Printed Page:- Subject Code:- BME0301

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (20..... - 20.....)

Subject: Engineering Mechanics & Strength of Material

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. Forces are called concurrent when their lines of action meet in. [CO1, K1] 1

(a) one point

(b) Two points

(c) Plane

(d) perpendicular planes

1-b. Angle of friction is the. [CO1, K1] 1

(a) Angle between normal reaction and the resultant of normal reaction and the limiting friction.

(b) Ratio of limiting friction and normal reaction

(c) The ratio of minimum friction force to the friction force acting when the body is just about to move

(d) The ratio of minimum friction force to friction force acting when the body is in motion.

1-c. The value of MOI depends upon. [CO2, K1] 1

(a) Type of material

(b) Weight of material

(c) Density of material

(d) Cross sectional dimension

1-d. Which of the following is not a basic type of strain?[CO2,K1] 1

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(a) Compressive strain.
(b) Shear strain
(c) Area strain
(d) Volume strain

1-e. Bending stresses are also known as. [CO3, K1] 1

(a) Longitudinal stresses
(b) Shear stresses
(c) Temp stresses
(d) Hoop stresses

1-f. The value of maximum bending moment in case of cantilever beam loaded with one point load w at the free end. [CO3, K1] 1

(a) WL
(b) $WL^2/2$
(c) WL/4
(d) $WL^2/8$

1-g. Relation between applied torque T on a shaft power transmitted P rotating at a speed of N rpm.[CO4, K1] 1

(a) $P= (2\pi NT)/60$
(b) $P= (\pi NT)/60$
(c) $P= 2\pi NT$
(d) $P= \pi NT$

1-h. What does Rankin's formula determine in column design? [CO4, K1] 1

(a) Buckling load for columns
(b) Direct stress in columns
(c) Bending stress in columns
(d) Eccentric loads on columns

1-i. What causes stress in thin pressure vessels?[CO5, K1] 1

(a) External pressure
(b) Internal pressure
(c) Bending moment
(d) Shear force

1-j. What is the primary difference between short and long columns in terms of stability? [CO5,K1] 1

(a) Short columns are more prone to buckling
(b) Long columns are more prone to buckling
(c) Short columns experience higher direct stresses
(d) Long columns experience higher bending stresses

2. Attempt all parts:-

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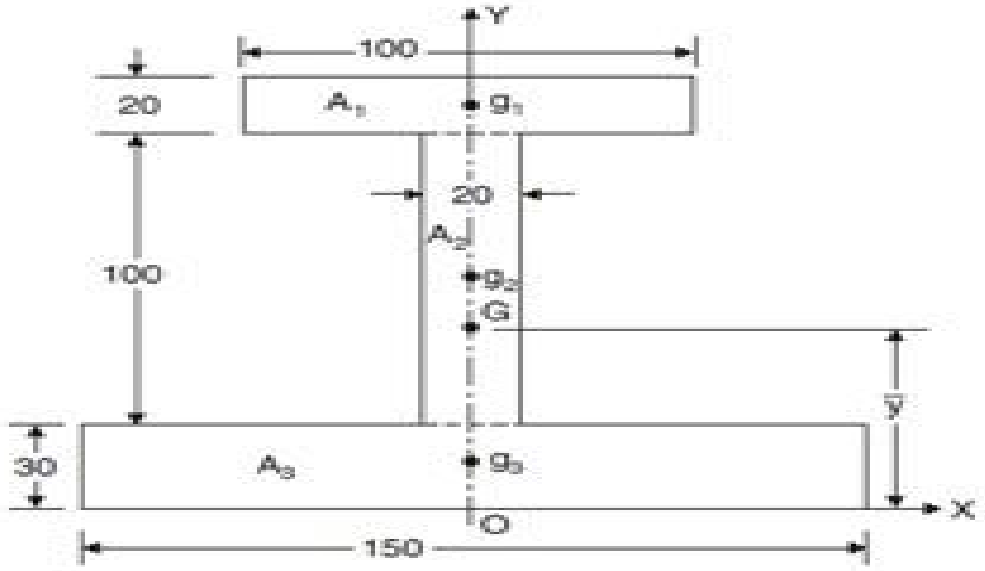
2.b.	Write down the Lami's theorem.. [CO1,K2]	2
2.a.	Distinguish between thick and thin cylinder. [CO5, K2]	2
2.c.	Explain polar moment of inertia. [CO2,K2]	2
2.d.	Write down the various types of support and load. [CO3,K2].	2
2.e.	Distinguish between column and struts. [CO4,K2]	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	A ladder of length 6m weighing 300N is placed against a vertical wall at 60^0 with the horizontal. the coefficient of friction between the wall and the ladder is 0.25 and that between ladder and floor is 0.30. A man of weight 750N stands at a distance 4m from the bottom of the ladder. find minimum horizontal force applied at the bottom of ladder to prevent slipping. [CO1, K3]	6
3-b.	Define the angle of friction and angle of repose. Also prove that in case of limiting friction, Angle of friction = Angle of repose. [CO1, K3]	6
3-c.	Locate the centroid of the I-section shown in *Fig.* [CO2, K3]	6

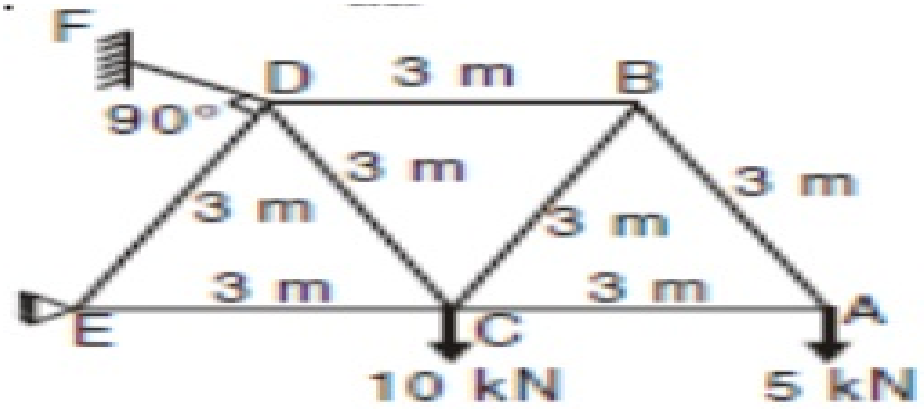


3-d.	Derive the mass moment of inertia of right circular cone about its axis of rotation. [CO2,K3]	6
3.g.	A cylindrical compressed air drum is 2 m in diameter with plates 12.5 mm thick. The efficiencies of the longitudinal (ql) and circumferential (qc) joints are 85% and 45% respectively. If the tensile stress in the plating is to be limited to 100 MN/~~, find the maximum safe air pressure. [CO5,K3]	6
3.e.	A steel shaft transmits 105 kW at 160 rpm If the shaft is 100 mm diameter, find the torque on the shaft and the maximum shear stress induced. Find also the twist of the shaft in a length of 6 m Take C = 8 x $l0^4$ N/mm^2. [CO4,K3]	6
3.f.	A boiler shell is to be made of 15mm thick plate having tensile stress of 120 N/mm2 If the efficiencies of the longitudinal and circumferential joints are 70% and 30%. Determine the maximum permissible diameter of the shell for an internal pressure of 2 N/mm^2. [CO5,K3]	6

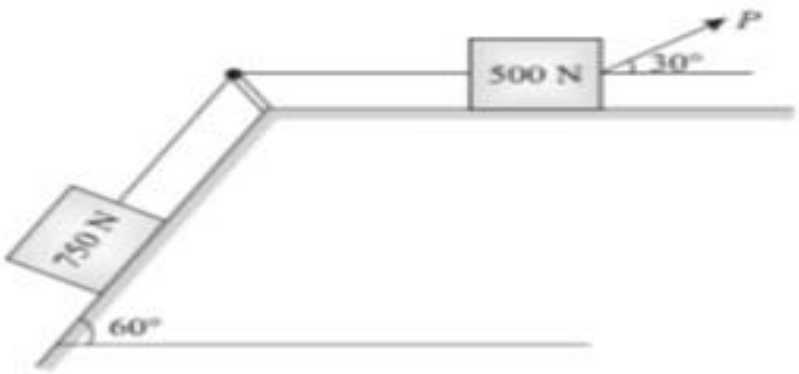
SECTION-C

4. Answer any <u>one</u> of the following:-

4-a. Analyze the truss and find the forces in all the members of the trusses shown in Fig. Indicate the nature of forces using the convention tension as +ve and compression as –ve. [CO1,K4] 10

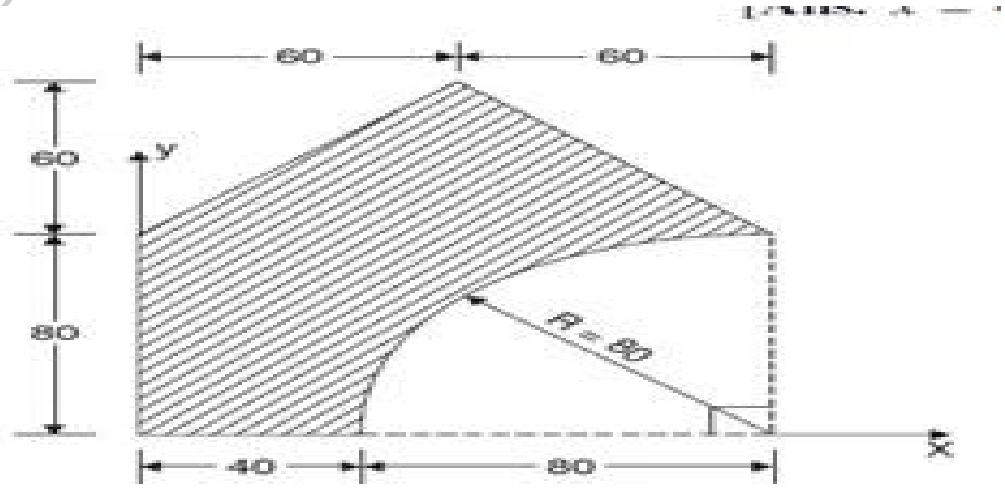


4-b. What is the value of P in the system shown in Fig.to cause the motion to impend? Assume the pulley is smooth and coefficient of friction between the other contact surfaces is 0.2. [CO1,K3] 10



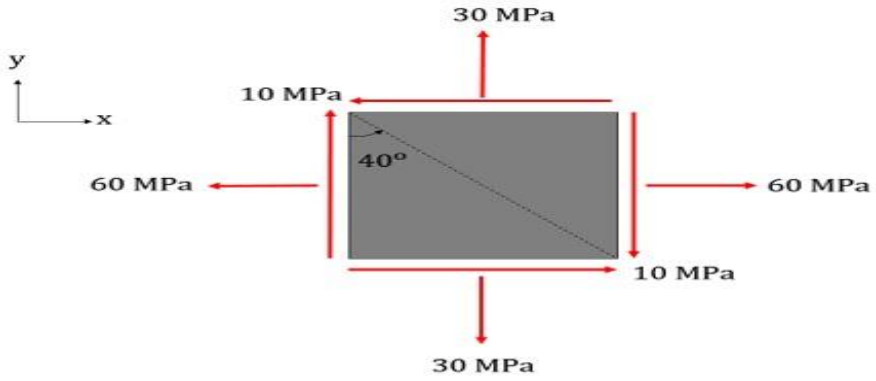
5. Answer any <u>one</u> of the following:-

5-a. Compute the second moment of area of the channel section shown in Fig. about centroidal axis.[CO2,K3] 10



5-b. For the state of plane stress shown in the figure: 10

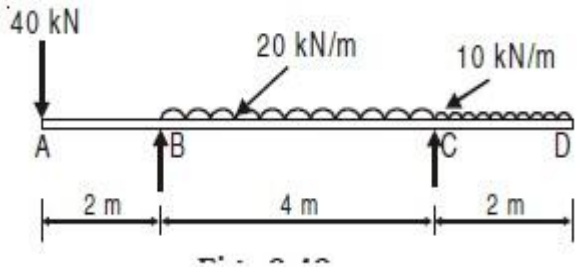
1. Draw the Mohr's circle and indicate the points that represent stresses on face X and on face Y.
2. Using the Mohr's circle, determine the normal and shear stress on the inclined plane shown in the figure and label this point as N on the Mohr's circle. [CO2,K3]



6. Answer any <u>one</u> of the following:-

6-a. Write down the assumptions made in theory of pure bending. Also derive the bending equation.[CO3, K3] 10

6-b. Draw the shear force and bending moment diagram of the following:-**[CO3, K3]** 10



7. Answer any <u>one</u> of the following:-

7-a. Derive the torsion equation of the circular shaft. Also write down the assumption made in torsion. [CO4, K3] 10

7-b. Derive the crippling load by Eulers's formula for a column being one end is fixed and other end is free. [CO4, K3] 10

8. Answer any <u>one</u> of the following:-

8-a. Derive the expression for max shear stress in a tin cylindrical shell subjected to internal pressure.[CO5, K3] 10

8-b. A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure. Length=1.2m, external diameter=20cm, thickness of metal=8mm, Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25cm^3 of liquid is pumped into the cylinder. Take E=2.1×105N/mm2 and poisons ratio=0.33. [CO5, K3] 10

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