

MECHANICAL ENGINEERING

4th SEMESTER – FULL TIME (R-2008)

CE 9211 – Fluid Mechanics and machinery
(Common to Manufacturing, Industrial & Mining Engineering)

Time : 3 Hrs

Max.marks: 100

Answer all Questions

8

PART – A (10 x 2 = 20)

1. Define Newton's law of viscosity
2. A liquid at 20°C has a relative density of 0.8 and a kinematic viscosity of 2.3 centi stoke. Determine its unit weight.
3. What is Moody diagram? State its use?
4. Sketch the flow separation region in a pipe bend
5. State the advantages of centrifugal pump and its accessories.
6. Define Specific speed of a pump with relevant expression.
7. State Buckingham's π theorem
8. Define governing of turbines. How it is achieved?
9. State few generally adapted scale ratios of hydraulic models
10. What is an ideal indicator diagram?

PART – B

11. (i) A plate 0.025 mm distant from a fixed plate, moves at a speed of 50 cm/sec and requires a force of 1.471 N/m² to maintain this speed. Determine the viscosity between the plates in poise. (6 marks)
 - (ii) The surface tension of water in contact with air at 20°C is given as 0.716 N/m. The pressure inside the droplet of water is to be 0.147 N/cm² greater than outside pressure. Calculate the diameter of the droplet. (6 marks)
 - (iii) Assuming the bulk modulus of elasticity of water is 2.07×10^6 kN/m² at standard atmospheric conditions, determine the increase of pressure necessary to produce 1% reduction in volume at the same temperature. (4 marks)
12. (a) (i) Derive Darcy Weisbach equation for friction loss (12 marks)
 - (ii) Enlist other minor losses with relevant formulae. (4 marks)

(OR)

12.(b) A 30 m long pipe line connects two reservoirs, both of which are open to the atmosphere. The difference in their water level is 12m. The pipe has three equal sections of 10m each. The first and last sections are 60 mm in diameter and intermediate section is 40 mm in diameter. The value of f for pipes is 0.0054. Calculate the flow rate and define the energy and hydraulic gradient lines. (16 marks)

13. (a) The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft L , Velocity V , air viscosity μ , air density ρ and bulk modulus of air K . Express the functional relationship between these variables and the resisting force. (16 marks)

(OR)

13. (b) (i) Write a short notes on Distorted models? State their advantages (8 marks)

(ii) The discharge through a weir is $1.5 \text{ m}^3/\text{sec}$. Find the discharge through the model of the weir if the horizontal dimension of the model = $1/50$ the horizontal dimension of the proto type and vertical dimension of the model = $1/10$ the vertical dimension of the prototype. (8 marks)

14.(a) A Pelton wheel is supplied with 1000 litres/sec of water under a head of 46 m. The mean bucket speed is 15 m/ses and the buckets deflect the jet through an angle of 165° . Estimate the power developed and the efficiency of the wheel. Take velocity co efficient of the jet as 0.975 and neglect friction in buckets. (16 marks)

(OR)

14.(b) (i) A centrifugal pump discharges $0.15 \text{ m}^3/\text{s}$ of water against a head of 12.5 m, the speed of the impeller being 600 rpm. The outer and inner diameters of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35° to the tangent at the exit. If the area of flow remains 0.07 m^2 from inlet to outlet, calculate (i) manometric efficiency of the pump (ii) vane angle at inlet. (12 +4 marks)

(ii) Classify centrifugal pumps through sketches based on flow direction with impeller

15.(a) (i) A single cylinder double acting reciprocating pump has the following details: $D = 200 \text{ mm}$, $N = 120 \text{ mm}$, $L = 400 \text{ mm}$ and $D_s = 150 \text{ mm}$. If an air vessel is fitted on the suction side, determine the crank angle at which there is no flow to the air vessel or from the air vessel. (8 marks)

(ii) Explain the purpose and principle of working of air vessels of reciprocating pumps. Enlist their advantages (5+3 marks)

(OR)

15.(b) Write a short note on following types of rotary pumps: (4+4+4+4 marks)

(i) Internal gear pump (ii) External gear pump

(iii) Vanes pumps (iv) Roots pump