

1.	Name of Course					Wastewater Engineering					
2.	Course Code					JWAE4333					
	JWAE= the first alphabet identify the faculty within which the subject is offered., JWAE= the remaining three alphabet identify the course that offers the subject, 4333 = the first digit identify level of study; in this case undergraduate level, 4333= the second and third digits identify subject identity and 4333 = the fourth digit identify credit value or credit hours										
3.	Name(s) of academic staff					To be Assigned					
4.	Rationale for the inclusion of the course/module in the programme					Core subject in Civil engineering					
5.	Semester and Year offered					1/4					
6.	Total Student Learning Time (SLT)			Face to Face			Total Guided and Independent Learning				
	L = Lecture T = Tutorial P = Practical S=Studio Works O= Others			L	T	P/S	O	Independent Study(IS) = 70 Total =126			
				42	14	-	-				
7.	Credit Value					3.0					
	Lecture (3 hours per week x 14 weeks) Tutorial (1 hours per week x 14 weeks)										
8.	Prerequisite (if any)					Hydraulics(JHYB 2193)					
9.	Course Objectives 1. To introduce the students with the system of transferring and treatment of wastewater. Course Learning Outcomes (CLO) At the end of the semester students should be able to: CLO1: Know the design and principles of various unit processes and operation for application as specific and standard components in wastewater treatment plants. CLO2: Understand the principals involved in the design of sewers and sewerage systems CLO3: Understand the process of wastewater treatment.										
10.	Transferable Skills: This course is expected the development of the following transferable skills: a) Self-management – an ability to manage time and task b) Learning skills - An ability to learn both independently and co—operatively; - An ability to use library skills, to find and organize information ; - An ability to use a wide range of academic skills (research, analysis, synthesis etc.); - An ability to identify and evaluate personal learning strategies. c) Teamwork - An ability to take responsibility and carry out agreed task; - An ability to take initiative and lead other; - An ability to identify and evaluate personal learning strategy. d) Problem solving - An ability to analyse; - An ability to think laterally about a problem; - An ability to identify strategy options;										

	- An ability to solve the problems e) Information technologies - An ability to use specialist software where relevant to the discipline.														
11.	Teaching-learning and assessment strategy A variety of teaching strategies are used throughout the course, including the following: - Classroom Lessons; Lecturer and power point presentations - Tutorial Session; - Student-Lecturer Discussion - Collaborative and Co-operative learn; - Independent study. Assessment: <table> <tr> <td>Course Work</td><td>40%</td></tr> <tr> <td>Assignment</td><td>10%</td></tr> <tr> <td>Quizzes/ Tutorials</td><td>10%</td></tr> <tr> <td>Test</td><td>20%</td></tr> <tr> <td>Examination</td><td>60%</td></tr> <tr> <td colspan="2"> </td></tr> <tr> <td><u>Total</u></td><td><u>100%</u></td></tr> </table>	Course Work	40%	Assignment	10%	Quizzes/ Tutorials	10%	Test	20%	Examination	60%			<u>Total</u>	<u>100%</u>
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12.	Synopsis: The course consists of two portions: water supply and wastewater Engineering. It introduces the concepts of demand and supply, estimation in Water Supply Planning Operation, methods of purification and distribution. Wastewater Engineering covers the essentials of sewerage systems and their operations. It includes sewerage design, treatment of wastewater and their disposal														
13.	Mode of Delivery: Formal lectures will be conducted 3 hours per week. Corporative learning is also conducted in which small group is formed which consist of student of different levels of ability.														

14.	Performance Criteria :						
	CLO-PLO	Assessment Tool	1	2	3	4	5
	Marks		0-39	40-49	50-59	60-74	75-100
	Grade		(F)	(D,D+)	(C-,C,C+)	(B-,B,B+)	(A-,A,A+)
	CLO1: Know the design and principles of various unit processes and operation for application as specific and standard components in water and wastewater treatment plants.	Assignment Quizzes Tutorial Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task
	CLO2: Understand the principals involved in the design of sewers and sewerage systems	Assignment Quizzes Tutorial Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information

			• Take responsibility and carry out laboratory test • Manage time and task	• Take responsibility and carry out laboratory test • Manage time and task	• Take responsibility and carry out laboratory test • Manage time and task	information • Take responsibility and carry out laboratory test • Manage time and task	• Take responsibility and carry out laboratory test • Manage time and task
	CLO3: Understand and the process of water waste treatment	Assignment Quizzes Tutorial Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Take responsibility and carry out laboratory test • Manage time and task

15.	Mapping of the Programme Objectives to the Programme Learning Outcomes											
	Programme Learning Outcomes (PLO) Programme Objectives (PO)	PLO1: Ability to acquire and apply knowledge of science and engineering fundamentals;	PLO2: Acquired in-depth technical competence in civil engineering discipline;	PLO3: Ability to undertake problem identification, formulation and solution;	PLO4: Ability to utilize systems approach to design and evaluate operational performance;	PLO5: Understanding of the principles of design for sustainable development;	PLO6: Understanding of professional ethics, Islamic values, social, cultural, global and environmental responsibilities of a professional engineer and commitment to them;	PLO7: Ability to communicate effectively, not only with engineers but also with the community at large;	PLO8: ability to function effectively as an individual;	PLO9: Ability to function effectively in group with the capacity to be a leader or manager;	PLO10: Recognizing the need to undertake lifelong learning, and possessing /acquiring the capacity to do so;	PLO11: ability to become Entrepreneur;
	PEO1: To produce graduates with proficient knowledge and competency in various areas in Civil/ Electrical/ Mechanical Engineering	✓	✓	✓								
	PEO2: To produce graduates with professional, generic attributes to meet the present and future global demands.				✓	✓	✓			✓	✓	
	PEO3: To produce graduates with Islamic humanistic values and reinvention skills to meet the requirement of a dynamic environment. These skills include Civil Intelligence, Moral Intelligence, Self-Reliance and Communication Skills							✓	✓	✓		✓

16.	Mapping of the course Learning Outcome to the Programme Outcome										
Programme Learning Outcomes (PLO) Course Learning Outcome (CLO)	PLO1: Ability to acquire and apply knowledge of science and engineering fundamentals;	PLO2: Acquired in-depth technical competence in civil engineering discipline;	PLO3: Ability to undertake problem identification, formulation and solution;	PLO4: Ability to utilize systems approach to design and evaluate operational performance;	PLO5: Understanding of the principles of design for sustainable development;	PLO6: Understanding of professional ethics, Islamic values, social, cultural, global and environmental responsibilities of a professional engineer and commitment to them;	PLO7: Ability to communicate effectively, not only with engineers but also with the community at large;	PLO8: ability to function effectively as an individual;	PLO9: Ability to function effectively in group with the capacity to be a leader or manager;	PLO10: Recognizing the need to undertake lifelong learning, and possessing /acquiring the capacity to do so;	PLO11: ability to become Entrepreneur;
	CLO1: Know the design and principles of various unit processes and operation for application as specific and standard components in water and wastewater treatment plants.	✓									
	CLO2: Understand the principals involved in the design of sewers and sewerage systems	✓	✓	✓							
	CLO3: Understand and the process of water waste treatment	✓	✓	✓							

17.	Content outline of the course/module and the SLT per topic					
	Details	SLT(Hour)				
		L	T	P	IS	Total
Topic 1	Introduction - Domestic waste disposal - Requirement, method of disposal, definition of wastewater/sewage, sewer, sewerage system, domestic waste disposal in rural areas. - Quantity of sewage Dry weather flow, design scale, quantity from public water supply, personal source and infiltration of water. The fluctuation of sewage flow. - Sewer Design Velocity, velocity flow-body, slope and diameter. Sewerage and sewerage equipment - Sewerage shape & material, manhole, invert siphon, storm overflow, rusting of sewer and its Sewerage Criteria - Physical chemical and biological, Biochemical Oxygen Demand (BOD), definition, determination of biochemical oxygen in laboratory. Decomposition cycle. General Method of Wastewater Treatment - General treatment method for sewage. - Grit chamber, oxidation pond, (types, principles and advantages. Septic tank (criteria, functions and limitation) - Activated sludge process (advantages and disadvantages) sludge treatment	9	3	-	15	27
	Sewers and Sewerage Systems Basis of sewerage design. Depressed sewers. Use of partial flow diagrams.	6	2	-	10	18
	Pumping of Water and Sewage Need for pumping. Types of pumps, capacity and number of pumps. Power for pumping. Pumping stations.	6	2	-	10	18
	Control of Water Pollution and Wastewater Disposal - Biochemical oxygen demand. Meaning and its significance as a parameter of organic pollution. Carbonaceous and nitrpgenous BOD, COD and TOC respirometer. - Self-purification. Dissolved oxygen curve. Streeter - Phelps equation.	6	2	-	10	18
	Tertiary Treatment - Cost consideration - Waste minimisation - Environmental management systems	3	2	-	5	10

	Topic 6	Treatment of Wastewater - Guidelines in sewage treatment - objectives of treatment, methods of treatment. Effluent quality Standards. Wastewater characteristics. - Primary treatment systems - Screens, grit chambers, Equalisation tanks, sedimentation tanks. - Consideration on plug and completely mixed plan. Residence time. Hydraulics and mean cell retention time. - Secondary treatment systems (Biological treatment process). - Attached growth - Filters - types, design consideration, Veltz equation and National Research Council Equation. Rotating Biological Contactors - Comparison between RBC and trickling filters, biowaters. - Dispersed growth - Activated Sludge - Theory, process and design consideration, Kinetics and Empirical Approaches. Operational problems of activated sludge systems modifications. Oxidation ponds - Types of ponds, consideration, design of facultative ponds. Use of oxidation ponds in Malaysia. - Sludge treatment and disposal - sludge conditioning. Dewatering, ultimate disposal.	9	3	-	15	27
	Topic 7	Advances in Wastewater Treatment overview	3	-	-	5	8
	Total(Hour)		42	14	-	70	126
18.	Main references supporting the course - Water and Wastewater Calculations Manual, 2nd Ed. by Shun Lin and C. Lee (Jun 26, 2007) Mark, Hammer - Water and Wastewater Technology (7th Edition) by Mark J. Hammer (Jan 15, 2011) - Water Quality Hazards and Dispersion of Pollutants by Wlodzimierz Czernuszenko and Pawel Rowinski (Oct 29, 2010)						
	Additional references supporting the course - Metcalf & Eddy, Inc., 'Wastewater Engineering: Collection and Pumping of Wastewater', McGraw Hill. - Metcalf & Eddy Inc., 'Wastewater Engineering: Treatment, Disposal and Refuse', Mc Graw-Hill. Hydrology for Engineers, Kohler, Linsley & Fransini.						
19.	Other additional information All materials will be available to the students in the library.						