GIET MAIN CAMPUS AUTONOMOUS,
GUNUPUR - 765022

Registration No: | | | | | | | | | | |

Total Number of Pages :2

B.TECH. DEGREE EXAMINATION-Nov-Dec.2018
End Semester Examination-III Semester
BMEPC3020-Fluid Mechanics and Hydraulic Machines
(Regulations 2017)(Mechanical Engineering)

Time : 3 Hours Maximum : 100 Marks Question Code:341412

Answer ALL Questions

PART-A (10 X 2=20 Marks)

1. (a) A fluid is said to be ideal, if it is
(a) incompressible (b) inviscous (c) viscous and incompressible (d) inviscous and incompressible [CO1][PO1]

(b) A body floats in stable equilibrium
(a) when its metacentric height is zero (b) when the meta centre is above C.G.. [CO1][PO1]
(c) when its e.g. is below it's center of buoyancy
(d) meta centre has nothing to do with position of C.G. for determining stability

(c) A hydraulic press has a ram of 15 cm diameter and plunger of 1.5 cm. It is required to lift a weight of 1 tonne. The force required on plunger is equal to [CO3][PO2]
(a) 10 kg (b) 100 kg (c) 1000 kg (d) 1 kg

(d) For pipes, laminar flow occurs when Reynolds number is
(a) less than 2000 (b) between 2000 and 4000 (c) more than 4000 (d) less than 4000 [CO2][PO2]

(e) Pitot tube is used for measurement of
(a) pressure (b) flow (c) velocity (d) discharge [CO2][PO1]

(f) The function of draft tube is to
a. increase the pressure of the exiting fluid b. increase the Kinetic energy of exiting fluid c. allow the turbine to be set below tail water level d. keep pressure at runner outlet above the atmospheric pressure [CO3][PO1]

(g) A Pelton wheel develops 1750 kW under a head of 100 metres while running at 200 r.p.m. and discharging 2500 litres of water per second. The unit power of the wheel is [CO3][PO1]
a. 0.75 kW b. 1.75 kW c. 0.25 kW d. 3.75 kW

(h) Which of the following turbine is preferred for 0 to 25 m head of water?
a. Francis turbine b. Pelton wheel c. Kaplan turbine d. none of these [CO3][PO1]

(i) Overall efficiency of a centrifugal pump is the ratio of a. Energy available at the impeller to the
a.energy supplied to the pump by the prime mover
b. Actual work done by the pump to the energy supplied to the pump by the prime mover
c. Energy supplied to the pump to the energy available at the impeller
d. Manometric head to the energy supplied by the impeller per Newton of water

(j) A centrifugal pump having an impeller of 10 cm diameter discharges 40 litre/second when running at 1000 rpm. The corresponding speed of a geometrically similar pump having an impeller of 40 cm diameter and $0.8 m^3/s$ discharge will be [CO4][PO2]
a. 276.4 rpm b. 298.3 rpm c. 312.5 rpm d. 358.2 rpm

PART-B (10 X 2=20 Marks)

2. (a) What are the conditions of equilibrium of a floating body and a submerged body? [CO1][PO1]
(b) Differentiate between Newtonian and Non- Newtonian fluid. [CO1][PO1]
(c) Define and explain Newton's law of viscosity. [CO1][PO1]
(d) Define Mach number. Define its importance with respect to fluid compressibility. [CO2][PO1]
(e) Distinguish between 1-dimensional, 2-dimensional and 3-dimensional flow. Give sketches. [CO2][PO1]
(f) State Bernoulli's theorem for steady and incompressible flow. [CO3][PO1]
(g) Define TEL and HGL. [CO3][PO1]
(h) Differentiate between impulse turbine and reaction turbine with an example of each. [CO4][PO1]
(i) What do you mean by governing of a turbine? [CO4][PO1]
(j) What do you mean by the overall efficiency of a turbine? [CO4][PO1]

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PART-C (4 X 15=60 Marks)

3. (a) (i) Derive expression for capillary rise. [5][CO1][PO2]

(ii) A tank with vertical sides is 1.5m x1.5m x 1.5m deep. It contains water for the lower 0.6m depth. The upper remaining part is filled with oil of relative density 0.9. Calculate i) the total pressure on one vertical side of the tank ii) the position of the center of pressure for one vertical side [10][CO1][PO2]

(or)

(b) (i) A solid cylinder of diameter 5m has a height of of 5m. Find the Meta centric height of the cylinder if the specific gravity of the material of cylinder is 0.7 and it is floating in water with the axis vertical. State whether the equilibrium is stable or unstable. [5][CO1][PO2]

(ii) A cylinder of 150mm radius rotates concentrically inside a fixed cylinder of 155mm radius. Both cylinders are 300mm long. Determine the viscosity of the liquid which fills the space between the cylinders if a torque 0.98 Nm is required to maintain an angular velocity of 60 rpm. [10][CO1][PO2]

4. (a) (i) The two dimensional stream function for a flow is y = 9+6x-4y+7xy. Find the velocity potential function f. [5][CO2][PO2]

(ii) Write short notes on [10][CO2][PO1]

a.Steady and Unsteady flow b. Uniform and Non- Uniform flow

c. Rotational and Irrotational flow d. Laminar flow and Turbulence flow

e. Eulerian analysis of fluid kinematics

(or)

(b) (i) Define the equation of continuity. Obtain the expression for continuity equation for a three dimensional flow. [5][CO2][PO2]

(ii) An idealized flow is given by V = 2x3i - 3x2y j. is the flow Steady or Unsteady? Is it two dimensional or three- dimensional flow? Make calculation for velocity, local acceleration and convective acceleration of a fluid particle in this flow fluid at point P (2, 1, 3). [10][CO2][PO2]

5. (a) (i) What is degree of reaction? [5][CO4][PO1]

(ii) Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW. It is working under a head of 7.62 m. peripheral velocity is 0.26 sqrt2 gH and the redial velocity of flow at inlet is 0.96 sqrt2 gH. turbine rotates at 150 rpm and hydraulic losses in the turbine is 22% of available energy. Assume radial flow discharge and calculate Discharge and overall efficiency. [10][CO4][PO2]

(or)

(b) (i) Prove that the work done per second per unit weight in a reaction turbine is given as: 1/g (VW1U1 _ VW2 U2) where VW1 , VW2 = velocities of whirl at inlet and outlet respectively.U1, U2=peripheral velocities at inlet and outlet respectively [5][CO2][PO2]

(ii) A Kaplan turbine develops 6500KW under ahead of 6m. The velocity of flow through the runner is 6.5 m/s. the diameter of the boss is 0.35 times the external diameter. The vane tips have a velocity of 22 m/sec. the overall efficiency is 85%. Determine the diameter of the runner and specific speed of the turbine. [10][CO2][PO1]

6. (a) (i) Explain with neat diagram the working of a single stage centrifugal pump. [5][CO4][PO1]

(ii) A centrifugal pump having impeller diameter of 1m, has backward curved vanes which makes an angle of 250 with the wheel tangent at the blade tip. At the operational speed of 1440rpm, the radial velocity of flow at the tip is 10 m/sec. determine i) actual work input per kg of water flow ii) absolute velocity of fluid at the impeller tip iii) manometric efficiency considering the kinetic energy at the outlet is wasted. [10][CO4][PO2]

(or)

(b) (i) What is NPSH of a centrifugal pump? Why it is necessary to maintain NPSH? [5][CO4][PO1]

(ii) With neat sketch analyse the indicator diagram of Reciprocating pump [10][CO4][PO1]

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