*Roll No. .....*

# OLE-3027

## B. Tech. 3rd Semester (Civil Engg.) Examination – April, 2021

### ENGINEERING MECHANICS

**Paper : PCC-CE-203-G**

*Time : Three Hours ]* *[ Maximum Marks : 75*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

***Note :*** Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

**1.** (i) What is mean by factor of safety ?

(ii) What do you mean by Mohr's correction ?

(iii) What is the assumption made in the analysis of a pin-jointed plane truss ?

(iv) State the assumption for shearing stress in a circular shaft subjected to torsion.

(v) How do you relate intensity of loading, shearing force and bending moment ?

(vi) What is the maximum bending moment for a simply supported beam subjected to uniformly distributed load and where it occurs ?

## SECTION – A

**2.** A steel bar is placed between two copper bars each having the same area and length as the steel bars at 15°C. At this stage, they are rigidly connected together at both the ends. When the term perature is raised to 315°C, the length of the bars increased by 1.5 mm. Determine the original length and final stresses in bars. Take Es = $210 \times 10^5$ GN/m$^2$; Ec = 110 GN/m$^2$; $\alpha s = 0.000012$ per degree centigrade; $\alpha c = 0.0000175$ per degree centigrade.

**3.** At a certain point in a strained material, the principal stresses are 100 MN/m$^2$ and 40 MN/m$^2$ both tensile. Find the normal, tangential and resultant stresses across a plane through the point at 48° to the major principal plane.

## SECTION – B

**4.** An overhanging beam ABC of length 8 m is simply supported at B and C over a span of 6 m and the portion AB overhangs by 2 m. Draw the shearing

force, bending moment diagram and determine the point of contra-flexure if it is subjected to uniformly distributed loads of 5 kN/m over the portion AB and 4 kN/m over the portion BC.

**5.** The moment of inertia of a symmetrical section of a beam about its neutral axis is 2500 $cm^4$ and its depth is 25 $cm^4$. Determine the longest span over which, when simply supported, the beam would carry a uniformly distributed load 6 kN/m run without the stress due to bending exceeding 130 $MN/m^2$.

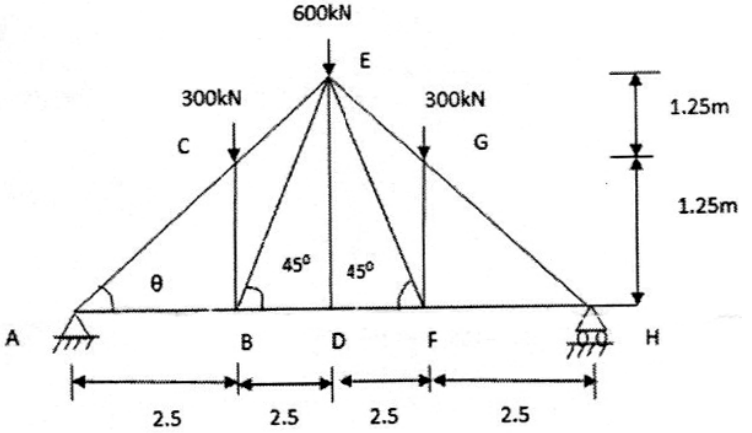
## SECTION – C

**6.** A steel shaft 1.5 m long, 40 mm diameter is rigidly fixed at the ends. A torque of 720 Nm is applied at a distance of 250 mm from one end. Calculate (i) fixing couple at the ends (ii) maximum shearing stress (iii) angle of twist at the point of application of torque. C = 85 $GN/m^2$.

**7.** A steel strut has an outside diameter of 120 mm and inside diameter of 80 mm and is 6 m long. It is hinged at both ends and is initially bent. Assuming the centre line of the strut as sinusoidal with maximum deviation of 6 mm, determine the maximum stress developed due to an axial load of 100 kN. Take E = 208 $GN/m^2$.

## SECTION – D

**8.** Analyse the pin jointed truss as shown by the method of section.




**9.** A circular steel shaft is subjected to combined bending and torsion, the bending moment being 20 kNm and torque 10 kNm. If safe equivalent stress in simple tension is 200 N/mm$^2$ and Poisson's ration is 0.25. Find suitable diameter of the shaft based on following theories.

(i) Maximum principal stress theory.

(ii) Maximum shear stress theory.

(iii) Shear strain energy theory.