INDIAN MARITIME UNIVERSITY

(A Central University, Govt. of India)

End Semester Examinations –June-July 2019

B. Tech (Marine Engineering)

Semester-II

Strength of Material- I

(UG11T3204)

Date: 02.07.2019 **Max Marks: 100**

Time: 03 Hrs. **Pass Marks: 50**

PART-A **Marks: 10X3 =30**

(All questions are Compulsory)

1.

(a) Draw a stress strain diagram for a ductile material and mark the silent points on it.

(b) Give the relationship between Bulk Modulus and Young's Modulus.

(c) Define resilience and proof resilience.

(d) Derive the relation between loading intensity, shear force and bending moment.

(e) What do you understand by the term wire winding of thin cylinder?

(f) Derive the equation of hoop stress for Spherical shell.

(g) What are the advantages of welded joints?

(h) What is section modulus? Write the formula of section modulus for circular section?

(i) What are the assumptions made in the Theory of Pure Torsion?

(j) Write down the formula for deflection of closely coiled helical spring and specify the notation used in it.

PART-B **Marks: 5X14=70**

(Answer any 5 of the Following)

2. A 500 mm long bar has rectangular cross-section 20 mm × 40 mm. The bar is subjected to:

(i) 40 KN tensile force on 20 mm × 40 mm face.

(ii) 200 KN compressive force on 20 mm × 500 mm face

(iii) 300 KN tensile force on 40 mm × 500 mm face.

Find the change in dimensions and volume, if $E = 2 \times 10^5$ N/mm^2 and poisson ratio = 0.3 (14 marks)

3. **a)** A composite bar consists of steel rod 30 mm diameter enclosed in copper tube 60 mm external diameter. The rod and the tube are joined together by means of 24 mm diameter pins, one at each end. Find the

shear stress induced in the pins, if composite section is subjected to temperature rise of 50°C.

Take: Es = 210 GN/m^2, Ec = 105 GN/m^2 ,

α_s =11X10^{-6}/^{0}C, α_c =17X10^{-6}/^{0}C (07 marks)

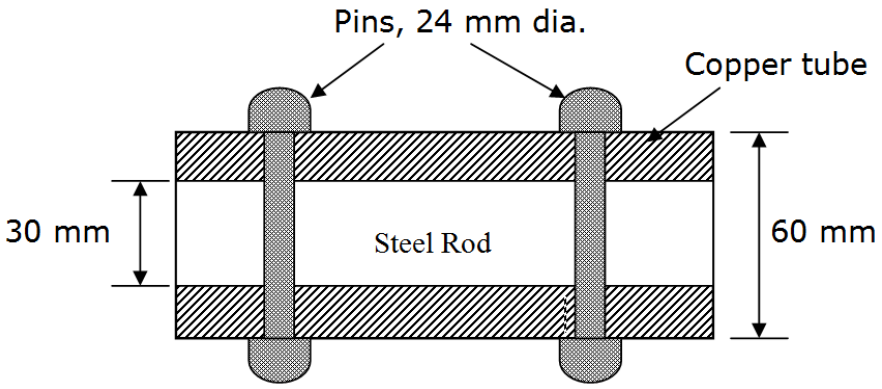

Figure: 1

b) Derive relation for change in length of the bar of uniformly tapering circular section of diameter d_1 at bigger end to d_2 at smaller end with subjected to an axial tensile load P. Take the length of the bar L and the modulus of elasticity as E.

(07 marks)

4. a) A steel bar is 4cm x 4cm in section ,3 m long is subjected to an axial pull of 128 KN .Taking, E=200 GN/m^2.Calculate the alteration in the length of the bar. Calculate also the amount of energy stored in the bar during the extension. (07 Marks)

b) A welded joint is provided to connect two tie bars 150 mm X 10 mm as shown in figure 2. The working stress in the bar is 120 MN/m^2. Investigate the design, if the size of the fillet is 12 mm.Take the working stress in the end fillet as 102.5 MN/m^2 and that in the diagonal fillet as 70 MN/m^2 (07 Marks)

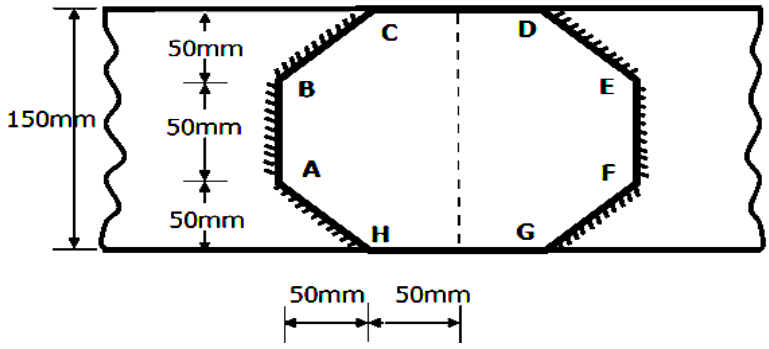

Figure: 2

5. The beam is supported & loaded as shown in figure 3. Draw Shear Force & Bending Moment diagrams indicating all important values. Locate the point of contraflexure,if any

(14 Marks)

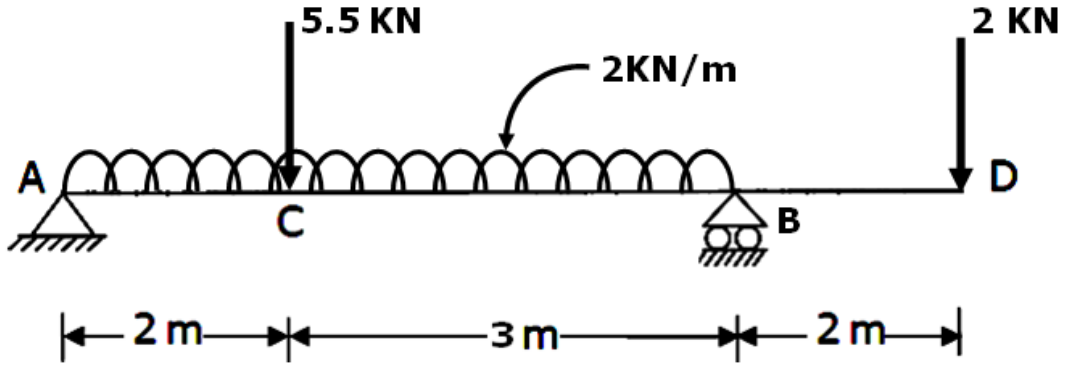

Figure: 3

6. A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are respectively 75 % and 40 %. If the tensile stress in the plating is to be limited to 120 MN/m^2.Find the maximum safe air pressure. (14 Marks)

7. **a)** Drive the flexural formula for a straight beam subjected to pure bending.

M/I =σ/y = E/R (10 Marks)

b) A steel wire of 5 mm diameter is bend into a circular shape of 6 m radius. Determine the maximum stress in the wire. Take E = 210 GN/m^2. (04 Marks)

8. **a)**A stepped shaft is subjected the couples (in the same direction) at the change in section at the free end as shown in figure 4.The length of each section is 500 mm and diameters are 80 mm,60 mm and 40 mm. If G= 80 GN/m^2 ,determine the angle of twist in degrees at the free end. (9 Marks)

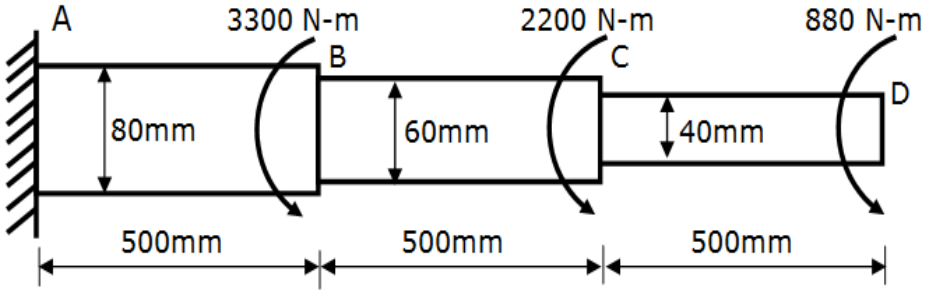

Figure: 4

b) A helical spring is made of 12 mm diameter steel wire wound on a 120 mm diameter mandrel. If there are 10 active coils, what is spring constant ? Take G = 82 GN/m^2. What force must be applied to the spring to elongate it by 40 mm? (5 Marks)

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