FACULTY OF ENGINEERING AND TECHNOLOGY

S.E.(Mech/Prod)Examination - Dec – 2014

Strength of Materials (Revised)

[Time: THREE *Hours*]   [Max. Marks: 80]

"Please check whether you have got the right question paper."

N.B
1) Q no 1 & Q no 6 are compulsory.
2) Attempt any two questions out of the remaining questions of the section A & section B each respectively.
3) Assume suitable data if necessary. & state it clearly.

SECTION A

Q.1   Attempt any five   10
   a) Define strength of materials.
   b) Draw stress strain curve for ductile material.
   c) State the maximum shear force induced in a cantilever of span 4m & carrying a point load of 30KN at its free end.
   d) Define beam and enlist types of beams.
   e) Enlist different types of elastic constant and define any one of them.
   f) Define shear stress & shear strain.
   g) Define thermal stress.
   h) What is lateral strain?
   i) State the relationship between young's modulus, modulus of rigidity & bulk modulus.

Q.2   a) A rigid bar ABCD is connected to steel bar at A & B and is having hinge at support 'C'. At free end a load of 40 KN is acting as shown in figure 1.
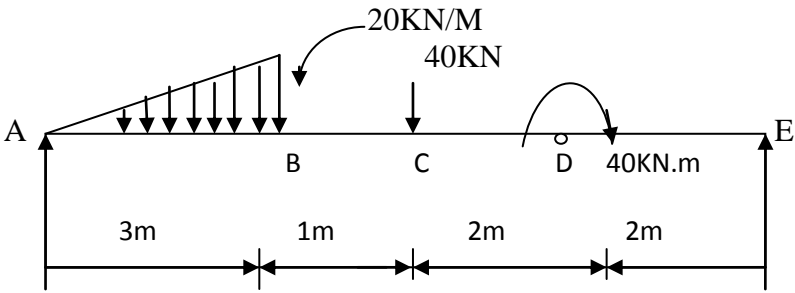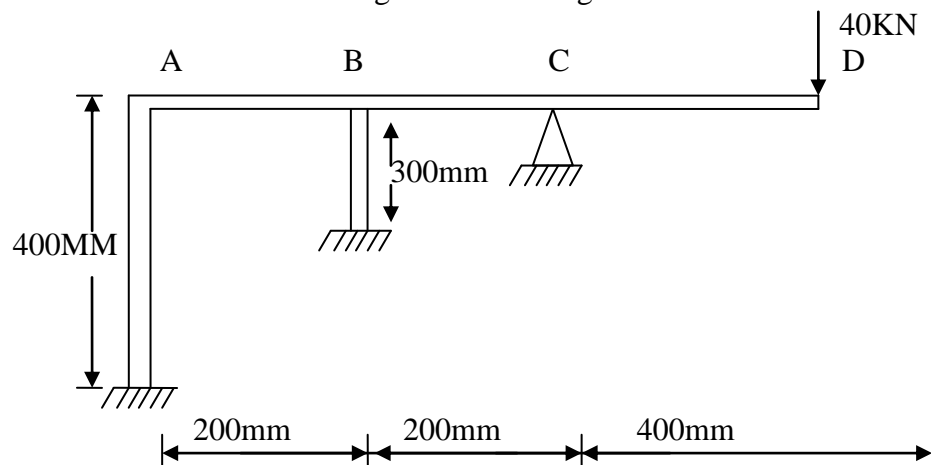

Figure 1

Find the forces developed in the bars and deflections of free end if $E = 2 \times 10^5 N/MM^2$, diameter of rod at A = 30mm and at B is 25mm.   12

   b) Write a note on shear force and bending moment diagrams.   03

Q.3   a) Draw shear force and bending moment diagrams for the simply supported beam shown in figure 2 indicating values at salient points.

12

Figure 2

b) Draw shear stress distribution diagram for T-section showing salient points.   03

Q.4   Derive the bending equation (flexure formula) for a beam.   15

Q.5   a) A steel bolt of 16mm diameter passes centrally through a copper tube of internal diameter 20mm & external diameter 30mm. The length of the whole assembly is 500mm. after tight fitting of the assembly the nut is over tightened by quarter of a turn. What are the stresses introduced in bolt & tube, if pitch of nut is 2mm. take Es=200GPa & Ec=120GPa.

12

b) Draw shear force and bending moment diagrams for a simply supported beam carrying uniformly distributed load over its entire span.

03

SECTION B

Q.6   Attempt any five   10
   a) Define strain energy
   b) What are the assumptions made in theory of torsion?
   c) Write the polar modulus for circular shaft.
   d) What are the methods for finding out the slope and deflection at a section?
   e) What is the radius of the Mohr's circle?
   f) Define thin cylinder.
   g) What are the types of stresses induced in a thin cylinder subjected to internal pressure?
   h) State the equation of torsion giving meaning of each term used.
   i) State expression for power transmitted by a shaft giving meaning of each term used.
   j) Define torsional rigidity.

Q.7   a) The principle stresses at a point in a material are $90 MN/M^2$ tension and 60 MN/M^2 compressions. Find analytically the normal and shear stresses on a plane inclined at 30^0 to the plane of greater principal stress.

10

b) A solid circular shaft is subjected to a torque of 1600NM. Find the diameter of the shaft if angle of twist is limited to 6^0 in a length of 3m. Take C =$8 \times 10^5 N/MM^2$.

05

Q.8   A thin cylindrical shell 1000mm long has 220mm external diameter. Thickness of metal is 10mm. it is filled with a fluid at atmospheric pressure. If an additional $25 \times 10^3 mm^3$ of the fluid is pumped into the cylinder, find the pressure exerted by the fluid on the wall. Take $E = 2 \times 10^5 N/MM^2$ & poison's ratio=0.3. Find also the hoop stress.

15

Q.9   a) A simply supported beam of uniform flexural rigidity EI and span l, carries two symmetrically placed loads at one-Third of the span from each end. Find the expression for deflection at the middle of the span.

10

b) Derive the condition for no tension for a circular column of diameter'd'.   05

Q.10   a) Prove that the stress produced by suddenly applied load is twice the one produced by the same load when applied gradually.

09

b) A bar, 4m long and 4cm in diameter, hangs vertically and has a collar at the lower end. Find the maximum stress induced in the bar when a weight of 4.0 KN falls through a height of 10cm on the collar. Take E = 200GPa.

06