M 18198

Reg. No. : .....

Name : .....

Third Semester B.Tech. Engg. Degree Regular / Supplementary Examination, November 2010

PT 2K6/2K6 ME 303 : MECHANICS OF SOLIDS

Time : 3 Hours Max. Marks : 100

Instruction : *Answer* ***all*** *the questions.*

I. a) Plot the stress-strain graph for mild steel and show the different points :

i) Yield point ii) Proportionality limit

iii) Ultimate point iv) Fracture point 5

b) Define Hook's law, St Venant's principle and Poisson's ratio. 5

c) Define 'Polar modulus of section and obtain 'Polar modulus of section' for circular solid and hallow sections. 5

d) Write a note on different types of supports and loads of a beam. 5

e) Define 'section modulus' and obtain for 'I' section and circular section. 5

f) State the assumptions that are considered during deriving the equation on 'theory of pure bending'. 5

g) A circular bar of diameter 25 mm is subjected to an axial load of 20 kN as shown in the figure (i). Find the stress on the plane making 30° to the plane of axial stresses and also on the plane which has maximum shear stress. 5

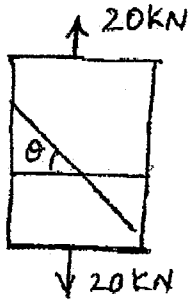


Fig. (i)

h) Define slenderness ratio and what are the limitations of Euler's theory. 5

P.T.O.

II. 1) i) A specimen of steel 25 mm diameter with gauge length of 200 mm is tested to destruction. It has an extension of 0.16 mm under a load of 80 kN and the load at elastic limit is 160 kN. The maximum load is 180 kN. The total extension at fracture is 56 mm and diameter at neck is 18 mm. Find :

a) The stress at elastic limit

b) Young's modulus

c) Percentage elongation

d) Percentage reduction in area

e) Ultimate tensile stress. **7**

ii) Obtain the relation between Young's modulus and modulus of rigidity and Young's modulus and Bulk modulus. **8**

OR

2) i) A steel rail is 12.6 m long and is laid at a temperature of 24°C. The maximum temperature expected is 44°C.

a) Estimate the minimum gap between two rails to be left so that temperature stresses do not develop.

b) Calculate the thermal stresses developed in the rails if,

i) No expansion joint is provided.

ii) If a 2 mm gap is provided.

c) If the stress developed is 20 MN/m^2, what is the gap left between the rails ?

(Take $E = 2 \times 10^5$ MN/m^2 and $\alpha = 12 \times 10^{-6}$ /°C. **7**

ii) A uniform round bar 24.5 mm diameter, when subjected to an axial tensile force 56.6 kN undergoes a change in diameter by 0.0042 mm. Taking modulus of rigidity as 80 GPa, determine Poisson's ratio and Young's modulus. **8**

III. 1) i) Derive the torque equation $\frac{T}{J} = \frac{z}{r} = \frac{G\theta}{L}$

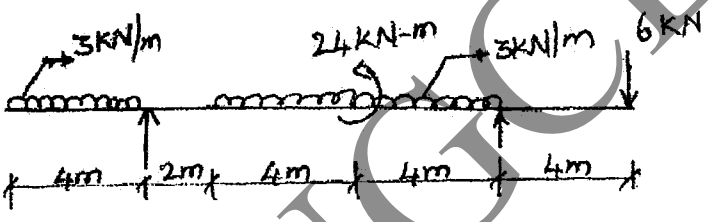
where T = torsional moment z = shear stress
J = Polar moment of inertia G = modulus of rigidity
r = distance of element from the centre of the shaft
θ = angle of twist
L = length of the shaft. **10**

ii) Obtain the equation for power transmitted by a shaft subjected to a torque T and rotated at N revolutions per minute. **5**

OR

2) i) Draw the bending moment and shear force diagram for the beam shown in the fig.

ii) Indicate the salient values on the diagrams. **15**



IV. 1) i) A beam with rectangular section ot width 60 mm and depth 120 mm is subjected to hogging bending moment of 12 kN-m. Determine maximum bending stress induced in the section and draw the bending stress distribution along the depth of the section. **7**

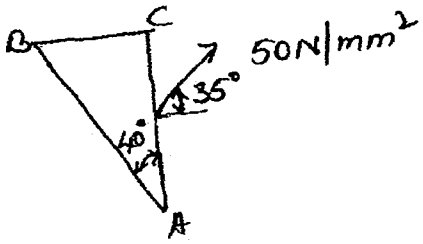
ii) Derive the relationship, $\sigma = \frac{My}{I}$, the flexure formula, for pure bending of beams. **8**

OR

2) i) Derive the expression $M = EI\frac{d^2y}{dx^2}$ for beams subjected to bending. **8**

ii) Show that for a rectangular beam maximum shear stress at the neutral axis is 1.5 times the average shear stress. **7**

V. 1) i) At a point in the vertical cross-section of a beam, there is a resultant stress of 50 N/mm^2, which is inclined upwards at 35° to the horizontal. On the horizontal plane through the point, there is only shearing stress. Find the magnitude and direction of the resultant stress on a plane AB which is inclined at 40° to the vertical as shown in the fig. **12**



ii) Define 'principal plane' and 'principal stress'. **3**

OR

2) i) A 2 m long pin ended column of square cross-section is to be made of wood. Assume E = 12 GPa and allowable stress being limited to 12 MPa. Determine the size of the column to support the following loads safely.

a) 95 kN

b) 200 kN

Use factor of safety of 3 and Euler's Crippling load for buckling. **15**

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Third Semester B.Tech. Engg. Degree (Regular/Supplementary) Examination, November 2010

PT 2K6/2K6 ME 304 : ELECTRICAL MACHINES

Time: 3 Hours Max. Marks: 100

Instruction : *Answer* ***all*** *questions.*

I. 1) Derive the emf equation of a D.C. machine.

2) What do you mean by back emf of a D.C. motor and what is its significance ?

3) List the losses taking place in a transformer.

4) Explain the principle of torque production in a 3 phase induction motor.

5) Explain the necessity of iterates for a 3 phase induction motor.

6) Write explanatory note on permanent magnet stepper motor.

7) List and explain the advantages of electrical drive system.

8) Define latching current and holding current of S.C.R. **(5×8=40)**

II. 1) Explain the concept of armature reaction in a D.C. generator. **9**

2) A 4 pole motor has a wave connected armature with 888 conductors. The brushes are displaced backward through 5 angular degrees (mechanical) from the geometric neutral. If the total armature current is 90 A, calculate the cross and back ampere turns per pole. **6**

OR

3) Explain the characteristics of a d.c. shunt motor. What are the application of shunt motor ? **7**

4) A 10 hp, 230 V shunt motor has an armature circuit resistance of 0.5 ohm and a field resistance of 115 Ω. At no load and rated voltage the speed is 1,200 rpm and the armature current is 2 A. If the load is applied the speed drops to 1100 rpm. Determine the armature current, line current and the torque developed. **8**

P.T.O.

III. 1) Compare the weight of copper used in a 2 winding transformer and an autotransformer. **6**

2) Find all day efficiency of a transformer having Max. efficiency of 98% at 15 kVa at unity power and loaded as follows :
12 hours : 2 kW at 0.5 pf. lag
6 hours : 12 kW at 0.8 pf. lag
6 hours : No load. **9**

OR

3) Derive the Torque slip characteristics of a 3 phase induction motor. **7**

4) The power input to a 500 V, 50 Hz, 6 pole, 3 phase squirrel cage induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW, and the friction and windage losses are 2 kW. Calculate :
i) slip ii) rotor copper loss
iii) brake hp and iv) the efficiency. **8**

IV. 1) Explain with a neat sketch the construction and principle of auto transformer starting for a 3 phase induction motor. **8**

2) A 12 kW, 3 phase, 6 pole, 50 Hz, delta connected induction motor runs at 960 rpm on full load. If it takes 85 A on direct starting find the ratio of starting torque to full load torque with a star-delta starter. Full load efficiency and power factor are 88% and 0.85 respectively. **7**

OR

3) Explain a method of synchronizing alternate with bus bars. **8**

4) From the following test results, determine the voltage regulation of a 2 kV single phase alternater, delivering a current of 100 A at 0.8 pf leading.

Test results : full load current of 100 A is produced on short circuit by a field excitation of 2.5 A. An emf of 500 V is produced on open circuit by the same field current. The armature resistance is 0.8 Ω. **7**

V. 1) Discuss about the factor effecting the choice of electrical drives. **8**

2) Explain about the nature and classification of load torque. **7**

OR

3) Draw the symbol and input-out characteristics of a BJT, MOSFET and IGBT. **7**

4) Explain slip power recovery scheme of speed control of an induction motor. **8**

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Third Semester B.Tech. Engg. Degree (Regular/Supplementary) Examination, November 2010

PT 2K6/ 2K6 ME 305 : FLUID MECHANICS

Time : 3 Hours Max. Marks : 100

Instructions : *i) Answer* ***all*** *questions.*
ii) Missing data ***if any*** *may be suitably* ***assumed.***

1. a) With the help of graph for shear stress V/S velocity gradient, explain different types of fluids.
   b) Explain the stability criteria for submerged bodies.
   c) What do you mean by hydraulic gradient line and total energy line ? Explain.
   d) Sketch and explain the principle of venturimeter.
   e) Define velocity potential function and stream function, and establish relationship between them.
   f) Discuss approximate and enact solutions of Navier Stokes equation.
   g) Define and give equations for displacement thickness and momentum thickness.
   h) Sketch and explain the effect of pressure gradient on boundary layer separation. **(8×5=40)**

2. a) A cubical block of sides 1 m and weighing 350 N slides down an inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5 vertical to 12 horizontal and has an oil film of 1 mm thickness. Calculate dynamic viscosity of oil, in poise. **8**
   b) State and prove hydrostatic law. **7**

   OR

   c) Derive the equation for total pressure and position of centre of pressure for an inclined submerged surface. **10**
   d) What percentage of an iceberg floats visibly above the sea level, if the density of iceberg is 900 kg/m^3 and density of the sea water is 1020 kg/m^3 ? **5**

P.T.O.

3. a) A 45° reducing bend is connected in a pipe line. The diameter at inlet and outlet of the bend being 60 cm and 30 cm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 9.5 N/cm^2 and rate of flow of water is 620 lits/sec. **8**

b) A pump has tapering pipe running full of water. The pipe is placed vertically with the diameter at the base and top being 4.5 m. and 0.75 mt respectively. The pressure at the upper end is 250 mm of Hg(vacuum) while the pressure at the lower end is 18 kN/m^2. Assuming head loss to be 25% of the difference in velocity head, calculate the discharge. The flow is vertically upwards and difference of elevation is 4 mt. **7**

OR

c) An orifice meter consisting of 100 mm diameter orifice in a 250 mm diameter pipe has a coefficient of discharge equal to 0.65. The pipe delivers oil (sp. gr. 0.8). The pressure difference on the two sides of the orifice plate is measured by a mercury oil differential manometer, which reads 800 mm of mercury. Calculate the rate of flow in liters/s. **5**

d) Derive Hagen Poiseuille formula from the fundamental. **10**

4. a) Derive three dimensional continuity equation in rectangular coordinates. Also state the assumptions. **8**

b) The velocity potential function is given by the expression

$\phi = \frac{-xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$. Find :

i) The velocity components in x and y directions.

ii) Show that ϕ represents a possible case of flow. **7**

OR

c) A stream function is given by the expression $\psi = 2x^2 - y^3$. Find the components of velocity and resultant velocity of a point P(4, 2). Also determine the value of velocity potential function at this point. **10**

d) Write a note on Computational Fluid Dynamics (CFD). **5**

5. a) Assuming that the velocity distribution in the boundary layer is given by

$$\frac{u}{U}=\left(\frac{y}{8}\right)^{1/7}.$$

Calculate $\frac{\delta^*}{\delta}, \frac{\theta}{\delta}$, and $\frac{\delta_E}{\delta}$

(where δ – boundary layer thickness

δ^* – displacement thickness

θ – Momentum thickness

δ_E – Energy thickness)

If at a certain section free stream velocity U was observed to be 10 m/s and thickness of boundary layer as 25 mm, calculate the energy loss per meter length due to formation of boundary layer. Take $\rho = 1.226$ kg/m^3. **15**

OR

b) Define the terms 'Drag' and 'Lift'. Also derive the expressions for them, in case of a solid bodys placed in a real fluid. **10**

c) A television transmitter antenna consists of a vertical pipe 20 cm diameter and 30 m high on top of a tall structure. Determine the total drag force on the antenna and bending moment about the base in a 30 m/s wind. Density of air is 1.22 kg/m^3 and viscosity of air is 17.9×10^{-6} Pa.S. Take coefficient of drag as 0.2. **5**

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Third Semester B.Tech. Engg. Degree (Regular/Supplementary) Examination, November 2010

PT 2K6/2K6 ME 306 : METALLURGY AND MATERIAL SCIENCE

Time: 3 Hours Max. Marks: 100

PART – A

Answer **all** questions in Part **A**. **All** questions carry **five** marks **each**.

1. a) For a FCC unit derive a relation between atomic radius and lattice side.
   b) What is Bragg's law ? Explain its use.
   c) Explain the mechanism of Frank Reed source for dislocation generation.
   d) For a atomic pair, explain how potential energy and interaction force varies as a function of separation distance.
   e) Neatly sketch Fe – Fe_3C phase diagram and label completely.
   f) Distinguish between annealing and quenching. Compare their microstructures and mechanical properties.
   g) What is meant by high speed steel ? What are its ingredients ? What are the important properties ?
   h) What is Brass ? Name two important types of Brass. Name one application each.

PART – B

2. a) Classify engineering materials into various groups. List out important properties of each group. 7
   b) What is meant by 'ASTM grain size number' ? If ASTM grain size number is 3, how many grains will be there in a unit area ? 5
   c) For an atom forming FCC and BCC units, what are the coordination number ? 3

OR

3. a) For a FCC unit, identify (110) (111) (210) [111] [100] [112]. 7

   b) What is meant by a bond ? Explain various types of bonds. 8

4. a) What is a dislocation ? What are the types ? Distinguish them. 6

   b) What are the Hume-Rothery rules ? List them 5

   c) Give a schematic structure of a cast ingot. Show all possible types of structures. 4

   OR

5. a) Distinguish between homogeneous and heterogeneous nucleation. Give examples. 5

   b) Draw a schematic stress-strain plot for mild steel. Identify elastic region, yield point, strain hardening region, ultimate tensile strength, breaking strength, modulus of toughness, modulus of stiffness. 8

   c) State Fick's first law of diffusion. Where it is applicable ? 2

6. a) Draw Cu – Ni equilibrium phase diagram. What type of phase diagram this is ? 3

   b) What is a solder material ? What type of phase diagram this system shows ? 3

   c) Explain carburising and nitriding treatments for steels. 9

   OR

7. a) What is fatigue ? Explain microscopic theory of fatigue damage. 7

   b) What are the factors promoting factor ? Explain. 8

8. a) What are the special properties required for a tool steel ? 6

   b) What do you mean by 18-8 stainless steel ? What is its use ? 3

   c) Write a note on applications of aluminium alloys. 6

   OR

9. a) With respect to stainless steels what do you mean by sensitisation ? 6

   b) Distinguish between grey cast iron, white cast iron and spheroidal graphite cast iron. Give one applications for each. 6

   c) Write a note on materials with medical applications. 3