Register Number: …………………

B.E. DEGREE EXAMINATIONS: APRIL/MAY 2010

Second Semester

(Common to B.E – Electrical and Electronics Engineering and Electronics & Instrumentation Engineering)

U07CE204: Fluid and Solid Mechanics

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 * 1 = 10 Marks)

1. The ratio of the specific weight of liquid to the specific weight of standard fluid is known as

   A. Specific Volume B. Weight Density C. Specific Gravity D. Viscosity

2. The fundamental S.I unit of pressure is N/m^2, this is also known as

   A. Pascal B. Stroke C. Poise D. None of the above

3. A Venturimeter is used for measuring:

   A. Pressure B. Flow rate C. Total Energy D. Piezometric Head

4. Darcy-Weisbach equation is used to find loss of head due to

   A. Sudden enlargement B. Sudden Contraction C. Friction D. None of the above

5. Specific speed of impulse turbine ranges from

   A. 12 to 70 B. 80 to 400 C. 300 to 1000 D. 1000 to 1200

6. Modulus of elasticity is defied as the ratio of

   A. Shear stress to shear strain B. Linear stress to linear strain

   C. Linear strain to lateral strain D. Lateral strain to linear strain

7. Poisson's ratio for aluminum is

   A. 0.13 B. 0.23 C. 0.33 D. 0.43

8. The ratio between the change in volume and original volume of the body is called strain

   A. Tensile B. Compressive D. Shear D. Volumetric

9. A member under tension is called

   A. Strut B. Tie C. Strut-tie D. None

10. A frame in which the number of members is less than $(2j - 3)$ is known as

   A. Perfect frame B. Deficient frame C. redundant frame D. None

PART B (10 x 2 = 20 Marks)

11. State Pascal's Law

12. Differentiate Cohesion from Adhesion

13. What are the basic assumptions made in deriving Bernoulli's theorem?

14. Define and explain the terms (i) Hydraulic gradient line (ii) Total energy line

15. Differentiate Impulse turbine from Reaction Turbine with examples

16. Define Poisson's ratio

17. A steel rod of 20 mm diameter and 1 m long is subjected to an axial pull of 50 KN. Determine elongation of the rod taking the Young's modulus $E = 2 * 10^5 \; N/mm^2$.

18. Define (a) Shear force (b) Bending moment at a section of the loaded beam.

19. Write any two important assumptions in simple theory of bending.

20. A steel shaft transmits 560 KW power at 200 rpm. Calculate the torque induced in it.

PART C (5 x 14 = 70 Marks)

21. (a) (i) A Newtonian fluid is filled in the clearance between a shaft and a concentric sleeve. The sleeve attains a speed of 50 cm/s, when a force of 40N is applied to the sleeve parallel to the shaft. Determine the speed of the shaft, if a force of 200N is applied. (8)

(ii) Calculate the capillary effect in a glass tube 5 mm diameter, when immersed in (1) water and (2) mercury. The surface tension of water and mercury in contact with air are 0.0725 N/m and 0.51N/m respectively. The angle of contact of mercury is 130^o. (6)

(OR)

(b) (i) The space between two square parallel plates is filled with oil. Each side of the plate is 75cm. The thickness of the oil film is 10mm. The upper plate which moves 3 m/s requires a force of 100N to maintain the speed. Determine:

(1) The dynamic viscosity of the oil.

(2) The kinematic viscosity of the oil, if the specific gravity of oil is 0.9. (7)

(ii) Differentiate between absolute pressure and gauge pressure and give suitable sample conversion. (7)

22. (a) (i) Water is flowing through a tapering pipe of length 200m having diameters 500mm at the upper end and 250 mm at the lower end, the pipe has a slope of 1 in 40. The rate of flow through the pipe is 250 litre/sec. The pressure at the lower end and at the upper end is 20 N/cm^2 and 10 N/cm^2 respectively. Determine the loss of head and direction of flow. (7)

(ii) A horizontal pipe of 400 mm diameter is suddenly contracted to a diameter of 200mm. The pressure intensities in the large and small pipe is given as 15 N/cm^2 and 10 N/cm^2 respectively. Find the loss of head due to contraction, if C_c = 0.62, determine also the rate of flow of water. (7)

(OR)

(b) (i) Derive Euler's equation of motion. From that derive Bernoulli's equation stating clearly the assumption made. (7)

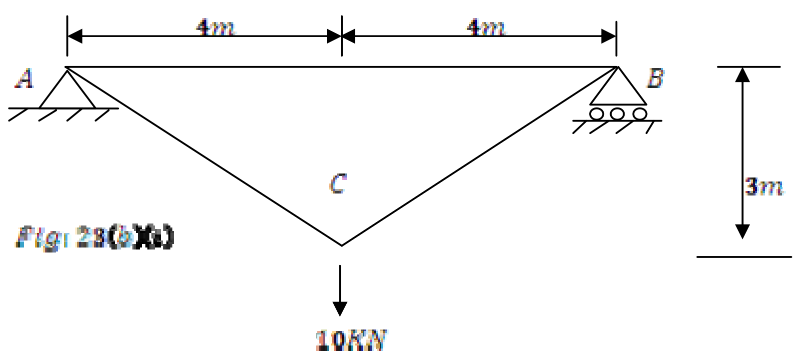
(ii) Water is flowing through a pipe 300mm in diameter at a velocity of 5 m/sec. The pressures at two points in the flow are 245.3 KN/m^2 and 196.2 KN/m^2 respectively. The datum heads at A and B are 12 m and 14m. Determine the direction of flow and loss of head between A and B. (7)

23. (a) (i) Derive the expression for specific speed of a turbine and hence classify the turbine given the following conditions: Power=7260KW, Head = 25m and speed =110rpm. (7)

(ii) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke length is 300 mm. The pump runs at 50 rpm and lift water through a height of 35 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2 litre/sec. Find the percentage of slip. (7)

(OR)

(b) (i) Compute the forces in all the members of truss shown in Fig. Q 23. (b)(i) (7)



(ii) An element in a stressed material has tensile stress of 500 MN/m^2 and a compressive stress of 350 MN/m^2 acting on two mutually perpendicular planes and equal shear stresses of 100 MN/m^2 on these planes. Find principle stresses and position of the principle planes. (7)

24. (a) (i) A simply supported beam of span 6 m is carrying a uniformly distributed load of 2 KN/m over the entire span. Calculate the magnitude of shear force and bending moment at every section, 2m from the left support. Also draw shear force and bending moment diagrams. (7)

(ii) A timber cantilever beam is 200 mm wide and 300mm deep is 3m long. It carries a point load of 5 KN at its free end. Find the maximum bending stress induced at a distance 2 m from the free end. (7)

(OR)

(b) (i) A cantilever beam of span 4 m carries point loads of 1KN, 2KN and 4KN at 1m, 2m and 4m from the fixed end. Draw the shear forces and bending moment diagrams. (7)

(ii) A steel plate of width 60mm and thickness 10 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and bending moment which will produce the maximum stress. Assume the modulus of elasticity of steel as $2*10^5$ N/mm^2. (7)

25. (a) (i) Find the maximum shear stress induced in a solid circular shaft of diameter 200 mm when the shaft transmits 190 KW power at 200 rpm. (7)

(ii) A close coiled helical spring is to carry an axial load of 1KN. Its mean coil diameter is to be 10 time that of wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring are 90 N/mm^2. (7)

(OR)

(b) (i) A hollow shaft is to transmit 300 KW at 80 rpm. If the shear stress is not to exceed $60 * 10^6 \, N/m^2$ and internal diameter is 0.6 of the external diameter, find the external and internal diameters assuming that the maximum torque is 1.4 times the mean. (7)

(ii) A helical spring is made of 12mm diameter steel wire wound on a 120 mm diameter mandrel. If there are 10 active coils, what is spring constant? Take: $Modulus\ of\ Rigidity\ C = 82 * 10^9 \, N/m^2$. What force must be applied to the spring to elongate it be 40 mm. (7)

****