COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

B.TECH. DEGREE III SEMESTER SUPPLEMENTARY EXAMINATION IN MARINE ENGINEERING DECEMBER 2020

MRE 1304 MECHANICS OF SOLIDS
(2013 Scheme)

Time: 30 Minutes [for Answering and Scanning/Uploading the page of the Answer Sheet]
Max. Marks: 10

INSTRUCTIONS

1. You have to be available in Google Meet Video Camera throughout the examination hours.
2. Those students who are not present through Google Meet Video Camera will not be permitted to write the online examination.
3. You have to share your '**live location**' to the faculty before uploading the answer sheet.
4. You have to answer only one question.
5. You have to write register number, subject code and module/group number (as given in the question paper) in each page.
6. Answer may not exceed one page of an A4 size paper in a standard handwriting, as far as possible.
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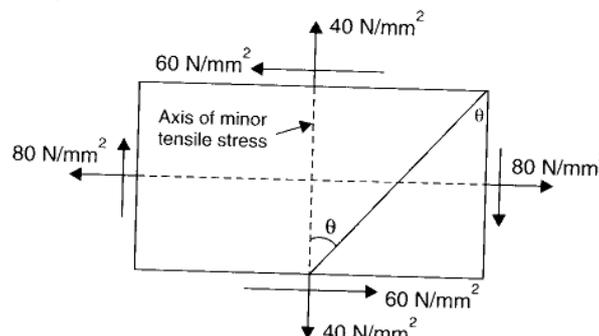
MODULE - I
(Answer *ANY ONE* question)

I(1).   A brass bar, having cross-sectional area of 1000 mm^2, is subjected to axial   (10)
forces as shown in figure below. Find the total elongation of the bar. Take
$E = 2 \times 10^5$ N/mm^2.
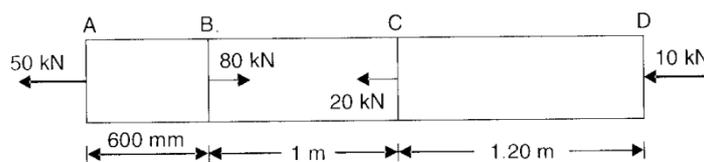
OR

I(2).   At a point within a body subjected to two mutually perpendicular directions, the   (10)
stresses are 80 N/mm^2 tensile and 40 N/mm^2 tensile as shown in the figure below.
Each of the above stresses is accompanied by a shear stress of 60 N/mm^2.
Determine the normal stress, shear stress and resultant stress on an oblique plane
inclined at an angle of 40° with the axis of minor tensile stress.

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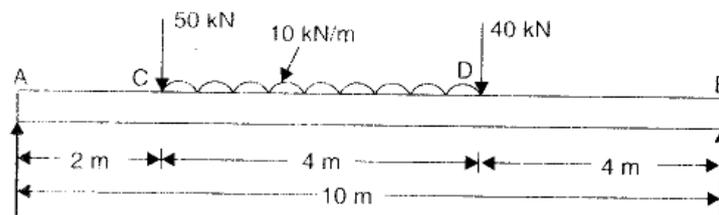
MODULE - II
(Answer *ANY ONE* question)

II(1).   A timber beam of rectangular section is to support a load of 36 kN uniformly   (10)
distributed over a span of 3.6 m when beam is simply supported. If the depth of
section is to be twice the breadth, and the stress in the timber is not to exceed
7 N/mm^2, find the dimensions of the cross-section. How would you modify the
cross-section of the beam, if it carries a concentrated load of 20 kN placed at the
centre with the same ratio of breadth to depth?

OR

II(2).   A simply supported beam of length 10 m, carries the uniformly distributed load   (10)
and two point loads as shown in figure given below. Draw the S.F.D. and
B.M.D. for the beam. Also calculate the maximum bending moment.

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MODULE - III
(Answer *ANY ONE* question)

III(1). A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress 10 N/mm^2 and central deflection is not to exceed 10 mm. (10)

OR

III(2). A beam of length 6 m is simply supported at its ends and carries two point loads of 50 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Find: (10)

   (i)   Deflection under each load.

   (ii)   Maximum deflection.

   (iii)   The point at which maximum deflection occurs.

Given $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 85 \times 10^6 \text{ mm}^4$.

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MODULE - IV
(Answer *ANY ONE* question)

IV(1). A solid circular shaft transmits 75 kW power at 200 r.p.m. Calculate the shaft diameter, if the twist in the shaft is not to exceed $1°$ in 2 metres length of shaft, and shear stress is limited to 60 N/mm^2. Take Modulus of rigidity $G = 1 \times 10^5$ N/mm^2. (10)

OR

IV(2). The stiffness of a close-coiled helical spring is 2 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of the spring is 125 N/mm^2. The solid length of the spring (when the coils are touching) is given as 5 cm. Find: (10)

    (i)   Diameter of wire.

    (ii) Mean diameter of the coils.

    (iii) Number of coils required.

Take Modulus of rigidity $G = 4.5 \times 10^4$ N/mm^2.

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MODULE - V
(Answer *ANY ONE* question)

V(1). A cylindrical shell 3 metres long which is closed as the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 2 N/mm^2. Take $E = 2 \times 10^5$ N/mm^2 and $\nu = 0.3$. (10)

OR

V(2). A simply supported beam of length 4 metre is subjected to a uniformly distributed load of 40 kN, l m over the whole span and deflects 15 mm at the centre. Determine the crippling loads when this beam is used as a column with the following conditions: (10)

    (i)   One end fixed and other end hinged.

    (ii) Both the ends pin jointed.

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