Reg. No. : | | | | | | | | | | |

Question Paper Code: 31074

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

Third Semester

Mechanical Engineering

01UME304 – FLUID MECHANICS AND MACHINERY

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define viscosity. Specify its unit in SI & MKS systems.
2. Determine the surface tension acting on the surface of a vertical thin plate of 1m length when it is lifted vertically from a liquid using a force of 0.3*N*.
3. What is the importance of Reynolds number in pipe flow?
4. List few minor losses in flow through pipes.
5. State the principle of dimensional homogeneity.
6. List any two dimensionless parameters and their field of application.
7. Define specific speed for roto dynamic machines.
8. Narrate the significance of cavitation in hydraulic turbines
9. Define “slip” in reciprocating pump. What is percentage slip?
10. Compare positive displacement pumps with dynamic Pumps.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Explain the concept of Laminar & Turbulent flow. (8)

(ii) Check whether the following flows are (a) steady and (b) irrotational

(i) $u = 2y, v = -3x$, *(ii)* $u = 3xy, v = 0$, *(iii)* $u = -2x, v = 2y$. (8)

Or

(b) What are the gauge pressure and absolute pressure at a point 3 *m* below the free surface of a liquid having a density of 1.53 X 10^3 kg/m^3, if the atmospheric pressure is equivalent to 750 *mm* of mercury? The specific gravity of mercury is 13.6 and density of water is 1000 kg/m^3. (16)

12. (a) (i) List out the assumptions involved in Euler's equation of motion. Derive the Bernoulli equation from Euler's equation in the case of incompressible flow.(10)

(ii) A tap discharges water evenly in a jet at a velocity of 2.6 *m/s* at the tap outlet, the diameter of the jet at this point being 15 *mm*. The jet flows down vertically in a smooth stream. Determine the velocity and the diameter of the jet at 0.6 *m* below the tap outlet. (6)

Or

(b) (i) Derive Darcy–Weisbach equation for calculating pressure drop in the process of design of piping systems. (10)

(ii) Two pipes of 0.35 *m* and 0.25 *m* dia and length 2000 *m* and 1500 *m* with *f* values 0.021 and 0.018 connected in series carry water from a reservoir to a supply system, the head available being 8 *m*. Determine the flow quantity neglecting minor losses. (6)

13. (a) (i) Explain the step by step procedure for solving dimensional homogeneity using Buckingham π Theorem. (6)

(ii) The pressure drop ΔP in flow of incompressible fluid through rough pipes is found to depend on the length l, average velocity u, fluid density ρ, dynamic viscosity μ, diameter D and average roughness height e. Determine the dimensionless groups to correlate the flow parameters. (10)

Or

(b) (i) Discuss the need and importance of models and similitude. (6)

(ii) List the types of model studies and explain any one in detail. (10)

14. (a) A Pelton turbine running at 720 *rpm* uses 300 *kg* of water per second. If the head available is 425 *m*, determine the hydraulic efficiency. The bucket deflects the jet by 165°. Also find the diameter of the runner and jet. Assume $C = 0.97$ and $f = 0.46$, Blade velocity coefficient is 0.9. (16)

Or

(b) (i) Explain the various losses in centrifugal pumps. (6)

(ii) A homologus model of a centrifugal pump runs at 600 *rpm* against a head of 8 *m*, the power required being 5 *kW*. If the prototype 5 times the model size is to develop a head of 40 *m* determine its speed, discharge and power. The overall efficiency of the model is 0.8 while that of the prototype is 0.85. (10)

15. (a) (i) Explain the significance of net positive suction Head at cavitation conditions in pumps (8)

(ii) With a neat sketch explain the working of a torque converter. (8)

Or

(b) (i) What is indicator diagram in reciprocating pumps? (6)

(ii) A single acting reciprocating water pump of 180 *mm* bore and 240 *mm* stroke operates at 40 *rpm*. Determine the discharge if the slip is 8%. What is the value of coefficient of discharge. If the suction and delivery heads are 6 *m* and 20 *m* respectively determine the theoretical power. If the overall efficiency was 80%, what is the power requirement? (10)

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