

Mechanical/Automobile
(3 Hours)

[Total Marks : 80

N. B. :

1. Question no.1 is compulsory.
2. Attempt any **THREE** from question no. 2 to 6.
3. Use illustrative diagrams wherever required.

Q. No.	Marks
Q1) Attempt ANY FOUR	
a) Define a fluid and distinguish between ideal and real fluids	05
b) A stone weights 245N in air and 168N in water. Calculate the volume and specific gravity	05
c) Explain Hydrostatic law	05
d) Define stream lines, path lines and streak lines	05
e) Define Mach number, stagnation density and stagnation temperature	05
Q2) a) The velocity components in two dimensional flow field are as follows $u = y^3/3 + 2x - x^2y$, $v = xy^2 - 2y - x^3/3$ i. whether the flow is possible ii. obtain an expression for stream function iii. obtain an expression for potential function	10
b) A sliding gate 3m and 1.5m high situated in a vertical plane has a coefficient of friction between itself and guide of 0.18. if the gate weight is 19n and its upper edge is at a depth of 9m, what vertical force is required to raise it? Neglect buoyancy force on gate.	10
Q3) a) Starting from the Navier Stokes equation for an incompressible Newtonian fluid derive Bernoulli's equation stating the assumptions	10
b) Derive the expression for stagnation density and stagnation temperature.	10
Q4) a) A pipeline of length 2400m is used for power transmission. If 115kW power is to be transmitted through the pipe in which water having a pressure of 500 N/cm ² at inlet is flowing? Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 100 N/cm ² . Take $f = 0.026$. also find diameter if pipe corresponding to maximum efficiency of transmission	10
b) write short note on i. Moody's diagram ii. Major and minor losses	10

Q. No.	Marks
Q5) a) A normal shock wave occurs in a duct in which air is flowing at a Mach number of 1.5. The static pressure and temperature upstream of the shock wave is 1.5 bar and 270°C. Determine pressure, temperature and mach number downstream of the shock. Also calculate strength of shock	10
b) Explain Prandtl's mixing length theory	10
Q6) a) The velocity profile within a laminar boundary layer over a flat plate is given by the equation $u/U = 2(y/\delta) - (y/\delta)^2$ Where U is the mean stream velocity and δ is the boundary layer thickness . Determine the displacement thickness and momentum thickness	10
b) Explain i. Aerofoil theory ii. Reynolds Transportation theorem	10