

Q.P. Code : 537800

(3 Hours)

[Total Marks : 100

- N.B. : (1) Questions No 1. is **compulsory**
(2) Attempt any **four** questions from the remaining **six** questions.
(3) Assume suitable data wherever necessary

1. Solve any **four** 5
- (a) What are smooth and rough pipes? 5
 - (b) Explain the terms hydraulic gradient and total energy line 5
 - (c) What are the important characteristics of Laminar flow. Give examples where such flow is encountered. 5
 - (d) Briefly, explain water hammer? What allowance is usually made for this in penstock design. 5
 - (e) An airplane moving at a supersonic speed is not heard by a stationary observer until the plane has passed him. Comment on the validity of this statement. 10
2. (a) Two reservoirs are connected by a pipeline which is 150mm in diameter for the first 6m and 250 mm in diameter for the remaining 15m length. The entrance and exit are sharp and change of section is sudden. The water surface in the upper reservoir is 6m above that in the lower reservoir. Determine the losses of head which occur and calculate the rate of flow. Take coefficient of friction as 0.01 for both the pipes. Also draw the hydraulic gradient and total energy gradient. 10
- (b) Show that the total loss of head due to friction in a dead end pipe with side tapplings is one third of what it would be if the inlet discharge Q remains constant and no liquid is drawn off along the length of the pipe. 10
3. (a) An old water supply distribution pipe 25 cm diameter of a city is to be replaced by two parallel pipes of smaller diameter having equal lengths and identical friction factor values. Find out the new diameter required. 10
- (b) Find the maximum power transmitted by jet of water discharging freely out of nozzle fitted to a pipe 300mm long and 10cm diameter with coefficient of friction as 0.01. The head available at the base of nozzle is 90m. 10

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4. (a) Water is flowing through a cast iron pipe of diameter 150mm and thickness 10mm which is provided with a valve at its end. Water is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 1.962MN/m^2 . Take K for water = 1.962GN/m^2 , E for CI Pipe = 117.7GN/m^2 . 10
- (b) Define Mach number. What is the significance of Mach number in compressible flow? 5
- (c) What do you understand by stagnation pressure? 5
5. (a) Show that the discharge per unit width between two parallel plates distance 'b' apart, when one plate is moving at velocity 'V' while the other is held stationary, for the condition of zero shear stress at the fixed plate is $q = b V / 3$. 10
- (b) A pipe 20 cm in diameter and 10 km long slopes upwards at a slope of 1 in 250m of pipe length traversed. An oil of viscosity 0.15kg S/m^2 and specific gravity 0.83 is required to be discharged through it at the rate of 25 lit/sec. Determine the head lost due to friction and the power required to drive the pump. 10
6. (a) Derive an expression for mean velocity for laminar flow between fixed parallel plates. 10
- (b) For laminar flow of an oil having dynamic viscosity 1.75N.S/m^2 in a 30 cm diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3.5m/s at the centre of the pipe. Calculate the shearing stress at the pipe wall and within the fluid 5cm from the pipe wall. 10
7. Write short notes on
- (a) Dash pot mechanism 5
- (b) Moody's diagram 5
- (c) Minor losses in pipes 5
- (d) Mach cone 5