University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

TIME – 3 Hrs 15 Min

THEORY EXAMINATION – FEB 2021	
B.TECH. (ME)	**SEMESTER –III**

M.M. - 56

PAPER – MEC-203

SUBJECT - MECHANICS OF SOLIDS-I

INSTRUCTIONS TO BE FOLLOWED

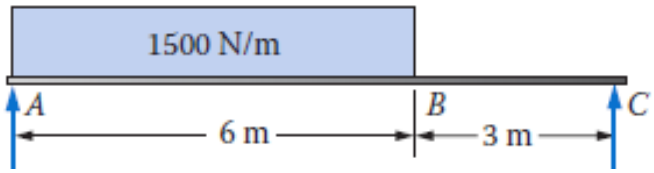
- **Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.**
- **For all B Tech. Mechanical Engineering Students, the Email ID is:- btechmechuiet@kuk.ac.in**
- **The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.**
- **The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.**
- **Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.**
- **Over-attemptation should be avoided.**
- **Handwriting should be neat and clean and diagrams should be clear and contrasted.**
- **The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.**
- **While attempting the paper, the candidate will use blue/black pen only.**
- **Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.**
- **Candidate must ensure that he/she has put his/her signature on each page of the answer sheet used by him/her. Answer sheet without the signature of the candidate will not be evaluated.**

PART-A

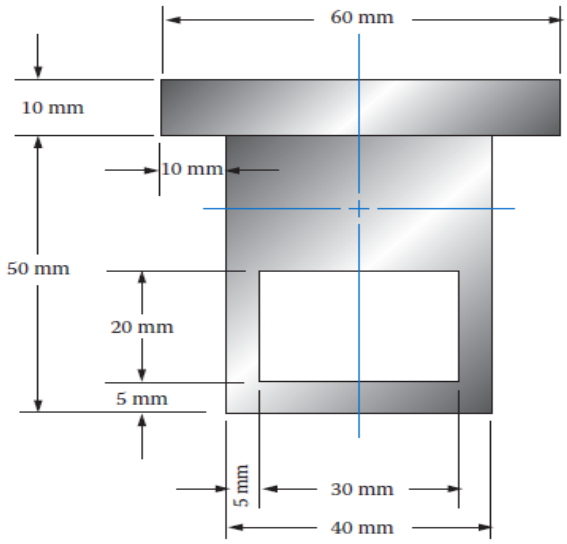
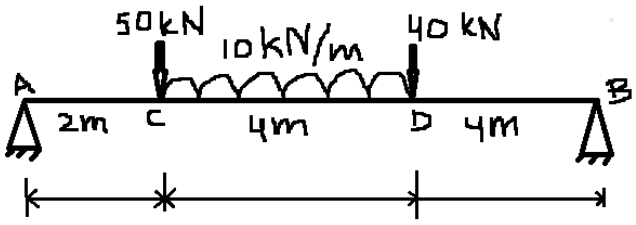
Q. No. – 1 Answer the following questions carrying one mark each. 15x1=15

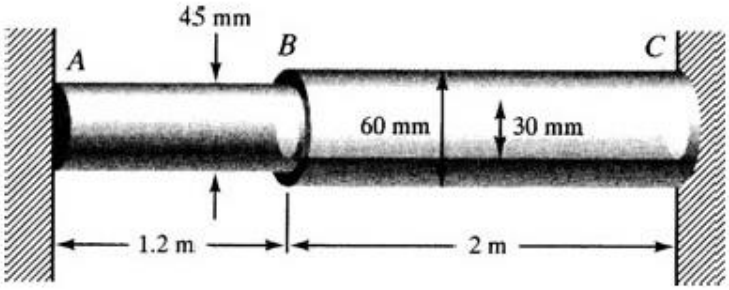
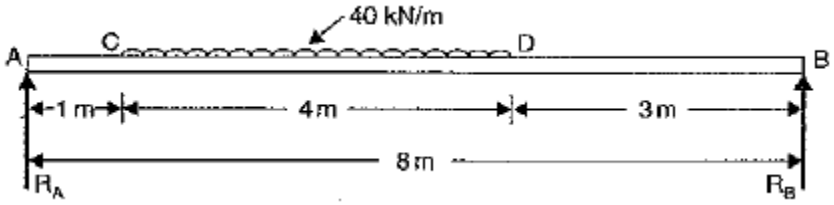
(i)	Define the principle of transmissibility.
(ii)	What are concurrent forces?
(iii)	Define the principle of resolution.
(iv)	Differentiate between static equilibrium and dynamic equilibrium.
(v)	Give examples of stable, unstable and neutral equilibrium.
(vi)	Differentiate between centre of gravity and centre of mass.
(vii)	Define torsional and lateral rigidity.
(viii)	What are true stresses and engineering stresses?
(ix)	Give distribution of shearing stress in beams of rectangular cross-section.
(x)	Define slenderness ratio.
(xi)	What do you understand by point of contraflexure?
(xii)	Hollow shafts are more efficient than the solid shafts. How?
(xiii)	Define principal plane and principal stresses.
(xiv)	Define the slope and deflection in beams.
(xv)	Name three methods used to find the slope and deflection in beams.

PART-B

2	Explain the stress-strain diagrams for ductile and brittle materials.	**5**
3	Define and classify beams. Compute and draw the shear force and bending moment for the loaded beam shown in fig. 1.  Fig. 1	**5**
4	Derive the formulae for computing the maximum shear stress on a circular bar subjected to torsion.	**5**
5	Derive the Euler's formulae for columns when both the ends are hinged.	**5**

PART-C

6	Find the location of the centroid of the area shown in fig. 2.  Fig. 2	**10**
7	A wrought iron bar is 7.5 m long and is 5 cm in diameter for 1.5 m of its length, 4 cm in diameter for 2 m of its length and 3 cm in diameter for the remainder. The bar is in tension and the stress is in the smallest section is 84 MPa. Find the total elongation of the bar if E = 200 kN/mm^2.	**10**
8	It has been determined that a point in a load-carrying member is subjected to the following stress condition: σ_x = -120 MPa σ_y = 180 MPa τ_{xy} = 80 MPa (CCW) Perform the following: **(a)** Draw the initial stress element. **(b)** Draw the complete Mohr' s circle, labelling critical points. **(c)** Draw the complete principal stress element. **(d)** Draw the maximum shear stress element.	**10**
9	Draw the SF and BM diagram for the beam shown in *fig. 3.* Also calculate the maximum bending moment.  *Fig. 3*	**10**
10	A stepped shaft has the appearance shown in Fig. 4. The region *AB* is aluminum, having *G* = 28 GPa, and the region *BC* is steel, having *G* = 84 GPa. The aluminum portion is of solid circular cross section 45 mm in diameter, and the steel region is circular with 60-mm outside diameter and 30-mm inside diameter. Determine the maximum shearing stress in each material as well as the angle of twist at *B* where a torsional load of 4000 N-m is applied. Ends *A* and *C* are rigidly clamped.	**10**

	 Fig. 4	
11	Develop a general shear formula for the beams subjected to transverse load.	**10**
12	A column of hollow cylindrical section 5 m long, with ends firmly built in has to carry an axial load of 380 kN. Determine the section if the internal diameter is to be 0.8 times of the external diameter. Take factor of safety as 6. Take. Take σ_c = 56.7 kN/cm^2 and α = 1/1600 in Rankine's formula.	**10**
13	From fig. 5, determine (i) the deflection of the beam at its mid-point (ii) position of maximum deflection. Take E = 2×10^5 MPa and I = 4.3×10^8 mm^4.  *Fig. 5*	**10**