Reg No.:_____ Name:_____

00000ME211121901

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination December 2020

Course Code: ME211

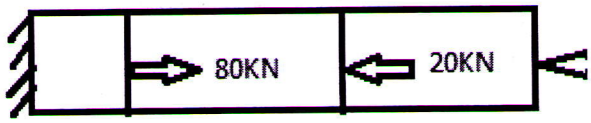
Course Name: MECHANICS OF SOLIDS AND MECHANICS OF MACHINES

Max. Marks: 100 Duration: 3 Hours

PART A

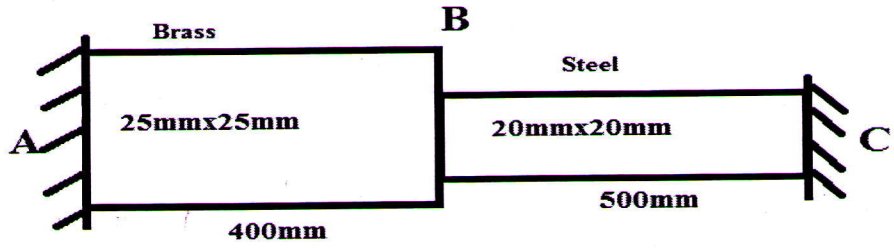
Answer any three full questions, each carries 10 marks. Marks

1 a) A brass bar having cross sectional area of $1000mm^2$ is subjected to axial forces as shown in figure. Calculate the total elongation of the bar by principle of superposition and method of sections ($E=1.05x10^5$ N/mm^2) (6)



b) Draw and explain the stress-strain diagram for mild steel. (4)

2 a) A bar made of brass and steel as shown in figure is held between two rigid supports A & C. Find the stresses in each material if the temperature rises by 40°C. Take $E_b=1x10^5$ N/mm^2 , $\alpha_b = 19 \times 10^{-6}/^o C$, $E_S= 2 \times 10^5$ N/mm^2 , $\alpha_s=12x10^{-6}/^o C$ (8)



b) Define working stress and FOS. (2)

3 a) Describe briefly the functions of elliptical trammel and scotch yoke. (7)

b) What is Kutzback's criterion for degree of freedom of plane mechanisms? In what way Gruebler's criterion is different from it? (3)

4 a) Explain Crank and Slotted Lever Mechanism with neat sketch. (6)

b) In what way is Oldham's coupling useful in connecting two parallel shafts when the distance between their axes is small? (4)

PART B

Answer any three full questions, each carries 10 marks.

5 Lay out the profile of a cam so that Lift of the follower is 30 mm Follower is moved outwards during 180° of cam rotation with cycloidal motion dwells for 20° of the cam rotation returns with uniform velocity during remaining 160° of the cam rotation. The base circle radius of cam is 28 mm. The axis of the follower passes through the centre of the cam axis. (10)

6 a) Sketch two teeth of a spur gear and show the following: flank, top land, bottom land, addendum, dedendum, tooth thickness, space width and circular pitch. (5)

b) Explain interference in involute gears. Explain any 3 methods to avoid interference in involute gears. (5)

7 a) Derive the relation for ratio of belt tension in a flat-belt drive. (6)

b) How sliding gear box arrangement helps to change the speed in automobiles. (4)

8 Find expression for the screw efficiency of a square thread. Also determine the condition for maximum efficiency. (10)

PART C

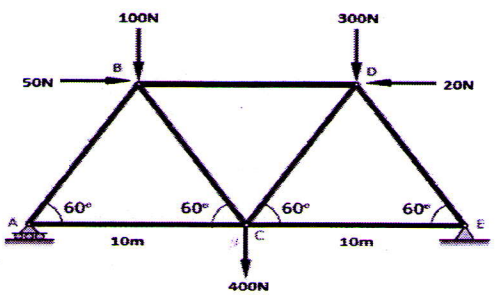
Answer any four full questions, each carries 10 marks.

9 a) Determine the input on the Crank of a slider crank mechanism for the static equilibrium when the applied piston load is 1500N. The length of the Crank and connecting rod are 40mm and 100mm respectively and the Crank has turned through 45° from the inner depth centre. (5)

b) What are free body diagram of a mechanism? How are they helpful in finding the various forces acting on the various members of a mechanism? (5)

10 a) What is meant by piston effort and crank effort? (4)

b) Draw the free body diagram for the following structure. (4)



c) Compare static force analysis and dynamic force analysis. (2)

11 Explain the turning moment diagrams for the following (10)

i) Single-cylinder double acting steam engine

ii) Single-cylinder four stroke engine

iii) Multi cylinder engine

12 a) Differentiate between Free and Forced vibration. (4)

b) Define natural frequency. (2)

c) Derive the expression for the magnification factor for forced-damped vibration. (4)

13 a) A machine part having a mass of 2.5kg vibrates in a viscous medium. A harmonic exciting force of 30N acts on the part and causes a resonant amplitude of 14mm with a period of 0.22second find the damping coefficient. If the frequency of the exciting force is changed to 4Hz, determine the increase in the amplitude of the forced vibrations upon the removal of the damper. (10)

14 a) An aircraft radio transmitter rates 26kg and is mounted on 5 springs which deflect 8mm when the transmitter is placed upon them. Neglected damping, find the percentage of engine vibration received by the transmitter for engine speed of 1500rpm. (6)

b) Discuss the effect of damping on vibratory system. What is meant by under damping, over damping and critical damping? (4)

****