Total No. of Printed Pages:3

SUBJECT CODE NO:- H-535
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECHANICAL)
Fluid Mechanics And Machines
(REVISED)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
1. Questions no.1 and 6 is compulsory.
2. Solve any two questions from section A and section B
3. Figures to the right indicate full marks.
4. Draw diagrams or graphs wherever required
5. Assume suitable data if necessary.

Section A

Q.1 Attempt any five of the following 10

1) One liter of crude oil weight 9.6N calculate its specific weight and density.
2) Define steady flow and Non- uniform flow.
3) Convert 30cm of oil column in N/m^2. Take specific gravity of oil 1.2.
4) Define convective and local accelerations.
5) What is buoyancy and center of buoyancy ?
6) If the surface tension at air water interface is 0.069 N/M, what is the pressure difference between inside and outside of an air bubble of diameter 0.009mm?
7) Define circulation.

Q.2 a) Find the total pressure and position of centre of pressure on a triangular plate of base 2m and height 3m which is immersed in water in such a way that the plane of the plate makes an angle of 60^o with the free surface of the water. The base of the plate is parallel to water surface and at a depth of 2.5m from water surface. 08

b) What is venturimeter? Derive an expression for the discharge through a venturimeter. 07

Q.3 a) i) Define and explain viscosity? State their unit for measurement of viscosity and kinematic viscosity. 04

ii) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720mm. The thickness of the oil film is 15mm. The upper plate which moves at 3m/s requires a force of 120N to maintain the speed. Determine 04

i) The dynamic viscosity of the oil.
ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.

b) A pipeline carrying oil of specific gravity 0.87 changes in diameter from 200 mm diameter at a position A to 500mm diameter at a position B which is A meters at a higher level. If the pressures at A and B are $9.81N/cm^2$ and 5.886 N/a respectively and the discharge is 200 liters/sec determine the loss of head and direction of flow. 07

Q.4 a) A solid cylinder 4m in diameter and 4m high is floating in water with its axis vertical. If its specific gravity is 0.6 find the metacentric height also state whether the equilibrium is stable or unstable and explain equilibrium condition of floating bodies. 07

b) State and derive the continuity equation in three- dimensions Cartesian coordinates. 08

Q.5 a) Define and explain briefly the following 07
i) Velocity potential ii) stream function
Also explain Relation between stream function and velocity potential

b) 360 liters per second of water is flowing in a pipe The pipe is bent by 120^o The pipe bent measures 360mm × 240mm and volume of the bend is $0.14m^3$ The pressure at the entrance is 73 KN/m^2 and the exit is 2.4m above the entrance section. 08

Section – B

Q.6 Attempt any five of the following 10

1) Define the term dimensional homogeneity with examples.
2) What are the characteristics of a boundary layer?
3) Define boundary layer thickness and displacement thickness.
4) Define an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
5) State hydraulic function of casing which is used for centrifugal pump.
6) Classify turbines according to direction of flow
7) What do you mean by net positive suction head (NPSH)?

Q.7 a) Obtain non karman momentum integral equation. 08

b) The velocity distribution in the boundary layer is given by $\frac{u}{U} = \frac{3}{2}\frac{y}{\delta} - \frac{1}{2}\frac{y^2}{\delta^2}$, δbeing boundary layer thickness. 07
Calculate the following
i) The ratio of displacement thickness to boundary layer thickness $[\frac{\delta^*}{\delta}]$
ii) The ratio of momentum thickness to boundary layer thickness $(\frac{\theta}{\delta})$

Q.8 a) The discharge Q of a centrifugal pump depends upon the mass density of fluid (P) the speed of the pump (N) the diameter of the impeller (D) the manometric head (H_m) and the viscosity of fluid (μ) show that 08

$$Q = ND^3\phi\left[\frac{\delta H}{N^2D^2}, \frac{\mu}{PND^2}\right] \; by\ using$$

Dimensional analysis

b) What are the advantages and applications of model testing Also explain similarities in model Analysis 07

Q.9 a) A single jet pelton wheel runs at 300nm under a head of 510m. The jet diameter is 200mm its deflection inside the bucket is 165^0 and its relative velocity is reduced by 15% due to friction determine 08

i) Water power
ii) Resultant force on the bucket
iii) Overall efficiency

Take : mechanical losses = 3% co-efficient of velocity = 0.98 and speed ratio = 0.46

b) Define specific speed of a centrifugal pump derive an expression for the same. 07

Q.10 Write short notes on any three of the following. 15

a) Draft tube
b) Non-dimensional numbers
c) Classification of turbines
d) Multi-stage centrifugal pump