist of torsionally loaded circular bar
- Able to draw shear force and bending moment diagrams for beams
- Able to compute bending and shear stress in beams
- Able to compute the deflection of beams
- Able to compute principal stresses/strains and maximum shear stress/strains by equations and Mohr's circle.
- Able to compute buckling load of columns with different end conditions

Synopsis Concept of stress and strain: Normal stress and strain (Tension and compression), shear stress and strain and bearing stress; Axially loaded bars : forces in bars and elongation, concept of statical indeterminacy, introduction to design of bars; Torsionally loaded circular bars : torsional moment in bars and angle of twist, introduction to torsion of thin-walled sections; Laterally loaded beams : Shear force and bending moment and stresses in beams (normal stress due to bending and shear stress), ,

Introduction to design of beam ; Deflection: Double integration method for beam deflection ; Stress and strain analysis: Concept of bi-axial stress, major and principal stresses, Use of Mohr's circle ; Columns : Concept of critical load (buckling load), Euler formula, effective length, effect of eccentric load and introduction to column design

References

1. James M. Gere, Mechanics of Materials - 5th Edition, Brooks/Cole, 2001.
2. Ferdinand P.Beer, E.Russell Johnston, Jr. and John T.DeWolf, Mechanics of Materials, International Edition - 3rd Edition, McGraw-Hill, 2002.
3. William Nash, Strength of Materials - 4th Edition, Schaum's Outlines, McGraw-Hill, 1999.
4. Russel C.Hibbeler, Mechanics of Materials – 4th edition, Prentice Hall, 1999.
5. Meor Othman Hamzah, Pengantar Analisis Struktur, Penerbit Universiti Sains Malaysia, 1988

EAS 181/2 Concrete Technology

Course Objectives

To introduce the basics of concrete technology which include component materials of concrete, tests on materials and concrete, production of concrete, concrete mix design and properties of concrete.

Course Outcomes

- Able to identify and explain the roles of cement, the basic ingredients, the manufacturing process, the major compound compositions, the hydration process, the tests on cement, types of cement and their applications.
- Able to describe the roles of water in concrete, the requirements for water and the tests on water.
- Able to identify and explain the important properties of aggregates and describe their effects on the properties of concrete in the fresh and hardened states, as well as describe the tests to assess the properties of aggregates.
- Able to explain the different types of admixtures, their uses and their effects on concrete.
- Able to design different grades of concrete mix to comply with specified requirements and appropriate construction practices.
- Able to identify, describe and discuss the major factors affecting strength and durability performance of concrete, as well as to describe the major deterioration processes of concrete.
- Able to describe and determine elasticity, shrinkage and creep of concrete.

Synopsis

Introduction to concrete; component materials for concrete (cement, aggregates, water, chemical admixtures, mineral admixtures); properties of materials, tests on materials; production processes of concrete, tests on fresh concrete; concrete mix design; tests on hardened concrete, properties of hardened concrete, strength, deformation, durability.

References

1. Sifat-Sifat Konkrit - A.M. Neville (terjemahan oleh Abd. Ghafar Abd. Rahman, Fatimah Othman, Zuber Hj. Din) Dewan Bahasa dan Pustaka, 1994.
2. Civil Engineering Materials- Neil Jackson, Ravindra K. Dhir (Editor). Macmillan Education, 1996.
3. Concrete Technology - A.M. Neville and J.J. Brooke, Longman, New Jersey, 1990.

EAA 110/2 Civil Engineering Drawing

Course Objectives

To give the basic concept and understanding of technical drawing and Computer Aided Design (CAD) in Civil Engineering applications.

Course Outcomes

- Able to know the graphic techniques and drawing principles.
- Able to manually draw basic engineering drawing.
- Able to draw basic engineering drawing using computer software (AutoCAD*).*

Synopsis

An introduction in graphical engineering which cover graphical technique and technical drawing principle in order preparing civil engineering drawing. Computer usage in drawing and detailing, Basic CAD practices, Basic AutoCAD usage.

References

1. Geotsch D. L., Nelson J. A and Chalk W. S. Technical Drawing, 4th Edition, Thomson Delmar Learning, New York, 1999.
2. Luzadder, W.J. & Duff, J.M. Introduction to Engineering Drawing: The Foundations of Engineering Design and Computer Aided Drafting, 2nd Edition, Prentice-Hall International Limited, London, 1992.
3. Madsen, D. A. Civil Drafting Technology (5th Edition), Prentice Hall, 2003.

EAS 253/3 Theory of Structures

Course Objectives

To gain knowledge on the analysis of statically determinate structures such as simple beams, frames, trusses, cable, three hinged arch, influence lines analysis and deflections.

Course Outcomes

- Able to analyze a statically determinate structures including simply supported beams, frames, plane trusses, cables and three hinged arch.
- Able to calculate deflection of simple beam using moment-area theorem and the conjugate beam method.
- Able to determine magnitude of reactions forces, shear force and bending moment for beams using influence lines analysis.

Synopsis

Basic concept of structural analysis, analysis of simply supported beams and frames, plane trusses, cable and three hinged arch, analysis of influence lines for beams and deflections.

References

1. Kassimali, A., Structural Analysis, 2nd edition, PWS Publishing,1999.
2. Hibbler, R.C., Structural Analysis, 3rd Ediiton, Prentice – Hall, 1994.

3. Rossow, E.C., Analysis and Behaviour of Structures, Prentice-Hall, 1996.

EAH 221/3 Fluid Mechanics for Civil Engineers

Course Objectives To gain knowledge on the concepts, principles and applications of fluid mechanics in Civil Engineering.

Course Outcomes

- Able to distinguish different types of fluids, their properties and acquire understanding on significance and development of fluid mechanics
- Able understand different type of basic units; rules and conventions in different units
- Able to acquire basic understanding of various fluid properties
- Able to acquire basic understanding, theory and application of principles of various fluid properties fluid statics
- Able to acquire basic understanding, theory and application of principles of measurement of pressure
- Able to understand the knowledge, theory, analyses and application of principles of hydrostatic forces
- Able to understand the knowledge, theory, analyses and application of principles of buoyancy
- Able to comprehend and apply the fundamental flowing fluid and the forces resulting from fluids flow
- Able to apply the energy equation to a real systems with pumps, fluid motors and energy losses from friction, valves and fitting
- Able to apply and analyze of drag and lift forces

Synopsis Introduction to fluid properties and characteristics, static fluid, forces in fluid, fluid kinematics, continuity equation and its application, momentum equation and its application, Bernoulli and energy equation and their application, boundary layers, lift and drag forces and their application, flow measurement.

References

1. Shames, Mechanics of Fluid', Fourth Edition, Mc Graw Hill, New York, 2003.
2. Mott, 'Applied Fluid Mechanics', Fifth Edition, Prentice Hall, New Jersey, 2000
3. Munson, Young and Okishi, 'Fundamental of Fluid Mechanics', Fourth Edition, Wiley, New Jersey, 2002
4. Fox, McDonald and Pritchard, ' Introduction to Fluid Mechanics', Wiley, Danvers, 2003

EAK 263/4 Geomatic Engineering

Course Objectives To gain knowledge on the concepts and applications of geomatic in Civil Engineering and to develop an understanding of the geomatic instrumentation, analysis and methodology.

Course Outcomes

- Able to know the framework of geomatic engineering and its practices in Malaysia, and its applications in the field of engineering.
- Able to solve geomatic measurement problems related to engineering by applying the appropriate techniques and surveying skills on the use of geomatics instruments.
- Able to know the concepts of vertical control, horizontal control, detailing, and use geomatics instruments in the conduct of such surveys.
- Able to recognize the professional and ethical responsibilities on geomatic engineering practices abreast with contemporary issues.
- Able to write and communicate in ensuring effective presentation of survey reports by way of multi-disciplinary teamwork and leadership skills as embedded in the geomatic field work sessions.

Synopsis

Introduction to engineering geomatic; Concepts of control in geomatic engineering: vertical controls, horizontal control, and detail surveying. Analysis of observation, theory of errors, geomatic computations, methods of booking and plotting of plans. Vertical Control: Principles of leveling and its applications, types and construction of levels, types of instrument adjustments, types of leveling procedures. Contouring and cross-sections. Horizontal control: Principles of theodolite and its application, types and construction of theodolite, types of instrument adjustment, traversing and linear measurement, methods of booking, computation and error analysis, and coordinate systems. Detailing: Types of detailing techniques, tachometric surveying; principles and methods of tachometric measurement, detailing and booking, accuracy, types of errors, plotting methods. Earthworks: Methods of calculating area of cross-sections, volume and mass-haul diagram. This course comprises field survey works to expose to the students the main field geomatic engineering works associated with the engineering practice.

References

1. Schofield, W., Engineering Surveying, 5th. Edition, Butterworths, London, 2001.
2. Kavanagh, B.F., Surveying: Principles and Application, 6th. Edition, Prentice Hall, 2003.
3. Bannister, A. and Raymond, S., Surveying, 6th. Edition, Longman Scientific & Technical, 1992.

EUP 222/3 Engineers in Society

Course Objective

To provide knowledge on ethics, management, law and financial accounting related to engineering industry and the related framework necessary for the effective conduct to the society and industry

Course Outcomes

- Able to know and perform the role and responsibilities of an effective engineer within society.
- Able to think critically and apply problem solving in the interpretation, and integration of knowledge.

- Aware of the challenges and restrictions caused by the internal and external environment.
- Able to attain presentation skills, analytical skills and professional skills.
- Able to work in a team and communicate effectively.

Synopsis Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behavior, code of engineering ethics, responsibilities of professional engineer, professional behavior. Basics of law for engineers: introduction to Malaysian legal system, law of contract, law of agency, law of tort, industrial law, intellectual property law, corruption law. Financial accounting: introduction to accounting, recording accounting information, trial balance, basics of financial statements, accounts adjustments, interpreting accounting information, financial statement analysis. Basics of management: introduction to management theories, planning, organizing, leading, controlling, management function.

References

1. Boatright, J. R., Ethics and The Conduct of Business, New Jersey, Prentice-Hall, 2000.
2. Dyson, J. R., Accounting for Non-Accounting Students, London, Pitman Publishing, 1999.
3. Hairul Azhar Abdul Rashid, et.al, Engineers in Society, Kuala Lumpur, McGraw Hill. 2004.
4. Robbins, S.P., & Coulter, M, 'Management', New Jersey, Prentice-Hall, 2004.

EAA 204/2 Structures & Strength of Materials Laboratory

Course Objectives To give knowledge to students regarding basics pertaining to laboratory experiments, preparation of laboratory report, importance of laboratory experiments, and to enhance students' understanding of theory taught in subject of Strength of Materials and Concrete Technology.

Course Outcomes

- Able to characterize and explain the behavior of mild steel under the action of tensile force.
- Able to determine and explain the effects of combined bending and torsional load on the behavior of metals.
- Able to determine experimentally the shear force and bending moment of beam and compare with theoretical values.
- Able to measure and verify experimentally the concept of pure bending of beam.
- Able to determine experimentally the deflections of cantilever beams under the action of asymmetrical load and to compare with theoretical values.
- Able to characterize experimentally the water requirement and setting characteristics of cement
- Able to determine experimentally the physical properties of aggregates.

- Able to assess experimentally the mechanical characteristics of coarse aggregates.

Synopsis Tensile test on mild steel; Combined action of bending and torsion; Shear and bending moment test; Asymmetrically loaded cantilever beam test; Bending of beam test, Tests on cement, Physical characteristics of aggregates, Mechanical characteristics of coarse aggregate.

References

1. James M. Gere, Mechanics of Materials, 5th Edition, Brooks/Cole, 2001.
2. Ferdinand P.Beer, E.Russell Johnston, Jr. and John T.DeWolf, Mechanics of Materials, International Edition, 3rd Edition, McGraw-Hill, 2002.
3. William Nash, Strength of Materials - 4th Edition, Schaum's Outlines, McGraw-Hill, 1999.

EAS 254/3 Structural Analysis

Course Objectives To equip students with knowledge about two basic methods – force method and displacement method – for the analysis of statically indeterminate structures

Course Outcomes

- Able to clearly define the concept of statically determinacy, redundancy, redundant restraints and redundant ; the advantages and disadvantages of statically indeterminate versus determinate structures ; the concept of geometric stable of structures
- Able to use displacement method of : slope deflection method and moment distribution method to analyze statically indeterminate beams and frames including effect of support settlements and sway of frames
- Able to carry out analysis to determine displacement and rotation of statically determinate beams and frames using method of virtual work for trusses, beams and frames
- Able to use force method of : method of least work to analyze statically indeterminate trusses, beams and frames
- Able to identify the difference between elastic and plastic analysis in terms of analysis procedures and behavior of structures
- Able to identify possible locations of plastic hinge and carry out analysis to obtain the plastic moment of continuous beams and frames.
- Able to analyze statically indeterminate beams using influence lines method.

Synopsis This course concentrates on the analysis of statically indeterminate structures. The course content includes; Concept of statical determinacy; Energy method for deflection in beams and frames; Force method for the analysis of statically indeterminate trusses, beams and frames; Displacement method for the analysis of statically indeterminate beams and frames; Plastic analysis and Influence Lines of Statically Indeterminate Beams.

References

1. Kassimali, A., Structural Analysis – 2nd edition, PWS Publishing, 1999.
2. Hibbler, R.C., Structural Analysis-3rd Ediiton, Prentice – Hall, 1994.
3. West, H.H., Fundamentals of Structural Analysis, John Wiley & Sons, 1993.
4. Rajan, S.D., Introduction To Structural Analysis and Design, John Wiley & Sons, Inc, 2001.
5. Schodek, Daniel L., Structures – Fifth Edition', Pearson Prentice Hall, 2004.

EAH 225/3 Hydraulics

Course Objectives

To introduce the principles of hydraulics to Civil Engineering students.

Course Outcomes

- Able to identify phenomenon governed by viscous force, gravity force, and surface tension forces and apply principles of similitude and simulate analyses
- Able to perform various dimensional analyses techniques in modeling
- Able to know and apply the theory, application, working principle, and analyses of turbines and pumps
- Able to acquire theory on pipe-full flow and applying relevant equations to compute flow in pipe and determine corresponding pipe size.
- Able to acquire theory on open channel flow and applying relevant equations to compute flow in open channels and determine required size of channels
- Able to acquire theory on sediment transport in rivers and applying relevant equations to compute sediment discharge in rivers and determining the half-life of reservoir taking into account sedimentation.

Synopsis

Flow in pipe, Rigid Boundary Flow, Loose Boundary Flow, Dimensional Analysis & Similitude Model, Pump & Turbine

References

1. Chanson, H., Hydraulics of Open Channel Flow. Elsevier, 2nd Edition, 2004.
2. Nalluri, C. & Featherstone, R.E., Civil Engineering Hydraulics, Blackwell Science, London, 4th Edition, 2001.
3. Sturm, T.W., Open Channel Hydraulics, Mc Graw Hill International, New York, 2001.
4. Department of Irrigation and Drainage, Urban Stormwater Management Manual for Malaysia (Manual Saliran Mesra Alam), 2000.
5. White, F.M., Fluid Mechanics, Mc Graw Hill International, New York, 6th Edition, 2008.

EAP 215/3 Water Supply and Water Treatment Engineering

Course Objectives To gain knowledge about the principles and engineering practices of water supply engineering in Civil Engineering.

Course Outcomes

- Able to know the various sources of water available, legislations related to water usage and proper methods of water extraction
- Able to assess the quantity of water available for public water supply and assess the limitation from each source due to pollution.
- Able to value quantity of water used for different purposes, to estimate population projection and design period for water supply scheme as currently used by consultants.
- Able to determine water quality and the effects of water quality and sanitation to the well being/health of the community
- Able to identify the technology of water treatment processes and its implication to the well being of the consumers or community
- Able to design each treatment unit and ready to use the knowledge when required to implement as an engineer upon graduation
- Able to realize the problems posed from treatment process and have the ability to solve them.
- Able to apply the knowledge to work and discharge their duty with integrity as a waterworks engineer.

Synopsis Water source and usage; water source assessment; method on estimating water usage; water characteristics, quality, tests and standard; physical, chemical, and biological process in water treatment; treatment units design, water quality problems and water distributions solutions

References

1. American Water Works Association American Society of Civil Engineers, Water Treatment Plant Design, 3rd. Edition, McGraw Hill, 1997.
2. American Water Work Association Water Quality and Treatment, A Handbook & Community Water Supplies, 5th. Edition, McGraw Hill, 1999
3. Environmental Quality Act 1974 and Regulations, MDC Sdn. Bhd, 1999.
4. Fuad Nik Abdullah, Nik, Bekalan Air, Pembentungan dan Pengairan, USM, 1990
5. Tebbut, T.H.Y., Principles of Water Quality Control, 4th.Edition, Pergamon Press, 1992.

EAG 245/3 Soil Mechanics

Course Objectives To gain knowledge and understanding on the principles of geotechnical engineering, in particular engineering properties of soil.

Course Outcomes

- Able to explain the process of soil formation, classify soils, and calculate various soil values using phase relationship principles.

- Able to classify soil based on general classification systems and the soil properties
- Able to plot soil compaction curve and interpret the relationship between density and moisture content. Able to relate between laboratory and practices as well as its importance in construction during group presentation
- Able to derive the basic flow equation, calculate permeability rates in soil and explain flow processes in soils
- Able to describe and calculate stresses terms and its usages and able to determine stress at a particular position in the ground due to imposed load
- Able to describe consolidation process, calculate total settlement, and calculate settlement at a given time after loading

Synopsis Formation and Types of Soil, Phase Relationship, Clay Mineralogy, Soil Classification and Index Properties, Soil in Water; Permeability and Seepage, Stresses in Soil, Compaction, Consolidation and Settlement

References

1. Budhu, M., Soil Mechanics and Foundations, John Wiley & Sons, Inc., United States of America, 2000.
2. Das, B.M., Principles of Geotechnical Engineering, 5th Edition, Brookes/Cole Thomson Learning, United States of America, 2002.
3. Craig, R.F., Soil mechanics, 7th Edition, Spon Press, 2004.

EAA 203/2 Structure, Concrete and Fluid Mechanic Laboratory

Course Objectives To give knowledge to students on the laboratory works related to the lectures on Theory of Structures, Concrete Technology and Fluid Mechanics.

Course Outcomes

- Able to verify experimentally the horizontal and vertical displacement for curved bars with various end fixity based on Castigliano's theory
- Able to verify the relationship between sag and tension in cable.
- Able to verify experimentally the effect of end conditions on buckling of strut.
- Able to produce experimentally the influence lines for deflection of beams.
- Able to determine and verify experimentally the horizontal thrust for both symmetrical and unsymmetrical three hinged arch.
- Able to determine and verify experimentally the force and strain in pin jointed frame when subjected to load.
- Able to perform concrete mix design to meet certain requirements and able to assess the properties of the concrete in the fresh and hardened states.
- Able to determine experimentally coefficient of discharge, contraction and velocity using orifice and notch.
- Able to determine and verify the Bernoulli's theorem. And also to determine types of flow and pressure measurement.

Synopsis Curved Bar and Continuous Beam, Sag and Tension in Cable, Deflection of Strut, Influence Line of Beam's Deflection, Three Hinged Arch, Force and Strain in Pin Jointed Frame; Concrete Mix Design and Tests on Concrete; Flow Through Orifice and Calibration of Notch, Bernoulli Theorem, Reynolds number, Bourdon Gauge

References

1. Hibbeler, R.C., Structural Analysis, 2nd Ed., Mac Millan, 1990.
2. Neville, A.M. and Brooks, J.J., Concrete Technology, Longman, 1993.
3. Neville, A.M., Properties of Concrete, Longman, Fourth Edition, 1995.
4. Young, J.F., Mindess, S., Gray, R.J. and Bentur, A., The Science and Technology of Civil Engineering Materials, Prentice-Hall International, Inc., 1998.

EAA 273/2 Civil Engineering Practice

Course Objectives Introducing students to the multi-disciplinary nature of civil engineering problems by integrating the material learnt in the various sub-disciplines of civil engineering.

Course Outcomes

- Able to know the layout, preliminaries work and taking off
- Able to know the contents of contract documents
- Able to select types of piles
- Able to recognize the types of material used in construction
- Able to comprehend a drainage systems and road & pavement construction
- Able to evaluate a performance of the project
- Able to apply safety measures during construction and understand a site condition at the construction site
- Able to inculcate the importance of sustainable development
- Able to complete the Annual Intensive Geomatics Practical (AIGP)

Synopsis Introduction to Engineering Drawing, Layout Plan, Preliminaries work, Taking off, Estimation, planning and cost control, Geotechnical Consideration, Concreting, Drainage work, Road and pavement, Management and construction performance, Safety in construction, Environmental Considerations, Intensive Geomatic Practical.

References

1. Civil Engineering Materials- Neil Jackson, Ravindra K. Dhir (Editor). Macmillan Education, 1996.
2. Concrete Technology - A.M. Neville and J.J. Brooke, Longman, New Jersey, 1990.
3. Nunally, S.W., Construction Methods and Management, Prentice Hall, 1998.
4. Chudley, R., Construction Technology Vol. 1, 2, 3, 4, ELBS/Longman, 1989.
5. Wright, P.H., Meyer, M. and Parsonson, P., Highway Engineering, John Wiley & Sons, 1995

6. Das, B.M., Principles of Geotechnical Engineering, 5th Edition, Brookes/Cole Thomson Learning, United States of America, 2002
7. Sincero, A.P. and Sincero, G.A., Environmental Engineering - A Design Approach, Prentice Hall, 1996.
8. Schofield, W., Engineering Surveying, 5th. Edition, Butterworths, London, 2001.
9. Manual for Intensive geomatic Practical, School of Civil Engineering, USM.

EUP 301/3 Engineering Management

Course Objectives

To extend students' knowledge and understanding of the direction and operation of organization in areas of human resources management, marketing management and engineering economics. This is also to develop students' ability to provide analysis and commentary to make decisions of work tasks in engineering activities.

Course Outcomes

- Able to appreciate the framework of managing employees at work
- Able to select the right and suitable human resources against specific requirements, and analyze the development needs of human resources.
- Able to allocate work, evaluate performance and understand the requirements of current human resource practices to ensure ethical and environmentally friendly behavior.
- Able to understand the marketing concepts and its implications for an organization in engineering industry.
- Able to generate marketing strategies based on evaluation of an organization's marketing mix, company, customers and competitors.
- Able to analyse and implement a marketing plan for an organization or engineering activities.
- Able to apply economic principles/theories in the analysis of problems/issues related to engineering activities.
- Able to assess the implications of economic change for organizations and engineering industry.

Synopsis

Human resources management: Human Resources Planning, Selection and Recruitment, Training and Organizational Development, Wage and Salary Management, Health and Safety, Industrial Relations, Motivation, Stress Management.

Marketing management: Marketing Dimensions, Buyers Behavior, Strategy Development in Industrial Market, Product Planning, Pricing Policy, Globalization.

Engineering economics: Introduction to Engineering Economics, The goals of a firm, demand and supply, Inflation and unemployment, Role of Government and Money Management, Introduction To E-Commerce and K-Economy, Economic Analysis – substitution, finance and project analysis, Economic Decisions- estimation and forecasting.

References

1. Bayliss, J.S., (1999), Marketing For Engineers, Prentice-Hall

2. Blythe, J., (2001), 'Essentials of Marketing', Essex,Financial-Times Prentice Hall.
3. Keat P. & Young, (2001), 'Managerial Economics For Decision Makers', Macmillan.
4. Mondy, R.W., & Noe, R.M., (2003), 'Human Resource Management', New Jersey, Perntice-Hall.
5. Sharifah Akmam Syed Zakaria, (2004), 'Asas Pengurusan Pemasaran Industri', Kuala Lumpur, Prentice-Hall

EAS 353/3 Reinforced Concrete Structural Design I

Course Objectives

To give exposure and knowledge on the principles of reinforced concrete design according to BS 8110/MS 1195 Code.

Course Outcomes

- Able to use relevant code of practice, determine loads on buildings and buildings components and understand the properties of concrete and steel
- Able to apply LSD concept on their design method
- Able to design singly and doubly reinforced concrete beam based upon cross-section , stress-strain relationship and simplified stress block
- Able to check and control shear failure, provide bonding and preventing torsion in their design.
- Able to conduct a service load analysis to control deflection and cracking of beams.
- Able to analyze and design simply supported and continuous beams based upon Code of Practice
- Able to analyze and design slabs (i.e. one way and two way) and transverse and longitudinal spanning stairs.
- Able to analyze and design columns (i.e. axial, uniaxial and biaxial).
- Able to analyze and design shallow foundation (i.e. isolated and combined strip and raft).

Synopsis

This course will cover the introduction design for reinforced concrete structures focusing on cross-section design, shear, bond and torsion design, limitation in deflection and cracking, detailing design in the first part. The second part will deal with beam design, one way and two slab design, column, shallow foundation and staircase. Code of practice such as BS 8110 Pt. 1, Part 2, Part 3, BS 4466 and BS 6399 Pt. 1 will be used as references.

References

1. Neville, A.M. and Brookes, J.J., Concrete Technology, Longman, UK, 1990.
2. E.J. O'Brien and A.S., Dixon, Reinforced and Pre-stressed Concrete Design: The Complete Process –Longman, 1995.
3. Kong, F.K. Dan Evans, R.H., Reinforced and Pre-stressed Concrete, 3rd. Ed., Van Nostrand (U.K). 1991

4. Mosley BS8110 – Code of Practice for the Structural use of Concrete, Part 1, 2 and 3, British Standard Institution, London.
5. C. E. Reynolds and J.C. Steedman, Reinforced Concrete Design Handbook, 10th. Edition, E&FN Spon, 1988.
6. C.E. Reynolds and J.C., Steedman, Examples Of The Design Of Reinforced Concrete Buildings to BS8110, 4th edition, E&FN Spon, 1992.

EAL 334/4 Highway Engineering

Course Objectives

To introduce the fundamentals of highway engineering that includes the process of planning, choice of materials, mix design, pavement design, construction and maintenance.

Course Outcomes

- Able to describe the construction techniques employed by early road engineers
- Able to describe the development of road network and planning in Malaysia.
- Able to describe the necessity for good highway drainage.
- Able to explain aggregate and binder properties required for road building and their relevant tests.
- Able to quantify the influence of temperature and time of loading on bitumen behavior.
- Able to differentiate types of bituminous mixtures and their production
- Able to design asphaltic concrete to JKR specification.
- Able to distinguish, design and make comparison between flexible and rigid pavements.
- Able to describe the correct techniques for flexible and rigid pavement construction.
- Able to identify and determine the source of pavement failure modes and maintenance method.
- Able to explain the role of highway lighting, safety devices and pavement markings to enhance traffic safety.

Synopsis

Introduction: road network, geotechnical aspects, route location, drainage. Highway materials: aggregate, binders. Bituminous materials: types, design, production. Pavement design: flexible, rigid, comparison. Construction: flexible and rigid pavements. Pavement maintenance: program and methods. Highway safety devices: pavement markings, road signs, lighting, safety fences to enhance traffic safety.

References

1. Wright, P.H., Meyer, M. and Parsonson, P., Highway Engineering, John Wiley & Sons, 1995.
2. Derucher, K. N., Korfiatis, G.P. and Ezeldin, A.S., Materials for Civil and Highway Engineers, 4th Edition, Prentice Hall, 1998.
3. Mannering, F.L. and Kilareski, W.P., Principles of Highway Engineering and Traffic Analysis, John Wiley & Sons, 1997.

EAP 313/2 Wastewater Engineering

Course Objectives

To gain knowledge on the principles and practices of wastewater engineering in Civil Engineering field.

Course Outcomes

- Able to define, distinguish, acquire, identify, recall, or recognize the scenario of wastewater engineering in Malaysia and overseas, the importance of treating wastewater and restate environmental regulation on effluent discharge in Malaysia.
- Able to distinguish, detect, identify, classify, discriminate, recognize, categorize, or deduce main wastewater characteristics physically, biologically and chemically.
- Able to judge, argue, validate, assess, appraise Dry Weather Flow, Peak Flow, Population Equivalent and Organic Loading of wastewater calculations
- Able to judge, argue, validate, assess, appraise type of sewer and the common materials used. Able to judge, argue, validate, assess, appraise sewer design based on Manning formula
- Able to distinguish, detect, identify, classify, discriminate, recognize, categorize, or deduce types of wastewater treatment plant
- Able to judge, argue, validate, assess, appraise screen, grit chamber and sedimentation tank design
- Able to judge, argue, validate, assess, appraise kinetics of BOD calculation
- Able to judge, argue, validate, assess, appraise design of selected biological treatment plant such as activated sludge system, SBR, RBC, aerated lagoon, septic tanks, etc.
- Able to distinguish, detect, identify, classify, discriminate, recognize, categorize, or deduce types of wastewater pumps
- Able to distinguish, detect, identify, classify, discriminate, recognize, categorize, or deduce sludge characteristics and the source. Able to write, tell, relate, produce, originate, modify, or document sludge disposal options

Synopsis

Introduction to wastewater; quality, flow and waste loading, sewer design, type of domestic wastewater treatment plant, physical treatment, biological treatment, wastewater pumping, sludge removal

References

1. Hamidi Abdul Aziz, Kejuruteraan Air Sisa: Kualiti Air dan Air Sisa, Utusan Publication, 1999.
2. Metcalf & Eddy, 'Wastewater Engineering, Treatment, Disposal and Reuse', 4th Edition, McGraw Hill International Edition, 2003.
3. Tebbutt, T.H.Y., Principles of Water Quality Control, 5th. Edition, Oxford: Butterworth-Heineman, 1998.
4. Gray, N.F., Biology of wastewater treatment, London: Imperial College Press, 2004.

EAG 345/3 Geotechnical Analysis

Course Objectives

To provide knowledge in the geotechnical field on the concepts of shear strength of soil, slope stability, lateral earth pressure, retaining walls, shallow foundations and deep foundations.

Course Outcomes

- Able to apply shear strength principles in geotechnical analyses; analyze shear strength using Mohr Circle, interpret data from shear strength tests (direct, tri-axial);
- Able to derive slope stability equations and calculate FOS using basic slope stability methods
- Able to formulate and analyze active and passive pressures according to Rankine's and Coulomb's theories
- Able to design & analyze stability of retaining walls against overturning, sliding, and bearing failure; Describe braced cuts.
- Able to explain ultimate bearing capacity theory, design shallow footings, and evaluate field load test data
- Able to estimate pile capacity, design pile load test, and identify various types of pile
- Able to describe various SI instrumentations, interpret SI data, and design SI program of a construction project

Synopsis

Geotechnical theories and analyses covering Shear Strength, Slope Stability, Lateral Earth Pressure, Retaining Walls, Shallow Foundations, and Deep Foundations. Introduction to site investigation, sampling, and field tests.

References

1. Das, B.M., Fundamentals of Geotechnical Engineering, Brookes/Cole Thomson Learning, United States of America, 2000.
2. Das, B.M., Principles of Geotechnical Engineering, 5th Edition, Brookes/Cole Thomson Learning, United States of America, 2002.
3. Craig, R.F., Soil Mechanics, 7th Edition, Spon Press, 2004.
4. Budhu, M., Soil Mechanics and Foundations, John Wiley & Sons, Inc., United States of America, 2000.

EAA 384/2 Construction Technology

Course Objectives

To give exposure and knowledge on the basics of construction technology and practices in Civil Engineering.

Course Outcomes

- Able to interpret, identify and explain the drawing and specifications for civil engineering construction work.
- Able to identify and explain the principles, advantages and disadvantages of conventional and modular types of building construction.
- Able to identify and explain the roles of different types of construction materials, their production processes, important properties, specifications and quality control.

- Able to identify and explain the processes and steps involved in earthwork for civil engineering construction.
- Able to identify and explain the different types of building foundations and their construction processes.
- Able to identify and explain the steps and processes involved in the construction of structures using reinforced concrete, pre-cast concrete, pre-stressed concrete, structural steel, composites.
- Able to identify and explain the construction processes for infrastructures which include water supply system, drainage system, and waste water facilities.

Synopsis Drawing and specifications for construction work, conventional and modular types of building construction, construction materials, earth work, building foundation, construction of building, building infrastructure, drainage system, water supply, waste water.

References

1. Nunally, S.W., Construction Methods and Management, Prentice Hall, New Jersey, 1998.
2. Polette, D., Landers, J.M., Construction Systems, Goodheart-Wilcox Co, 1995.
3. Ambrose, J.E., Building Structures, John Wiley & Sons, 1993.

EAA 305/2 Hydraulic, Geotechnical and Environmental Engineering Laboratory

Course Objectives To learn various experimental procedures and testing techniques in Hydraulics, Geotechnical and Environmental Engineering.

Course Outcomes

- Able to determine optimum moisture content and maximum dry density; and the relationship between density and moisture content
- Able to interpret liquid limit, plastic limit, and plasticity index of soils samples. Able to determine the particle size distribution for the soil and the specific gravity of soil
- Able to determine the permeability value of soil sample and relate the laboratory and practice work.
- Able to analyze and classify water and wastewater quality in term of solid content, organic content, inorganic content, heavy metals content and others pollutant.
- Able to characterize water and wastewater in term of physical, chemical and biological characteristics.
- Able to familiarize with water and waste quality test methods, equipments and chemicals and standards operating procedures.
- Able to use the Pelton wheel apparatus, obtain characteristic curve between power / torque and the speed in rotation per minute (rpm).
- Able to relate between the hydraulic gradient and mean velocity of flow for both laminar and turbulent flows, determine the critical Reynolds Number (Rn) and determine the friction factor (f) and Rn relationship for laminar and turbulent flow.

- Able to determine the coefficient of discharge, Cd for the flow under the sluice gate, verify the relationship for the initial and sequential depth, determine the head loss at hydraulic jump and verify all specific force before and after the hydraulic jump.
- Able to find relation between the head loss in friction, hf and flow rate, Q and between friction factor, f and the Reynolds Number, Rn. Able to determine head loss constants for different pipe fitting and head losses in sudden expansion and sudden

Synopsis Introduction to laboratory practices and experiments. To familiarize the students with the use of various testing equipment and enable them to conduct sample testing.

References

1. Fox., McDonald and Pritchard, Introduction to Fluid Mechanics, Wiley, Danvers, 2003
2. Shames, Mechanics of Fluid, Fourth Edition, McGraw Hill, New York, 2003.
3. Craig R.F., Soil Mechanics, 5th. Ed., Chapman & Hall 1992.
4. Head, K.H. Manuals of Soil Laboratory Testing, Vol. 1,2 & 3 Pentech Press, 1980.
5. Sawyer., Environmental Chemistry, 2nd. Edition, McGrawlHill, 1996.
6. Standard Methods for the Examination of Water & Wastewater 19th. Edition, 2001.

EAG346/2 Geotechnical Design

Course Objective Giving knowledge to student in aspects of geotechnical engineering design.

Course Outcomes

- Able to design and analyze a retaining wall system
- Able to design and analyze a slope stability system
- Able to design and analyze shallow and/or deep foundation system

Synopsis Geotechnical engineering design and analysis covering site investigation works, retaining wall, slope stability (application of GEOSLOPE software for design and analysis), and foundation (Shallow or Deep)

References

1. Das, B.M., Fundamentals of Geotechnical Engineering, Brookes/Cole Thomson Learning, United States of America, 2000.
2. Das, B.M., Principles of Geotechnical Engineering, 5th Edition, Brookes/Cole Thomson Learning, United States of America, 2002.
3. Craig, R.F., Soil mechanics, 7th Edition, Spon Press, 2004.
4. Budhu, M., Soil Mechanics and Foundations, John Wiley & Sons, Inc., United States of America, 2000.

EAH 325/3 Engineering Hydrology

Course Objective To gain knowledge on the concept and principle of engineering hydrology.

Course Outcomes

- Able to define, distinguish and identify various hydrological processes in a catchment
- Learn the theory on rainfall occurrence, measurement, and rainfall data analysis for engineering application.
- Learn the theory and application and measurement on infiltration processes
- Learn the theory and application and measurement on evaporation processes
- Learn the theory and analysis in ground water engineering.
- Learn the theory and application of stream flow measurement.
- Learn the theory and application of hydrograph analysis.
- Learn the theory and application of statistical techniques to solve hydrological problems.
- Learn the application and design urban drainage system.

Synopsis

Hydrology & it's important; World water balance; History of hydrology; Application in Engineering; Hydrological Cycle and Catchment Processes; Rainfall Measurement; Infiltration Measurement; Evaporation Measurement; Stream flow Measurement; Stream flow Hydrograph and Base flow; Statistical Hydrology and Frequency Analysis; Urban Hydrology; Ground Water.

References

1. Bedient P B & Huber W C, Hydrology and Floodplain Analysis, Addison-Wesley, 1992.
2. Clarke, R T, Statistical Modelling in Hydrology, John Wiley, 1994.
3. Chow V T, Maidment D R & Mays L W, Applied Hydrology, McGraw Hill, 1988.
4. Maidment D R, Handbook of Hydrology, McGraw Hill, New York, 1993.
5. McCuen R H, Hydrologic Analysis and Design, Prentice Hall, New Jersey, 1998

EAS 354/3 Design of Timber and Steel Structures

Course Objective

To give exposure and knowledge on structural design of steel and timber structures according to BS5950 and MS544 respectively.

Course Outcomes

- Able to recognize and evaluate fundamental material behavior of steel, fundamental structural responses of steel members, and to use the current code of practice for design purposes
- Able to design, select appropriate steel members subjected to bending and to check their capacity due bending, shear, bearing and deflection
- Able to design steel members subjected to axial loads, transverse loads and combined axial and transverse loads.
- Able to design steel roof trusses, plate girder and portal frames
- Able to select and design appropriate connection details using different types of fasteners.
- Able to recognize and evaluate fundamental material behavior of

timber, properties etc. and fundamental structural responses of timber members, and to use the current code of practice for design purposes
- Able to design, select appropriate timber sections subjected to bending and also able to check their capacity due bending, shear, bearing and deflection
- Able to design and select timber sections subjected to axial loads, transverse loads and combined axial and transverse loads
- Able to design and select appropriate timber sections for members in roof trusses.
- Able to select and design appropriate connection details using different types of fasteners.

Synopsis This course is divided into two parts i.e. steel and timber designs. The first part covers the introduction of design for steel, design considerations, design of flexural member, compression member, tension member and connections. Roof trusses, plate girder and portal frames. The second part covers the introduction of design for timber using the local material. The students will be exposed to design of flexural member, axially and laterally loaded member (i.e. tension, compression and bending), roof trusses and connections. MS 544 Pt. 1 and 2 2001 will be used as a code of practice in their design calculation.

References

1. Extracts from British Standards. BS5950, BSI
2. McGinlay, T. J. and Ang, T. C., Structural steelwork: design to limit state, 2nd edition, Butterworth, Heineman.1992
3. Dowling, Knowles & Owens, Structural steel design. Butterworth. 1988
4. Netherco, D. A., Limit state design of structural steelwork, 2nd edition, Chapman & Hall. 1991
5. Hambly, E., Structural Analysis by Example, Archimedes. 1994

EAL 335/4 Transportation and Traffic Engineering

Course Objective Introducing basic concept and application of transportation and traffic engineering. Understanding of the operational analysis and design of transportation system and traffic facilities.

Course Outcomes
- Able to explain the traffic system entity and transportation institution in Malaysia.
- Able to describe the basic concepts used in transportation and traffic engineering.
- Able to provide an efficient and effective public transportation system.
- Able to apply the 4-stage modeling
- Able to conduct the traffic impact study.
- Able to differentiate traffic volume characteristics.
- Able to carry out the traffic volume and speed study and analyse the data.
- Able to provide solution to alleviate traffic congestion based on the speed, flow and density relationship.

- Able to analyze two way two lane highway.
- Able to identify the causes of traffic accident and able to provide recommendation to reduce accident casualties from traffic engineering point of view.
- Able to analyze and design traffic light junction, priority junction, and roundabout.

Synopsis Transportation system entity; Traffic characteristics; Capacity of transportation and traffic facilities; Transportation planning and modeling; Aspect of Traffic safety; Public Transport; Traffic Management.

References

1. Danial Mohamed, Pengenalan Tinjauan dan Analisis Lalu Lintas, Dewan Bahasa dan Pustaka, Kuala Lumpur, 1993.
2. Salter, R.J., Highway Traffic Analysis and Design, MacMillan Education, London, 1988.
3. Ortuzar, J.D. and Willumsen, L.G., Modelling Transport, John Wiley & Sons, Chichester, 1990.
4. Institute of Transportation Engineers, "Traffic Engineering Handbook', Prentice Hall, New Jersey, 1991.
5. Institute of Transportation Engineers, "Transportation Planning Handbook", Prentice Hall, New Jersey, 1992.

EAA 304/2 Geotechnical, Highway and Traffic Engineering Laboratory

Course Objective To learn various laboratory test procedures in geotechnical, highway and traffic engineering

Course Outcomes

- Able to set up direct shear test, accumulate data, and determine shear strength equation of soil sample
- Able to set up unconfined compression test, accumulate data, plot data on Mohr circle, and determine shear strength of soil sample
- Able to set up triaxial test (cu test only), accumulate data, plot data on Mohr circle, and determine shear strength of soil sample
- Able to set up odometer test (consolidation test), accumulate data, and determine consolidation parameters of soil samples
- Able to set up the vane shear test, accumulate data, and determine soil's shear strength
- Able to set-up the CBR test to assess sub grade soil strength value
- Able to carry out tests to determine aggregate and binder properties
- Able to carry out mix design in accordance with the Marshall method to determine optimum binder content
- Able to use Sidra 2.0 software to design optimum signal timing at traffic light junction and input the signal timing into traffic light controller using MATC software.
- Able to carry out data collection and calculation of saturation flow rate at traffic light junction.

- Able to use Vehicle detection equipment to observe spot speed and able to analysis spot speed data

Synopsis Introduction to laboratory practices and experiments. To familiarize the use of various testing equipment and enable them to conduct laboratory tests via hands-on

References

1. Craig R.F., Soil Mechanics, 5th. Ed., Chapman & Hall 1992.
2. Head, K.H. Manuals of Soil Laboratory Testing, Vol. 1, 2 & 3 Pentech Press, 1980.
3. BSI, Method for Sampling and Testing Mineral Aggregate, Sand and Filler: Physical Properties', BS 812: Part 2: British Standards Institution, London, 1975.
4. BSI, Petroleum and its Products: Penetration of Bituminous Materials', BS 2000: Part 49: British Standards Institution, London, 1983
5. BSI, Petroleum and its Product: Softening Point of Bitumen (Ring and Ball)', BS 2000: Part 58:, British Standards Institution, London, 1983.
6. BSI Hot Rolled Asphalt for Roads and Other Paved Areas, BS 594: Part 1: British Standards Institution, London, 1992

EAS 355/2 Advanced Concrete Technology

Course Objective To give exposure on aspects of concrete technology from the perspective of admixtures, production, properties and types of special concretes, durability and duration of concrete structures, as well as concrete repair techniques

Course Outcomes

- Able to identify, explain and analyze the roles of admixtures in concrete, their advantage and limitations, their effects on concrete properties and their contribution towards durability performance of concrete.
- Able to explain the different types of special concretes, their production, utilization, advantages and limitations.
- Able to identify and explain the mechanisms of concrete deterioration processes, factors affecting the deterioration processes and identify measures to reduce the likelihood of each deterioration process occurring.
- Able to explain the common non and semi-destructive testing methods for concrete, identify their uses and limitations, and interpret tests results/data.
- Able to explain and analyze the important properties of repair materials, describe the common repair techniques to concrete structures, and identify their advantages and limitations.

Synopsis Introduction to laboratory practices and experiments. To familiarize the the use of various testing equipment and enable them to conduct laboratory tests via hands-on.

References

1. Hewlett, P.C, Lea's Chemistry of Cement and Concrete , Butterworth-Heinemann, 2004.
2. ACI, BRE, Concrete Society, ICRI, Concrete Repair Manual, 2nd. Edition, American Concrete Institute, 2003.
3. Newman, J and Choo B.S, Advanced Concrete Technology- Concrete Properties, Oxford, Butterworth-Heinemann 2003.
4. Newman, J and Choo B.S, Advanced Concrete Technology- Constituent Materials, Elsevier Science Publisher 2003.
5. Newman, J and Choo B.S, Advanced Concrete Technology- Processes, Oxford, Butterworth-Heinemann 2003.

EAA 393/2 Computational Problem Solving in Civil Engineering

Course Objective

To give exposure to the importance of understanding the computer software and train the students to build and develop software in solving civil engineering related problems.

Course Outcomes

- Able to gain knowledge of software programming development and improve program design and implementation skills through the execution of an individual project.
- Able to plan, develop, test and deliver a working computer program for Civil Engineering Problem of significant size in a high level language, together with associated documentation
- Able to present project information report with analysis, argument and commentary, to the intended audience, including appropriate acknowledgement and referencing of sources.

Synopsis

Background of software and purpose for civil engineering; Type of software, definition and method software, solving problem for civil engineering for example, commercial software in academic, research and operational/ application for civil engineering. Methodology of software construction: Choosing appropriate problem, forming problem statement, programming language, design and development of software. Software application and appropriate for civil engineering : Validation process, bench mark process, software application, effective presentation

References

1. Hanly, Koffmen & Horvath, Program Design for Engineers, Addison Wesley, 1995
2. Ian Sommerville, Software Engineering, 5th Ed., Addison-Wesley, 1996
3. R.S. Pressman, Software Engineering: A Practitioner's Approach, 4th Ed., McGraw-Hill, 1997
4. A. Behforooz & F.J. Hudson, Software Engineering Fundamentals, Oxford University Press, 1996

EAA 371/5 Industrial Training

Course Objective

The Industrial Training Program provides practical training for civil engineering students to give them a broad and structured understanding of engineering practice, understand the needs of civil engineering industry

and help them satisfy training requirements of the Board of Engineers Malaysia (BEM) for registration purpose.

Course Outcomes

- Able to work in the office/site to deal with the construction project
- Students will be able to acquire, translate and applied various aspects of design and construction.
- Able to demonstrate their understanding
- Able to acquire, translate and applied various aspects of critical path method
- Able to acquire, translate and applied various aspects on value engineering.
- Able to acquire, translate and applied various aspects on quality assurance.

Synopsis The training is designed to strike a balance between the development of skills and an appreciation of civil engineering processes. Training programs requires application of knowledge at an intellectual level to match their ongoing academic activities. The goal of this program is to train students to be professional engineers and helping them to be more competitive in the world marketplace.

References

1. Industrial Attachment Manual, Unit for Industrial Training, USM Engineering Campus .
2. EAC/BEM/IEM Manual, Requirements for Undergraduate Industrial Training

EAA 453/2 Reinforced Concrete Structural Design II

Course Objectives This course serves as the continuity to EAS 353 (Reinforced Concrete Design I) and is design to provide the students with basic principles to analyze, design and detail other reinforced concrete structures as well as the introduction to pre stressed concrete

Course Outcomes

- Able to calculate pile capacity (structural) of bored and micro piles
- Able to identify types of load condition and forces acting on structures
- Able to know and apply the design concept of reinforced concrete concretes
- Able to know and use BS 8110 and Designer's Handbook as design reference
- Able to produce structural drawings and detailing

Synopsis Introduction to deep foundation, Structural capacity of bored and micro piles, Pile capacity check, Introduction to pile cap design, Flat slab design, Retaining wall and basement design, Introduction to Pre-stressed concrete structures.

References

1. Neville, A.M. and Brookes, J.J., Concrete Technology, Longman, UK, 1990.

2. E.J. O'Brien and A.S., Dixon, Reinforced and Prestressed Concrete Design: The Complete Process, Longman, 1995.
3. Kong, F.K. Dan Evans, R.H., Reinforced and Prestressed Concrete, 3rd. Ed., Van Nostrand (U.K). 1991
4. Mosley BS8110, Code of Practice for the Structural use of Concrete, Part 1, 2 and 3, British Standard Institution, London.
5. C. E. Reynolds and J.C. Steedman, Reinforced Concrete Design Handbook, 10th. Edition, E&FN Spon, 1988.
6. C.E. Reynolds and J.C., Steedman, Examples Of The Design Of Reinforced Concrete Buildings to BS8110, 4th edition, E&FN Spon, 1992.

EAA 493/3 Integrated Design Project

Course Objectives To integrate the Civil Engineering disciplines; to extend knowledge, through project work, in engineering principles, planning and design; to develop skills in team work, resource investigation, communications and management.

Course Outcomes

- Able to comprehend on a project planning, conceptual design and construction activities
- Able to comprehend available manuals and implementation guidelines
- Able to apply information available to the maximum usage
- Able to work in a team work as a leader or as a supportive member.
- Able to communicate effectively among group and others

Synopsis Integrate knowledge in planning, design and construction; Preparing the students competency in engineering practices; Provide substantial engineering project and focus and refer to professional standards and manuals; Preparation of a complete report describe civil engineering processes and provide recommendation and draw conclusions; Build up "bridging" to civil engineering professionalism; Provide opportunity of personal creativity and initiative.

References All related Civil Engineering Books.

EAA 483/2 Construction Management

Course Objectives To gain knowledge on management aspects in construction industry.

Course Outcomes

- Able to acquire, translate and applied various aspects of development and organization of project
- Able to acquire, translate and applied various aspects of contract management.
- Able to acquire, translate and applied various aspects of bidding award process
- Able to acquire, translate and applied various aspects of critical path method

- Able to acquire, translate and applied various aspects on value engineering.
- Able to acquire, translate and applied various aspects on quality assurance.
- Able to acquire, translate and applied various aspects on safety and health in construction.

Synopsis Construction Management for Civil Engineering includes: Contract Management, Project Management; Planning technique; Value Engineering; Quality assurance; and Safety and Health in Construction.

References

1. Nunally, S.W., Construction Method and Management, Prentice-Hall, 1987.
2. Civil Engineering, Standard Method of Measurement, Institution of Civil Engineers, (UK), 1976.
3. Jimmie W. Hinze., Construction Planning and Scheduly, Prentice Hill 1998
4. Barrie, D. S. & Paulson B. C., Professional Construction Management, Mc Graw Hill, 1992.

EAP411/3 Solid Waste Management and EIA

Course Objectives To introduce principals of solid waste management, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP)

Course Outcomes

- Able to identify various components of solid waste and their sources and examine the physical, chemical and biological characteristics of waste
- Able to identify factors influencing waste generation rate and evaluate the collection route and system
- Able to apply appropriate processing techniques for materials and energy recovery from waste
- Able to develop design for final disposal of waste in landfill
- Able to identify methods to control and treat gas and leachate production in landfill
- Able to define EIA and its objectives and relate the cost- benefit of the projects economically and socially
- Able to apply the knowledge and technique acquired to predict the environmental impacts from any construction activities
- Able to produce the generic contents of an EIA report for any prescribed activities
- Able to relate the role and importance of EMP in any construction project
- Able to produce, evaluate and review the contents of any EMP reports

Synopsis Solid Waste Management; What is solid waste, engineering principles, treatment of solid waste, ultimate disposal. Environmental Impact assessment (EIA; Introduction; Application of EIA in Malaysia;

Preparation of report and case study. Environmental Management Plan; Introduction, preparation of report and case study.

References

1. Agamuthu, P. and Nather Khan (Editor), Effective Solid Waste Management, Ecotone Management Sdn. Bhd., 1997.
2. Anderson, D.M. and Meggyes, T. (Editor), Landfill Liner System-A state of the art report, Penshaw Press, UK., 1995.
3. Bagchi, A., Design, construction and monitoring of sanitary landfill, 3rd. Edition, John Wiley & Sons, 1996.
4. Chriestensen, T.H., Cossu, K. and Stegmann, R. (Editor) , Landfilling of Waste: Leachate, Elsevier Applied Science, 1992.

EAH416/2 River Conservation and Rehabilitation

Course Objectives To gain knowledge on river conservation and rehabilitation holistically through the application of sediment transport theory

Course Outcomes

- Able to acquire knowledge on natural river characteristics
- Able to identify and recognize the cause of flood and water scarcity and possible reuse of water
- Able to attain knowledge on sediment transport and to apply them in river modeling and assess various design conditions based on modeling results and to judge the best solution to be taken.
- Able to acquire knowledge on sediment data collection in rivers.
- Able to apply various options based on modeling results and to judge the best solution to be taken.

Synopsis Natural river characteristics, Problems and Opportunities, River Conservation, River Rehabilitation

References

1. Petts, G., Heathcote, J. & Martin, D. Urban Rivers: Our Inheritance and Future, IWA Publishing, London, 2002
2. FISRWG - Federal Interagency Stream Restoration Working Group. Stream Corridor Restoration: Principles, Processes, and Practices, 2001
3. Julien, P.Y. River Mechanics, Cambridge University Press, UK, 2002.
4. Nalluri, C. & Featherstone, R.E. Civil Engineering Hydraulics. Blackwell Science, Oxford, UK, 2001
5. Lagasse, P. F., Schall, J. D. & Richardson, E. V.). Stream Stability At Highway Structures, US Department Of Transportation, Publication No. FHWA NHI 01-002 (Hydraulic Engineering Cir. No. 20), 2001.

EAK465/2 Geographical Information System

Course Objectives Basic understanding to spatial mapping, geographic information management, and remote sensing technology. Spatial data collation, data analysis and image processing and the integration of spatial information technology.

Course Outcomes

- Able to explicate the GIS concepts in the acquisition, processing, organization, and management of spatial data;
- Able to use spatial data and spatial analysis in engineering problem solving;
- Able to clarify the advantages and disadvantages of using raster vs. vector based GIS;
- Able to utilize raster GIS software to perform spatial analysis.

Synopsis

Introduction to Geographic Information System (GIS); database management system. Spatial analysis and data collation. Remote Sensing technology; satellite image processing and its application in civil engineering. Integrated remote sensing and GIS technology. Development of spatial decision support system. Laboratory sessions on software application in spatial data analysis and processing

References

1. N. Ibrahim dan Z. Majid., Prinsip Sistem Maklumat Geografi. Universiti Teknologi Malaysia. 2002.
2. R. Rainis dan Noreshah M.S., Sistem Maklumat Geografi. Dewan Bahasa dan Pustaka, Kuala Lumpur, 1998
3. Jones, C.B. Geographical Information Systems and Computer Cartography. Longman Singapore Publishers. 1997
4. Cassettari, S. Introduction to Integrated Geo-Information Management. Chapman & Hall, London. 1993.

EAS 453/2 Pre-Stressed Concrete Design

Course Objectives

To give students the basic principle of pre-stressed concrete design, to enable them to work in the real pre-stressed industries.

Course Outcomes

- Able to explain the basic principle of pre-stressed
- Able to recognize the equipment used in pre-stressed concrete
- Able to calculate the losses in pre-stressed
- Able to calculate the ultimate moment of the pre-stressed beam
- Able to determine the deflection in the PC beam
- Able to describe the meaning of uncracked and cracked shear
- Able to select the pre-stressed system and calculate the anchorage bond system
- Able to apply code of practice for pre-stressed design

Synopsis

Principle of pre-stressing, behavior of material, loss and pre-stressed, section analysis, deflection, shear, pre-stressed system and anchorage bond, design of pre-stressed beam.

References

1. N Krisna Raju., Pre-stressed Concrete. Tata McGraw Hill Publishing Company Limited, 1981
2. M.K Hurst, Pre-stressed Concrete Design. E& FN SPON, 2006
3. James R. Libby, Modern Pre-stressed Concrete: Design Principles and Construction Methods. Amazon, 1990

4. T.Y Lin, Ned. H. Burns, Design of Pre-stressed Concrete Structures. Amazon , 2008

EUM 213/3 Operational Research

Course Objectives To gain knowledge and understanding on the concepts and applications of operational research in engineering.

Course Outcomes

- Able to formulate mathematical models and solve LP problems.
- Able to formulate transportation and assignment models and solve these problems.
- Able to draw project networks and calculate critical paths of projects.
- Able to apply inventory techniques.
- Able to apply decision analysis to engineering problems.
- Able to apply queuing models and calculate performance of the model.

Synopsis Introduction to operational research. Solving linear programming problems using graphical technique, the M method, the two phase method and the dual simplex method. Modeling and solving of transportation and assignment problems. Definitions and examples of network models. Project scheduling using CPM and PERT. Decision analysis. Modeling and solving inventory and queuing models.

References

1. Taha, H.A. Operations Research : An Introduction, 7th Edition, Prentice-Hall, 2003.
2. Hillier, F.S. and Lieberman, G.J., Introduction to Operations Research, 7th Edition, McGraw-Hill, 2001.
3. Ignizio, J.P., Pengaturcaraan Linear Dalam Sistem Matlamat Tunggal Dan Berbilang (terjemahan Bidin Yatim dan Ahmad Shukri Yahaya), Dewan Bahasa Dan Pustaka, 1992.

EAP 412/4 Environmental Studies

Course Objectives To gain knowledge on the assessment and controlling aspects of air and noise pollution and on the industrial wastewater management

Course Outcomes

- Able to judge, argue, validate, assess, appraise how noise is generated, wave principles , various noise parameters such as its unit in decibel, sound intensity; sound power; sound pressure; addition of harmonic sound, averaged sound level, analysis of sound
- Able to judge, argue, validate, assess, appraise sources, effect, dosage and main regulation of noise
- Able to judge, argue, validate, assess, appraise measurement of noise and doing calculation on main noise category such as Equivalent Sound Pressure Level (Leq), Percentage of noise (Ln), Day and Night sound Pressure Level (Ldn
- Able to judge, argue, validate, assess, appraise principles of noise control; control at source; control at pathways; control at receiver

- Able to define, distinguish and identify waste characteristics and scheduled waste and able to relate the knowledge of waste characteristics and apply it to waste handling with attention on safety of schedule waste in Malaysia and the related legislation.
- Able to define, distinguish and identify industrial wastewater, industrial solid waste, their characteristics, impact to the environment and able to define, distinguish and identify waste reduction and cleaner production and their present application scenario.
- Able to apply knowledge of waste characteristics to develop waste treatment strategies. Able to judge or assess different treatment methods.
- Able to recognize the scenario of clinical waste management in Malaysia and the related legislation. Able to translate legislation and Acts on Waste handling in to practice. Able to judge or assess different handling procedures.
- Able to identify and differentiate air pollutants and its effects onto receptors
- Able to measure air pollutants, indentify and use suitable air pollution control methods
- Able to identify meteorology factors, relating their effects on air pollution dispersions and use Gaussion model to calculate air pollutant concentrations
- Able to single out air pollution related legislations in Malaysia

Synopsis

Air Pollution – Definition and sources; classification and characteristics of pollution; impact of pollution; measurements; pollutant dispersion models, meteorological aspect on air dispersion; air pollution control

Noise Pollution – Introduction; important characteristics of sound, sources, effect and regulation of noise pollution, measurement and analyses of noise, noise control

Industrial waste management – Terminology and legislation aspect; waste handling-storage, collection, safety aspect; industrial wastewater; Industrial solid waste; waste reduction and cleaner production; treatment and disposal of non-hazardous industrial waste; treatment and disposal of hazardous industrial waste; clinical waste management

References

1. Davis, M.L. & Cornwell, D.A., Introduction to Environmental Engineering', 2nd Edition, McGraw Hill, Singapore, 1991.
2. Eckenfelder, W.W, Industrial Water Pollution Control, McGraw Hill, 1989.
3. Sincero, A.P. and Sincero, G.A., Environmental Engineering - A Design Approach, Prentice Hall, 1996.
4. de Never N., Air Pollution Control Engineering. McGraw Hill, 2000
5. Environmental Engineering Science Nazaroff W.W. & Alvarez-Cohen L., John Wiley and Sons. 2001

EAH 422/4 Advanced Water Resources Engineering

Course Objectives To gain advance knowledge on management of water resources and urban drainage in Civil Engineering.

Course Outcomes

- Able to comprehend the theory and application in management of water resources
- Able to apply various design techniques for hydraulic structures in water resources management.
- Able to recognize the relationship between water resources and environmental constrain.
- Able to distinguish the theory and application of MSMA
- Able to be familiar with the theory and application of Irrigation System

Synopsis Water resources development planning, storm water management, cross-drainage design, river design and irrigation system.

References

1. DID Malaysia, Urban Storm water Management Manual for Malaysia, JPS Malaysia, K. Lumpur, 2000.
2. Novak, P., Moffat, A.I.B., Nalluri, C. & Narayanan, R. Hydraulic Structures, Spon Press, London, 3rd Edition, 2001.
3. Chin, D.A Water Resources Engineering. Prentice Hall, New Jersey, 2000.
4. James, L.G. & Skoyerboe, G.V., Surface Irrigation: Theory and Practice, Prentice Hall, 1992
5. Stahre, P. & Urbanos, B.R., Stormwater Detation for Drainage, Water Quality and CSO Management. Prentice Hall, 1990.
6. Mc Cuen, 'Hydrologic Design and Analysis' Mc Graw Hill, 1998

EAL 432/4 Advanced Highway and Transportation Engineering

Course Objectives To comprehend the comprehensive transportation planning process, covering emphasis on advanced travel demand modeling and furnishing the supply side of transport.

To comprehend aspects of highway geometrics which encompass the horizontal and vertical alignment, cross section, highway aesthetics, at-grade intersections, grade-separated intersections and aspects of road safety related to road geometrics.

Course Outcomes

- Able to analyze transportation problems, including the causes and effects, define a particular study area, provide comprehensive transport planning process and link travel demand modeling to transportation planning process.
- Able to apply the gravity model for trip distribution modeling.
- Able to apply the LOGIT model for modal split modeling.
- Able to solve trip assignment models.
- Able to carry out transport planning using the EMME/3 software.
- Able to understand the driver, vehicle and traffic characteristics that

influence road geometrics.

- Able to describe the basic elements in road geometry such as road hierarchy, access control, topography, design speed and sight distances.
- Able to differentiate between different curve types and the design criteria used in the horizontal and vertical alignments.
- Able to describe the elements in a road cross section and at-grade intersection.
- Able to list down the justifications for an interchange and its types.

Synopsis Transportation planning process, defining the study area, application of advanced travel demand models, furnishing the supply side of transport. Driver, vehicle and traffic characteristics, introductory design elements, sight distance, horizontal and vertical alignment, highway aesthetics, road cross section, at-grade and grade separated intersection, road geometrics and safety.

References

1. REAM (2002), A Guide on Geometric Design of Roads, Road Engineering Association of Malaysia, Shah Alam
2. Meor Othman Hamzah, Rekabentuk Geometri Jalan dan Lebuh Raya, Cetakan ketiga, Penerbit USM, 1989.
3. Jabatan Kerja Raya Malaysia, Arahan Teknik (Jalan) 8/86 A Guide on Geometric Design of Roads, Kuala Lumpur, 1986.
4. Lembaga Lebuh Raya Malaysia, Interurban Toll Expressway System of Malaysia- Design Standards, Kuala Lumpur, 1986.
5. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, Fifth Edition, Washington DC, 2004
6. Jabatan Kerja Raya Malaysia, Arahan Teknik (Jalan) 13/87 A Guide to the Design of At-Grade Intersections, Kuala Lumpur, 1987.
7. Jabatan Kerja Raya Malaysia, Arahan Teknik (Jalan) 12/87 A Guide to the Design of Interchanges, Kuala Lumpur, 1987.
8. Jabatan Kerja Raya Malaysia, Road Safety Audit - Guidelines for the Safety Audit of Roads and Road Project in Malaysia, Kuala Lumpur, 1997.

EAG 442/4 Advanced Geotechnical Engineering

Course Objectives To introduce the various methods of advanced geotechnical engineering analyses

Course Outcomes

- Able to use stereographic projection method to analyze rock slope stability against sliding and toppling
- Able to describe index properties of rock in calculating RQD, RMR, and Q values for given rock
- Able to classify various land erosion and slope failure categories, determine causes, and suggest qualitative remedies
- Able to evaluate slope instability and formulate structural

reinforcement using geo-textile, geo-grid, soil nailing, and reinforced earth
- Able to identify problems associated with geotechnical engineering at site and methods of overcoming them by way of ground improvements
- Able to calculate settlement and propose settlement enhancement procedure

Synopsis Advance geotechnical studies covering rock mechanics, reinforced earth and ground improvements

References

1. A.C. Waltham., Foundations of Engineering Geology , Blackie Academic and Professional, 1994.
2. R.A. Goodman., Introduction to Rock Mechanics , 2nd. Ed., J. Wiley and Sons, 1991.
3. E.T. Brown., Underground Excavation, 2nd. Ed., 1993.
4. Das, B.M., Principles of Foundation Engineering, PWS Publishers, 1984.

EAS 454/4 Advanced Structural Engineering

Course Objectives To equip students with knowledge on advanced structural analysis

Course Outcomes
- Able to apply matrix method in the analysis and results interpretation of 2D truss and beam problems
- Able to apply finite element procedures (including use of program) to the analysis and results interpretation of 2D truss, beam and frame problems
- Able to determine free vibration response(damped and undamped), natural frequency, natural period, viscous damping ratio for SDOF problems
- Able to explain the design criteria and different structural forms in tall buildings and perform analysis of tall building
- Able to explain the factors influencing wind load and determine wind pressure based on MS1553,2002
- Able to determine seismic force on building

Synopsis Matrix method; Finite element method; Structural dynamics; Analysis of tall buildings; Wind load on structures based on Malaysian Standard; Introduction to Seismic Loading

References

1. Bathe, K.J., Finite Element Procedures. Prentice Hall, 1996.
2. Clough, R.W. and Penzien, J. Dynamics of Structures. 2nd edition, McGraw-Hill, Inc, 1993.
3. Mario, Paz., Structural Dynamics – Theory and Computation. 3rd edition, Van Nostrand Reinhold, 1991.
4. Craig R.R. Jr., Structural Dynamics – An Introduction to Computer

Methods. John Wiley & Sons, Inc, 1991.
5. Mosley W.H., Bungey J.H. & Hulse R., Reinforcement Concrete Design, 5th Edition, Palgrave, 1999
6. Reynolds C.E. & Steedman J.C., Reinforced Concrete Designer's Handbook, 10th Edition, E&FN Spon, 1988.

EAK 462/4 Advanced Geomatic Engineering

Course Objectives

To give exposure and knowledge on the applications of advanced geomatic measurement and to develop an understanding of the modern geomatic practice and mapping relevant to the Civil Engineering practice.

Course Outcomes

- Able to know the framework of advanced geomatic engineering practice in Malaysia, modern survey concepts, the use of softwares in data analysis.
- Able to achieve proficiency and ability to solve distance measurement using electronic distance measurement (EDM) instrument, to test the accuracy of distance measurement through EDM test and data analysis.
- Able to recognize the fundamental concepts of building surveys, the manner in which vertical and horizontal controls are established, to set on drainage system and the transfer of levels from bench marks.
- Able to recognize the concepts of global positioning system (GPS), GPS design, methods of positioning, its errors and accuracy.
- Able to know the concepts of offshore positioning, measurement techniques, tides and the preparation of hydrographic charting.
- Able to recognize the professional and ethical responsibilities on geomatic engineering practices abreast with contemporary issues.
- Able to write and communicate in ensuring effective presentation of survey reports by way of multi-disciplinary teamwork and leadership skills as embedded in the geomatic field work sessions.

Synopsis

Introduction: Introduction to advanced geomatic measurements concepts and contemporary practice of geomatic engineering. Modern survey; Field-to-finish (F2F) survey concepts; concepts of traditional and modern survey, total station system, cost benefit analysis, engineering surveying software. Distance measurement using EDM: introduction and principles of distance measurement, types of electromagnetic waves and signal, types of instrument and its usage in engineering, EDM test and data analysis. Building surveys: Building surveys; setting out buildings and large structures, methods of horizontal and vertical controls, setting out drainage and transfer of levels. Global Positioning Systems (GPS): principles of GPS, instrumentation design, positioning methods, errors and positioning accuracy, differential and real time positioning. Offshore positioning: instruments and depth measurement techniques, tides, datum levels and navigation chart.

References

1. Schofield, W., (2001) 'Engineering Surveying', 6th. Edition, Butterworths, London.
2. Kavanagh, B.F., (2003) 'Surveying: Principles and Application', 6th. Edition, Prentice Hall.
3. Bannister, A. and Raymond, S., (1992), Surveying, 6th ed., Longman Scientific & Technical.

EAA 492/6 Final Year Project

Course Objectives

Provides a learning experience for the student upon the range of skills developed throughout the course including research iniative, technical expertise, reporting skills both written and oral, and to provide a test of the student's capacity for independence of thought and judgment.

Course Outcomes

- Able to carry out preparatory work such as literature search/review of past work/software/hardware
- Able to evaluate material of direct relevance to the investigation
- Able to focus on main issues/formulate the problem/ identify areas of major contribution in the project.
- Able to validate the problem statement and solution through analytical studies/ software design and simulation/designing and building instrumentation/experimentation
- Able to write a dissertation and a technical paper
- Able to present and defend the thesis.

Synopsis

An individual project is required, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an individual research and development project, and a typed and bound thesis on the project should be submitted at a date to be determined by the Faculty

References

1. School of Civil Engineering. Guideline for Final Year Project. USM.
2. Civil Engineering Journal locally and Internationally
3. Civil Engineering Portal and Web reference
4. Civil Engineering Text Books