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S.E. (Mining) (Sem-IV) (Revised Course 2016-2017) EXAMINATION MAY/JUNE 2019
Fluid Mechanics & Machinery

[Duration : Three Hours]

[Max.Marks : 100]

Instructions:

- 1) Answer any five questions. At least two from part-A, two from Part-B and one from part – C.
- 2) Missing data, if any may be suitably assumed.
- 3) Illustrate your answers with sketches wherever required.
- 4) Figures to right indicate full marks.
- 5) Make suitable assumptions if required and state them clearly.
- 6) All symbols and abbreviations have their usual meaning.

PART - AAnswer any two from Q1 to Q3: (2 × 20=40)

- Q.1 A. Define Bulk modulus of elasticity of the liquid. The pressure of a liquid is increased from 60 Bar to 100 Bar and the volume is decreased by 0.2%. Determine the bulk modulus of elasticity of the liquid. 08
- B. Find the pressure due to following in Pascals. 08
 (a) 100 cm of water (b) 100 cm of oil Sp. gravity =0.8
 (c) 20 cm of Hg Sp. Gravity =13.6
 Define : Guage Pressure and Vacuum Pressure
- C. What do you understand by convective & local accelerations? 04
- Q.2 A. State Bernoullis Theorem. 09
 The water flows through an inclined pipe of 50m long having a slope of 1 in 20. The pipe tapers from 5m diameter to 1m diameter from higher end to lower end. The water flow is 500 l/s. The pressure of the water at the entry is 1.2 bar. Find the pressure of the water at the exit.
- B. Water flows over a rectangular weir of 1.2m wide and depth of water over it is 16.5 cm. The water coming out from the weir passes over a right angled triangular notch. Find the depth of water over the triangular notch. Take $C_d = 0.62$ (weir) and $C_d = 0.6$ (notch). 07
- C. A 3-dimensional unsteady flow field is represented by a velocity. 04
- Q.3 A. A venturimeter 40 cm × 15 cm is fitted to measure a discharge of 10 litres/sec of water flowing through a pipe. A mercury manometer is connected to the venturimeter. Find the deflection in mercury in cm. Take C_d for Venturimeter as 0.96. 10
- B. A rectangular tank 5m long, 2m wide and 1.5m high is filled with water to a height of 1m. If the tank is moving with an acceleration of 1 m/s^2 horizontally, 10

Find:

- The Total hydrostatic force acting on each side.
- Force required to impart the acceleration.

PART B

Answer any two from Q4 to Q6: (2 × 20=40)

- Q.4 A) A Siphon of 5cm dia has a summit 2m above the water level in the tank and discharges into the atmosphere at 4m below the free water level in the tank. Find: 10
- The velocity of flow through the Siphon
 - Discharge
 - Absolute pressure at the crest.
- Take $f=0.004$ and atmospheric pressure head = 10.3 m of water.

- B) Pipes 1, 2, 3 are connected to three reservoirs A, B, C respectively 10

Pipe	Diameter (cm)	Length (m)	Connectivity
1	15	350	AJ
2	10	200	BJ
3	10	250	CJ

Where J is the junction where all three pipes meet.

Calculate the discharge in each pipe if friction factor = 0.02

Elevation of reservoir A, B and C are 126.00 m, 109.00 m and 100.00 m respectively.

- Q.5 A) Describe the principle and working of a reciprocating pump. Draw an ideal Indicator Diagram for a single acting reciprocating pump. 10
- B) State the functions of Air Vessel fitted on reciprocating pump. 04
- C) A single acting reciprocating pump running at 60 RPM delivers 18 l/sec of water. The diameter and stroke of the cylinder are 20 cm and 30 cm respectively. Find coefficient of discharge and percentage slip. 06
- Q.6 A) With a neat sketch explain construction and working of Hydraulic Crane. 10
- B) The inlet and outlet diameters of an impeller of a centrifugal pump are 20 cm and 40 cm respectively. Find the maximum speed for starting the pump if it works against a total Head of 25 m. 06
- C) Write short notes on: 04
- NPSH
 - Cavitation

PART C

Answer any one from Q7 & Q8 (1 × 20 = 20)

- Q.7
- A) Define Surface Tension and Capillarity. A soap bubble of 3 cm diameter is formed when its inside pressure is 2N/m^2 . Find the surface tension of soap bubble. 08
- B) A rectangular plate 2m wide and 6m long is immersed in water vertically, 2m side is parallel to the free water surface and it is 1 m below the surface. Find 08
- a) Total Pressure on the plate.
- b) Position of center of pressure.
- C) Explain Momentum Equation and state its application. 04
- Q.8
- A) A pipe of 20 cm in diameter carrying water at the rate of $1\text{m}^3/\text{s}$ suddenly increased to 40 cm diameter. Find out the head Loss due to sudden expansion. 04
- B) Write short note on: 06
- (i) Operational Difficulties in Centrifugal Pump.
- C) With the help of a neat sketch explain working of Hydraulic Ram. 10