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Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE (2K SCHEME) EXAMINATION, MARCH 2013

EE 2K 403 – MECHANICAL ENGINEERING – III

(2K Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Calculate the specific weight, density and specific gravity of one litre of liquid weighs 7 N.

(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 1.53×10^3 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 = 1000 kg/m^3.

(c) What do you mean by characteristics curves of a turbine? Discuss different operating characteristic curves for reaction turbines.

(d) Define Cavitation and causes for creating cavitation. Mention the effects of cavitation and methods of its prevention.

(e) What do you mean by critical radius of insulation? Explain it with help of material and surface resistances.

(f) What is black body? What are its properties? Why does a cavity with a small hole behave as a black body?

(g) What do you mean by the term psychrometry? When dehumidification of air is necessary and how it is achieved?

(h) Explain sinking fund method of depreciation.

(8 × 5 = 40 marks)

II. (a) A vertical sluice gate is used to cover an opening in a dam. The opening is 2 m wide and 12 m high. On upstream side of the gate, liquid of specific gravity 1.3 lies up to 2 m above the top of the gate, where as on the downstream side, water is available up to the height touching the top of the gate. Find the net force acting on the gate and its position? Find also the force acting horizontally at the top of the gate which can open it? Assume the gate is hinged at the bottom

Or

(b) Water is flowing over a flat plate 2 m × 1.5 m with a velocity of 0.2 m/sec. Find the thickness of boundary layer and shear stress at 1.4 m from the leading edge of the plate? The flow is parallel to 2 m side. Take $\rho = 1000$ kg/m^3 and $\mu = 0.01$ poise for water. Also find the total drag force on one side of the plate?

Turn over

III. (a) A single jet Pelton wheel develops 1.69 MW power. When the gross-head available is 360 m and running at 560 R.P.M. The water is supplied through a penstock which is 1200 m long. Take $C_v = 0.98$, f (friction factor for penstock) = 0.02, $\eta_h = 85\%$. The head lost in penstock is 12 m of water. Draw the velocity triangles and find out (i) Quantity of water supplied to the turbine ; (b) Diameter of nozzle ; and (c) Diameter of penstock.

Or

(b) Using Buckingham Π theorem, show that the velocity passing through an orifice is given by :

$$v = \sqrt{2gh}\, f\left(\frac{\rho v H}{\mu}, \frac{d}{H}\right).$$

IV. (a) A pipe, 4 cm in outer diameter is maintained at uniform temperature at T_1 and is covered with an insulation (k = 0.20 W/m K) in order to reduce the heat loss. The heat is dissipated from the outer surface of insulation into an ambient $T\infty$, with heat transfer coefficient of 8 W/m^2 K. Determine the thickness of insulation at which the heat dissipation rate would be the maximum. Calculate the ratio of the heat loss from the outer surface of insulated pipe and that of from bare pipe for thickness of insulation equal to critical radius and the thickness of insulation is 2.cm thicker than the critical radius.

Or

(b) The local atmospheric pressure at Mahableshwar hill station in Maharashtra (1610 m from sea level) is 83.4 kPa. Air at this pressure and 20° C flows with a velocity of 8 m/s over a 1.5 m × 6 m flat plate whose temperature is 134° C. Determine the rate of heat transfer from the plate if the air flows parallel to 6 m long side, and the 1.5 m side.

V. (a) (i) Show the following processes on the skeleton psychrometric chart. Dehumidification of moist air by cooling, and adiabatic mixing of two streams.

(ii) Draw a line diagram of air conditioning required in winter season. Explain the working of different components in the circuit.

Or

(b) The loads on a power plant with respect to time for 24 hours are given below :

Time (hous)	0 – 6	6 – 8	8 – 12	12 – 14	14 – 18	18 – 22	22 – 24
Load (MW)	40	50	60	50	70	80	40

Draw the load curve and find out the load factor of the power station. If the loads above 60 MW are taken by a standby unit of 20 MW capacity, find out the load factor and the use factor of the standby unit.

(4 × 15 = 60 marks)