3E1119
B. Tech. III - Sem. (Main) Exam., Dec. - 2018
PCC Automobile Engineering
3AE4 – 07 Mechanics of Solids
AE, ME

Time: 3 Hours   **Maximum Marks: 160**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL   2. NIL

PART – A

(Answer should be given up to 25 words only)   [10×3=30]

All questions are compulsory

Q.1   Define the following –

   (i)   Ductility

   (ii) Toughness

   (iii) Malleability

Q.2   Discuss stress – strain diagram for ductile materials.

Q.3   What do you understand by Poisson's ratio.

Q.4 Define modulus of Elasticity (E) & modulus of Rigidity (G).

Q.5 Distinguish between simply supported beam and fixed beam.

Q.6 Define bending moment & its sign convention. http://rtuonline.com

Q.7 What do you understand by torsion. Write the equation of torsion.

Q.8 Distinguish between principal stress and principal strain.

Q.9 Define maximum principal stress theory along with its graphical representation.

Q.10 What is the difference between a column and a strut?

PART – B

(Analytical/Problem solving questions)   [5×10=50]

Attempt any five questions

Q.1 Derive an expression showing relation between modulus of elasticity and modulus of rigidity.   [10]

Q.2 Derive the following relation –   [10]

$$M = E I \frac{d^2 y}{d x^2}$$

Q.3 What is the use of theories of failure? Name them & discuss in brief.   [10]

Q.4 A circular rod of steel 10 mm diameter is tested for tension and it was observed that when tension was 11 kN, the total extension on a 300 mm length was 0.20 mm. Find the value of E.   [10]

Q.5 Explain the different methods of determining the deflection of statically indeterminate beams.   [10]

Q.6 Explain the stresses in thin walled pressure vessels.   [10]

Q.7 What is area moment method? Where is it used?   [10]

PART – C

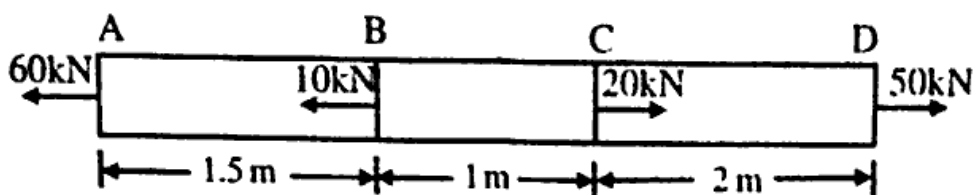## Attempt any four questions

Q.1 (a) Explain the concept of free body diagram taking a suitable example.   [10]

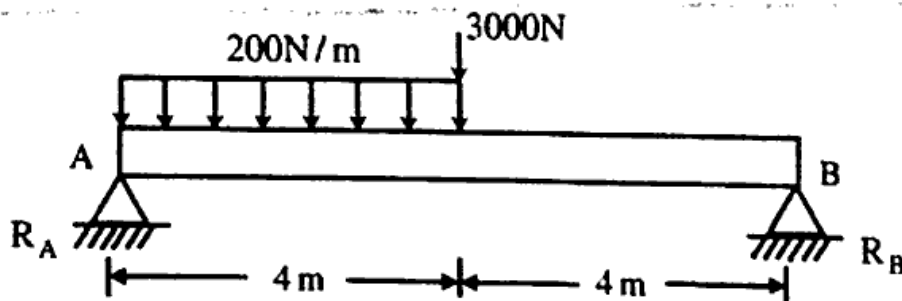(b) A steel bar of 25 mm diameter is acted upon by forces as shown in figure. Determine the total elongation of the bar. http://rtuonline.com   [10]

Q.2 (a) Explain the various types of static loading and support conditions in beams.   [10]

(b) Draw the SFD & BMD of a loaded beam as shown in figure –   [10]

Q.3 (a) Explain and compare the different theories of elastic failures.   [10]

(b) If the principal stresses at a point in an elastic material are 2f tensile, f tensile and $\frac{1}{2}$ f compressive, calculate the value of 'f' at failure according to five different theories for failure to just take place. The elastic limit in simple tension is 200 N/mm² and Poisson's ratio = 0.3.   [10]

Q.4 (a) Define torsion and torsion rigidity. [6]

(b) Two shafts of same material & lengths are subjected to save torque. If the first shaft is a solid circular section & second shaft is of hallow section whose internal dia. is 2/3 of outer dia. & the maximum shear stress developed in each shaft is same. Compare the weight of shaft. http://rtuonline.com [14]

Q.5 A thin cylinder shell 120 cm dia 1.5 cm thick 6 m long is subjected to internal fluid pressure 2.5 N/mm² of the value $E = 2 \times 10^5$ N/mm², $\mu = 0.3$. [20]

Find –

(i) Change in dia.

(ii) Change in length

(iii) Change in volume