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Code No: R1621032 **R16** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
MECHANICS OF SOLIDS
(Com to ME, AE & AME)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define elasticity and plasticity? (2M)
   b) Write the types of loads? (2M)
   c) State the assumptions made in the theory of simple bending. (2M)
   d) Write Mohr's theorems? (3M)
   e) Define volumetric strain? (2M)
   f) Write the limitations of Euler's Formula? (3M)

PART –B

2. A bar of elastic material is subjected to directed stress in a longitudinal direction, and its strains in the two directions at right angles are reduced to one-half and one third respectively to those which normally occur in a ordinary tension member. If E=200kN/mm^2 and m = 4, what is the value of elastic constant? (14M)

3. Determine the shear force and bending moment diagrams for the cantilever loaded as shown in Figure: 1 (14M)

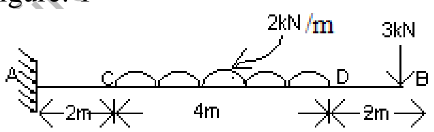

Figure: 1

4. a) A beam of symmetrical section 30cm deep and I= 12000cm^4, carries U.D.L. of 16kN/m. Calculate the maximum span of the beam if the maximum bending stress is not to exceed160N/mm^2. With this span, calculate the maximum central load if the bending stress is not to exceed the limit given above. (9M)
   b) From first principles show that the shear stress is not maximum at the neutral axis in case of an isosceles triangular section. (5M)

5. A beam of uniform section, 10 meters long, is simply supported at the ends. It carries point loads of 110 KN and 60 KN at distances of 2m and 5m respectively from the left end. Calculate: The deflection under each load and maximum deflection. Given: E = 200x10^{6}N/m^{2}and I = 118x10^{-4}m^4. (14M)

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6.	a)	Derive a formula for the proportional increase of capacity of a thin spherical shell due to an internal pressure.	(5M)
	b)	A cylindrical tank open at top and having vertical axis, is of 2.75 m inside diameter and 20 m high. The tank is filled with water and is made of structural steel with a yield point of 220 MN/ m^2. Determine the thickness of the tank if (i) longitudinal joint is 90% efficient and (ii) longitudinal joint is 70% efficient. Assume factor of safety as 3.	(9M)
7.		A solid shaft transmits 2000 kW at the 200 rpm. The maximum torque developed in the shaft is 1.8 times the mean torque. The distance between the bearings is 1.8 meters with a flywheel weighing 50 kN midway between the bearings. Determine the shaft diameter if (i) the maximum permissible tensile stress is 60 MPa (ii) the maximum permissible shearing stress is 40 MPa.	(14M)

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R16

SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018

MECHANICS OF SOLIDS

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Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Write the types of stresses and strains? (2M)
   b) Define point of contra flexure? (2M)
   c) Define bending stress? (2M)
   d) Define slope, deflection and radius of curvature? (3M)
   e) Write about circumferential stress? (2M)
   f) Write about buckling and stability? (3M)

PART –B

2. a) Define proportionality limit, elasticity limit, yield stress and ultimate stress of a material? (4M)
   b) A circular rod of steel 14mm diameter is testing in a testing machine and it is found that when the tension is 18kN the total extension on a 21cm length is 0.15mm.Find the value of E. (10M)

3. A beam of length 6m is simply supported at its ends. It is loaded with a gradually varying load of 750 N/m from left end to 1500 N/m to the right end. Construct the SF and BM diagrams and find the magnitude and position of the maximum BM. (14M)

4. A simply supported rectangular beam is 150mm wide by 300mm deep carries a central concentrated load of 12KN and a distributed load of 8KN/m on a span of 3metres. Determine the maximum bending stress in the beam and bending stress at 1metre from the left end. (14M)

5. a) What is Macaulay’s method for finding out the slope and deflection of a beam? (5M)
   b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 mm (wide) x 160 mm (deep), and E = 10 GN/m^2, calculate slope and deflection. (i) at the free end of the cantilever, (ii) at a distance of 0.55 m from the free end. (9M)

6. A cylindrical shell of 200 mm diameter and 1 metre length is filled with a fluid at atmospheric pressure. The wall thickness is 8mm. If an additional 2 x 10^4 mm^3 of the fluid is pumped into the cylinder, find the pressure exerted by the fluid on the wall of the cylinder. Find also the hoop stress induced. E = 2 x 10^5 N/mm^2 ; Poisson’s ratio = 0.3. (14M)

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7. A steel shaft of diameter 200 mm runs at 300 rpm. This steel shaft has a 30 mm thick bronze bushing shrunk over its entire length of 8 meters. If the maximum shearing stress in the steel shaft is not to exceed 12 MPa, find (14M)
   i) power of the engine
   ii) torsional rigidity of the shaft.
   Take G_{steel} = 84000 N/mm²; G_{bronze} = 42000 N/mm².

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Code No: R1621032 **R16** SET - 3

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MECHANICS OF SOLIDS
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Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Draw stress – strain diagram for mild steel? (2M)
b) Define shear force and bending moment ? (2M)
c) Define section modulus? (2M)
d) What is moment area method? (3M)
e) Write about longitudinal stress? (2M)
f) Write about shafts in parallel? (3M)

PART –B

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2. a) Define young's modulus, shear modulus and Bulk modulus. Derive the relation between them. (5M)
b) The following data refer to a tensile test conducted on a mild steel bar : (9M)
diameter of the specimen = 20 mm
length of the specimen = 200 mm
extension at a load of 40 kN = 0.12mm
Load at yield point = 80kN
Maximum load = 150 kN
Total extension = 50 mm
Neck diameter = 15 mm.
Determine (i) young's modulus (ii) yield stress (iii) ultimate stress (iv) percentage elongation and (v) percentage reduction in area.

3. An overhanging beam of length 7m is supported centrally at two points 5m apart. It carries a uniformly increasing load of 400 N/m from the left end to 800 N/m at the midspan. It also carries a point load of 1000N at the right end. Draw the SF and BM diagrams and locate the point(s) of contra flexure. (14M)

4. The cross-section of a joist is a T-section 12.5 ×12.5×1.2cm with 12.5 cm side horizontal. Find the maximum intensity of shear stress and sketch the distribution of stress across the section if it has to resist a shear force of 90kN. (14M)

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5. a) A beam of length 6m is simply supported at the ends. It carries a uniformly distributed load of 4 kN/m over a length of 2 metres from the left end. Find the maximum deflection of the beam. (10M)
Take $E = 2 \times 10^5$ N/mm^2 and $I = 2 \times 10^7$ mm^4.
b) Write about double integration method? (4M)

6. a) Derive a formula for the hoop stress in a thin spherical shell subjected to an internal pressure. (4M)
b) A cylindrical shell l0 m long and 50 cm in diameter and 12mm thick is at atmospheric pressure. What would be its dimensions when it is subjected to an internal pressure of 2 MN/ m^2? E = 200 GN/ m^2 and m = 4. (10M)

7. Derive an expression for the Euler's crippling load for a long column with following end conditions: (14M)
(i) both ends are hinged (ii) both ends are fixed.

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Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define working stress and factor of safety? (2M)
   b) Write the types of beams? (2M)
   c) Write the equation of bending? (2M)
   d) Write the differential equation for the elastic line of a beam? (3M)
   e) Write Lame's equation? (2M)
   f) Write about shafts in series? (3M)

PART –B

2. a) The piston of a steam is 40cm diameter and the piston rod diameter 6cm diameter. The steam pressure is 1.05 N/mm^2.Find the stress in the piston rod and the elongation of 75cm, taking E = 205kN/mm^2 when the piston is on the in-stroke. (10M)
   b) Write a note on impact loads? (4M)

3. A beam of length 6m is simply supported at its ends. It is loaded with a gradually varying load of 750 N/m from left end to 1500 N/m to the right end. Construct the SF and BM diagrams and find the magnitude and position of the maximum BM. (14M)

4. A 60cm× 20 cm I- joist has 2.5cm thick flanges and 1.8cm thick web. Calculate the maximum intensity of shear stress and sketch the distribution of stress across the section, the S.F. at the cross-section being 650kN. (14M)

5. A girder of uniform section and constant depth of 500 mm is freely supported over a span of 8 metres. Calculate the deflection for a uniformly distributed load on it such that the maximum bending stress induced is 90 N/ mm^2. Take E=2.04X10^5 N/mm^2. If for the above girder, the flanges are so portioned that there is uniform flange stress of 90 N/ mm^2 throughout the beam, calculate the central deflection. (14M)

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6. a) A boiler shell is to be made of 15mm thick plate having a limiting tensile stress of 100 MN/m^2. If the longitudinal and circumferential efficiencies are 70% and 30% respectively, determine what maximum diameter of the shell would be allowed for a maximum pressure of 2 MN/m^2. (7M)

   b) A vertical cylindrical gasoline storage tank, made of 20mm thick mild steel plate has to withstand maximum pressure of 1.5 MN/m^2. Calculate the diameter of the tank if stress if 240 MN/m^2, factor of Safety 2 and joint efficiency 70%. (7M)

7. Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in the derivation? (14M)

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