PAPER ID-421619

Subject Code: KCE403

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
HYDRAULIC ENGINEERING AND MACHINES

Time: 3 Hours ***Total Marks: 100***

Notes:

- *Attempt all Sections and Assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks **(10X2=20)**	
Q1(a)	Define specific energy and total energy.		1
Q1(b)	Distinguish between pipe flow and open channel flow.		1
Q1(c)	Distinguish between most economical and most efficient channel.		2
Q1(d)	Explain GVF.		2
Q1(e)	Explain hydraulic jump with the help of a diagram.		3
Q1(f)	Define surges in open channel.		3
Q1(g)	Explain Speed ratio and Jet ratio of a Pelton turbine.		4
Q1(h)	Define pumps.		4
Q1(i)	Define reaction turbine with the help of a suitable example.		5
Q1(j)	Define specific speed of a turbine.		5

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks **(3X10=30)**	
Q2(a)	Illustrate the condition under which the rectangular and triangular section of an open channel is most economical and derive these conditions.		1
Q2(b)	Explain and sketch the GVF profiles produced on i. Mild Slope ii. Steep Slope iii. Critical Slope		2
Q2(c)	A hydraulic jump is occurring in a rectangular channel of 3 m width, discharge is 7.8 m^3/s and depth before the jump is 0.28 m. Calculate: i. Sequent Depth ii. Energy loss during the jump		3
Q2(d)	Illustrate centrifugal pump? Describe the principle and working of a centrifugal pump with a neat sketch.		4
Q2(e)	Illustrate the phenomenon of cavitation? What is its effect on turbine? How it can be avoided?		5

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q3(a)	Explain the concept of specific energy depth curve and prove the critical flow condition for all types of channels.		1
Q3(b)	A flow of 5 m^3/s is passing at a depth of 1.5 m through a rectangular channel of 2.5 m width. The kinetic energy correction factor α is found to be 1.20. What is the specific energy of the flow? What is the value of the depth alternate to the existing depth if α = 1.0 is assumed for the alternate flow?		1

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q4(a)	A rectangular channel has a width of 2 m and carries a discharge of 4.8 m^3/ sec with a depth of 1.6 m. At a certain section a small smooth hump with a flat top and of height 0.5 m is proposed to be built. Neglect energy loss. i. Calculate the water surface elevation on the hump. ii. Calculate the minimum size of hump to cause critical flow over the hump.		2
Q4(b)	A rectangular channel is 3.5 m wide and conveys a discharge of 15 m^3/s at a depth of 2 m. It is proposed to reduce the width of the channel at a hydraulic structure. Assuming the transition to be horizontal and the flow to be frictionless, determine the water surface elevation upstream and downstream of the constriction when the constricted width is: (i) 2.5 m, (ii) 2.2 m.		2

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SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q5(a)	Derive an expression for sequent depth ratio and energy loss in a hydraulic jump for a rectangular channel.		3
Q5(b)	A horizontal rectangular channel 4 m wide carries a discharge of $16 m^3/s$. Determine whether a jump may occur at an initial depth of 0.5 m or not. If a jump occurs, determine the sequent depth to this initial depth. Also determine the energy loss in the jump.		3

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q6(a)	Explain in detail the working of a reciprocating pump with the help of a suitable diagram.		4
Q6(b)	A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Calculate: i. Force on the plate ii. Work done iii. Efficiency of the jet		4

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q7(a)	Illustrate draft tubes and its types with the help of a suitable diagram. Prove that the pressure at the inlet of the draft tube is less than atmospheric pressure.		5
Q7(b)	A Pelton wheel is to be designed for the following specification. Shaft Power =11722 KW, Head = 380 m, Speed = 750 rpm, Overall Efficiency = 86%, Jet diameter (d) not to exceed one-sixth of wheel diameter (D). Determine: i. Wheel diameter ii. No. of Jets required iii. Diameter of Jets. Take $Kv_1 = 0.985$ and $Ku_1=0.45$.		5