P4254

[4860]-1050

M.E. (Civil) (Water Resources and Environmental Engineering)
ENVIRONMENTAL HYDRAULICS AND ENVIRONMENTAL STRUCTURES
(2013 Credit Pattern) (Semester - II)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer any 5 questions.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of electronic pocket calculator, logarithmic table, slide rule, mollier charts and steam table is allowed.*
5) *Use IS Code 456 and IS Code - 1893 - (Part - I) - 2002.*

Q1) a) Explain the working of wind pump with figure. **[4]**

b) Axial flow compressor is design 55% reaction with inlet and outlet angle for rotor blade is $81°$ and $45°$ measured axially. The mean speed of blade is 375 m/s and axial velocity of flow is constant throughout. Assume W.F. = 0.9 Determine the number of stage if pressure ratio is 8 : 1 with isentropic efficiency 82%. The stagnation inlet temperature is 450 K Take Gama = 1.3, R = 286 NM/kg $°K$ Cp = 1.004 kJ/kg $°K$. **[6]**

Q2) a) Compare the performance of centrifugal compressor. **[4]**

b) A pump supplies oil at 200 lit/min to 50mm diameter double acting cylinder. the rod diameter is 20 mm and the load acting on the cylinder during extension and retraction is 8 kN. Find the hydraulic pressure, piston velocity and the cylinder power during extension and retraction store.**[6]**

Q3) a) Explain the working of LVDT. **[4]**

b) Explain working of thermocouple and working of RTD with figure. **[6]**

Q4) A four story RCC Frame structure is use for carrying pipe line in plant situated in Zone IV. The height of each floor is 3.5 meter and total height of RCC structure is 14 meter. The dead load and live load on each floor are as follows, On First Floor = 3500 kN, On Second Floor = 3400 kN, On Third Floor = 3400kN, On Fourth Floor = 2500 kN respectively. The soil below foundation is assumed to be hard rock. Find out total base shear as per IS Code - 1893 - (Part - I) - 2002. **[10]**

Q5) Determine EBCT, Mass of GAC, Volume of water to treated for the following data, Volume of GAC used = 20 cum. Meter, Volumetric flow rate = 1600 lit/min., Initial and final concentration of pollutant is 8 mg/ lit and 0.07 mg/lit. Freundlich Capacity Factor = 24(mg/gm) (Lit/mg)1/n, and intensity parameter n = 0.8. **[10]**

Q6) a) A closed vessel is to be design to withstand internal pressure of 65 MPa having inside diameter of 500mm Following properties may be assumed Yield Strength = 300 MPa, 'Ultimate Tensile strength = 510 MPa, Poission ratio = 0.4, Estimate wall thickness on the basis of, **[5]**
   i) Maximum Principle Stress Theory
   ii) Maximum Shear Stress Theory

b) An air receiver of a cylindrical portion of 2.5 meter length and 1.3 meter in diameter. It is closed by hemispherical ends. The pressure is not exceeding 4 N/mm². If the material is stress having yield point 270 N/mm² and if factor of safety is 2.5 used. Find the required thickness of the cylinder and thickness of hemispherical shape cylinder, assume joint efficiency for both cylinder is 0.8. **[5]**

Q7) a) Determine only forces acting on a circular water tank for following data Height of tank is 5 meter, Capacity of tank 4000 cum meter, grade of concrete and steel is M20 and Fe 250. Take axial and compressible stress in concrete as 1.2 MPa and 7 MPa. Use IS code 456. **[5]**

b) Determine area and depth of foundation of square column carrying load of 1200 kN vertical. The SBC of soil is 110 kN/M², density of soil is 25 kN/ m³, angle of repose = 32°. **[5]**

Q8) A pressure vessel consist of a cylindrical shell of inside diameter 1600 mm. Which is closed by torispherical head with a crown radius of 1200 mm. The operating pressure inside the cylinder is 4 MPa. The yield strength of the material is 320 MPa. The corrosion allowance is 2.5 mm and weld efficiency is 82%. Determine the thickness of cylindrical shell and the torispherical head. **[10]**

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