

1.	Name of Course					Hydraulics				
2.	Course Code					JHYB2193				
	JHYB= the first alphabet identify the faculty within which the subject is offered., JHYB = the remaining three alphabet identify the course that offers the subject, 2193 = the first digit identify level of study; in this case undergraduate level, 2193 = the second and third digits identify subject identity and2193 = 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					2/2				
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) =56 Total =126		
				42	14	14	-			
7.	Credit Value					3.0				
	Lecture (3 hours per week x 14 weeks) Tutorial (1hour per week x 14 weeks) Practical (2 hours fortnightly x 7 weeks)									
8.	Prerequisite (if any)					Fluid Mechanics (JFLM 2063)				
9.	Course Objectives 1. This course is to equip the students with open channel flow, coastal processes, aspects of sediment transport in river engineering and coastal hydraulics. Course Learning Outcomes (CLO) At the en d of the semester students should be able to: CLO1: understand and carry out analysis of open channel flow. CLO2: understand the hydraulic considerations involved in hydraulic structures. CLO3: understand the physical processes such as sedimentation in rivers. CLO4: understand the theory of waves and knowledge of coastal hydraulics.									
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>5%</td></tr> <tr> <td>Tutorials /Quizzes</td><td>5%</td></tr> <tr> <td>Laboratory Work</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	5%	Tutorials /Quizzes	5%	Laboratory Work	10%	Test	20%	Examination	60%			<u>Total</u>	<u>100%</u>
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12.	Synopsis: This course deals with hydraulics principles related to open channel flow, hydraulic structure, River Engineering and Sedimentation, Wave and Coastal hydraulics																
13.	Mode of Delivery: Lectures; Tutorials; Practical.																

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: Understand and carry out analysis of open channel flow.	Assignment Tutorial Quizzes Laboratory work Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)
	CLO2: Understand the hydraulic considerations involved in hydraulic structures	Assignment Tutorial Quizzes Laboratory work Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range

			of academic skills (research, analysis, synthesis etc.)	of academic skills (research, analysis, synthesis etc.)	of academic skills (research, analysis, synthesis etc.)	• Use wide range of academic skills (research, analysis, synthesis etc.)	of academic skills (research, analysis, synthesis etc.)
	CLO3: Understand the physical processes such as sedimentation in rivers.	Assignment Tutorial Quizzes Laboratory work Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)
	CLO4: Understand the theory of waves and knowledge of coastal hydraulics.	Assignment Tutorial Quizzes Laboratory work Test Examination	Fail to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Poor to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Satisfactory to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Good to: • Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)	Excellent to: • To: Learn both independent and cooperatively • Use library skills, to find and organize information • Use wide range of academic skills (research, analysis, synthesis etc.)

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						synthesis etc.)	
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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											
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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: Understand and carry out analysis of open channel flow.	✓									
	CLO2: Understand the hydraulic considerations involved in hydraulic structures.	✓									
	CLO3: Understand the physical processes such as sedimentation in rivers.	✓	✓	✓							
	CLO4: Understand the theory of waves and knowledge of coastal hydraulics.	✓	✓	✓							

17.	Content outline of the course/module and the SLT per topic					
	Details	SLT (Hours)				
		L	T	P	IS	Total
Topic 1	Introduction Introduction to hydraulics and its application in civil engineering.	3	1	-	4	8
Topic 2	Open channel flow. - Uniform flow in open channels. Calculating velocity and discharge using Chezy, Bazin and Manning formulas for different types of cross-sections and optimum cross sections. - Non-uniform flow in open channels. Steady flow, gradually varied flow and rapidly varied flow. Surface profile classification. Concept of specific energy and alternate depths. Critical depth in rectangular channels. Froude number. Critical, subcritical and supercritical flows. Critical depths in non-rectangular channels. Occurrences of critical flow conditions. Effect of change in bed level - flow over broad crested weir. Effect of lateral contraction of a channel-Venturi flume. - Hydraulic jumps – classification and location	12	4	-	16	32
Topic 3	Hydraulic structures - dams - spillways - outlet works and stilling basins	6	2	-	8	16
Topic 4	River engineering and sedimentation - Engineering process, bed materials transport, suspended sediment transport and sediment transport - Equations (bed load, suspended load and total load), threshold of movement - Entrainment function - sediment measurement, - sediment yield of water shed - sediment simulation - reservoir sedimentation - River forms - meanders, river training and regime theory.	12	4	-	16	32

	Topic 5	Waves and coastal hydraulics - Theory of deep sea and shallow water waves - Wave forces on structures - Solitary and Cnoidal waves - Stokes general equation for waves. - Reflection and refraction processes. - Local fluid velocities and accelerations in shallow and deep sea conditions. - Local fluid displacements in shallow and deep sea conditions.	9	3	-	12	24
	Practical	Practical - Flow through rectangular open channel v-notch - Determination of critical depth in open channel flow - Flow over sharp crested weir	-	-	14	-	14
	Total (Hour)		42	14	14	56	126
18.	Main references supporting the course - Open-Channel Flow by M. Hanif Chaudhry (Dec 4, 2007) - Fundamentals of Hydraulic Engineering Systems (4th Edition) by Robert J. Houghtalen, A. Osman Akan and Ned H. C. Hwang (Aug 17, 2009) - Water Resources Engineering by Larry W. Mays (Jun 8, 2010) - Civil Engineering Hydraulics by C. Nalluri (Jul 21, 2009)						
	Additional references supporting the course K. Subramanya - Flow in Open Channels. Tata McGraw Hill Publishing Company Limited, 1979, Second Edition. - Ned H.C. Hwang, Robert J. Houghtalen - Fundamentals of Hydraulic Engineering Systems, Third Edition, Prentice Hall, 1996. - Charles Jaeger - Fluid Transients in Hydro-Electric Engineering Practice, Blackie & Son Limited, 1977. - Roberson Cassidy, Chaudhry - Hydraulic Engineering, Second Edition, 1997, John Wiley & Sons. - Post-Graduate Course in Sediment Transport Technology Proceedings, volume 1 & 2, 1994, Turkey. - B.B. Sharp - Waterhammer - Problems and Solutions, 1981, Edward Arnold.						
19.	Other additional information All materials will be available to the students in the library.						