$98 \times x - \frac{20 \times x^2}{2} - 20(x-5) - 40(x-7.5)$

$98 \times 0.5 - \frac{20 \times (0.5)^2}{2} - 20(0.5-5) - 40(0.5-7.5)$

$233 - \frac{2.5}{2} \quad 72205 - (2.5) \quad 70 - 40$

4015

B.Tech. Examination, 2011

(Second Semester)

(C.S. & I.T.)

Paper - IV (A)

MECHANICAL ENGINEERING

Time Allowed : Three Hours

Maximum Marks : 100

Note : (i) Attempt all questions.

(ii) Assuming missing data if any.

(iii) Use of steam table and mollier chart is permissible.

Q. 1. Attempt any four parts of the following : **4×5=20**

(a) Describe thermodynamic systems with neat sketches.

(b) What is property of a system ? Classify and explain.

(c) Explain laws of thermodynamics.

(d) Describe thermodynamic processes and Quasi-static process on P-V diagram.

(e) A machine working on a Carnot cycle operates between 305 K and 260 K. Determine C.O.P. When it is operated as :

(i) A Refrigerating machine

(ii) A Heat pump

(iii) A Heat engine.

2. Attempt any two parts : **2×10=20**

(a) Define terms available energy and unavailable energy.

0.25 kg of air at constant pressure and a temperature of 250°C receives 300 kJ of heat reversible. Determine the available and unavailable energy if the temperature of surrounding is 27°C. Take C_p = 1.005 kJ/kg K.

(b) What is high grade and low grade energy ? Give important example of each category. Why is the second law of thermodynamics refered to as the law of degradation of energy.

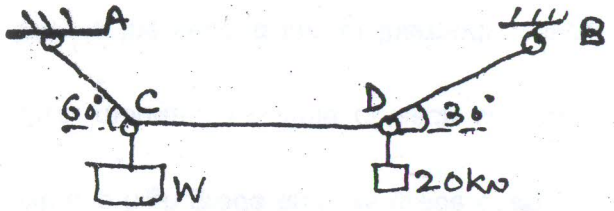
(c) What do you understand by entropy principle ? Show that entropy is a property of a system.

Q. 3. Attempt any two parts : **2×10=20**

(a) What is a thermodynamic cycle ? Derive an expression for thermal efficiency of otto cycle and show efficiency of this cycle is a function of compression ratio only.

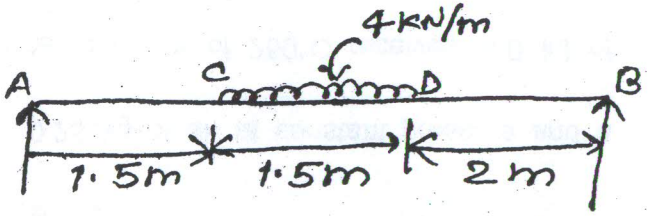
(b) Find the air standard efficiencies for the otto and diesel cycles on the basis of equal compression ratio of 10 and equal heat rejection of 840 kJ/kg. The suction conditions are 1 bar and 328 K.

(c) A cord supported at A and B carries a load of 20 kN at D and a load of W at C as shown in figure. Find the value of W so that CD remains horizontal.

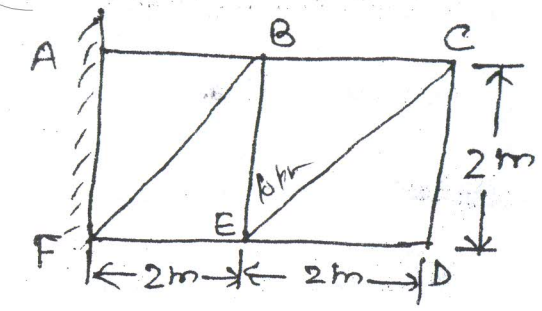


Q. 4. Attempt any two parts : **2×10=20**

(a) Draw the shear force diagram and bending moment diagram for the given beam as shown in Fig below :



(b) Determine the forces in all members of truss shown in Fig. below :



(c) What are various assumptions made in bending of beams ? Derive bending equation

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

where all quantities are in usual notations.

Q. 5. Attempt any two parts : **2×10=20**

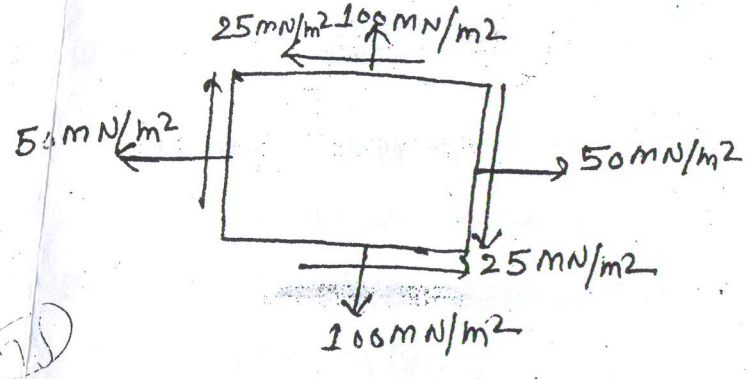
(a) A point in a material is subjected to a stress as shown in Fig. below.

Calculate :

(i) Principal stresses

(ii) Maximum shear stress

(iii) Direction of principal planes.



(b) The internal diameter of a hollow shaft is $\frac{2}{3}$ of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material.

(c) Describe following terms :

(i) Elastic constants

(ii) Mohr's circle

(iii) Stress-strain diagram

(iv) Strain energy

(v) Complementary shear stress

$x=0$ $98\times5-\frac{20\times5^2}{2}$

$x=5$

$98x-\frac{20x^2}{2}-20(x-5)$

$98\times7.5-\frac{20\times(7.5)^2}{2}-20(7.5-5)$

98 $735-562.5-20(2.5)$

$735-562.5-50$

-123

5261

B. Tech. Examination, 2013

(Second Semester)

(C.S. & I.T. Branch)

Paper - II

ENGINEERING MECHANICS

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any **five** questions.

Q. 1. Explain : 20

(a) Systems of forces

(b) Parallelogram law of forces

(c) Lami's theorem

(d) Free body diagram

(e) Triangle law

(f) Wedge friction

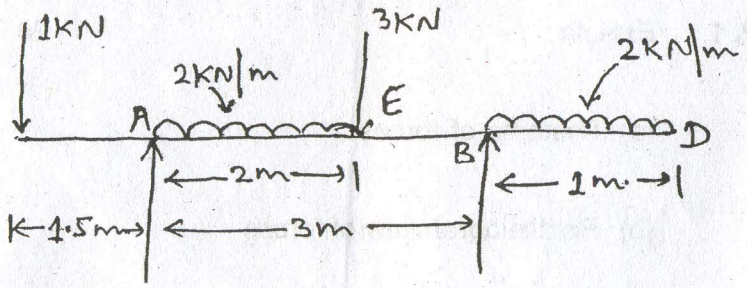
(g) Screw jack

(h) Torsion

(i) Strain energy

(j) D' Alembert's principle

Q. 2. (a) A beam AB of span 3 m overhanging on both sides is loaded as shown in Fig.



Determine the reactions at the supports A and B. **10**

(b) A block weighing 1500 N, overlying a 10° wedge on a horizontal floor and leaning against a vertical wall is to be raised by applying a horizontal force to the wedge. Assuming the coefficient of friction between all the surface in contact to be 0.3. Determine the minimum horizontal force required to raise the block. **10**

Q. 3. (a) A beam of length ℓ carries a uniformly distributed load of 'w' per unit length. The beam is supported on two supports at equal

distances from the two ends. Determine the position of the supports, if the B.M. to which the beam is subjected to, is as small as possible. Draw B.M. and S.F. diagram for the beam. **10**

(b) Explain the followings : **10**

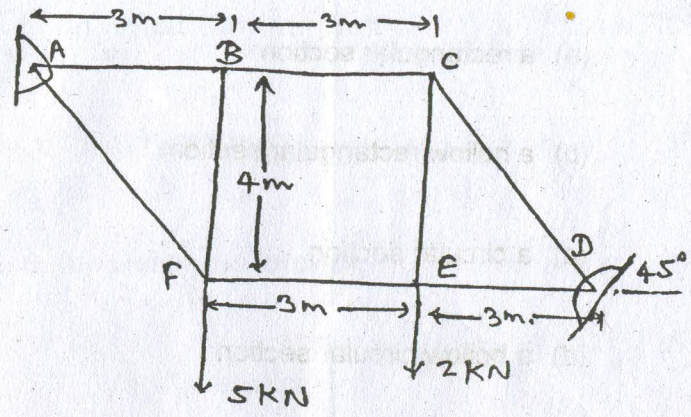
(i) Frame and it's types

(ii) Method of joints

(iii) Method of sections

(iv) Compressive stress

Q. 4. (a) A truss hinged at A and supported on rollers at D, as shown in Fig.



Find the forces in the members BC, FC, FE of the truss. **10**

(b) What is the difference between a simply supported frame and a cantilever frame ? Discuss the method of finding out reactions in both the cases. **10**

Q. 5. Derive an equation for moment of inertia of the following sections about centroidal section : **20**

(a) a rectangular section

(b) a hollow rectangular section

(c) a circular section

(d) a hollow circular section

Q. 6. (a) Find the C.G. of a solid hemisphere of radius r. **10**

(b) At a certain instant a body of mass 10 kg falling freely under the force of gravity was found to be falling at the rate of 20 m/sec. What force will stop the body in : **10**

(i) 2 seconds and

(ii) 2 metres

Q. 7. (a) What is the Belt Friction ? State it's application. **10**

(b) Define the following : **10**

(i) Kinematics

(ii) Rectilinear motion

(iii) Curvilinear motion

(iv) Rotational motion

(v) Uniform velocity

Q. 8. (a) Derive the bending formula : **10**

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

(b) Derive the Torsion formula : 10

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}$$

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B.Tech. Examination, 2013

(First Semester)

(M.E. and E.C. Branch)

ENGINEERING MECHANICS

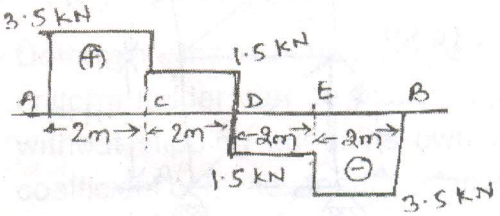
Paper - II

Time : Three Hours] **[Maximum Marks : 100**

Note :– Attempt any **five** questions. All questions carry equal marks.

1. (a) What is cone of friction? State its significance, also write the characteristics of frictional force. 10

(b) The shear force diagram of simply supported beam is given below. Calculate the support reaction of the beam and also draw the bending moment diagram of the beam. 10



[P. T. O.

2. (a) The frustrum of a right circular cone has a bottom radius 5 cm, top radius 3 cm and height 8 cm. A co-axial cylinder hole of 4 cm diameter is made through out the frustrum locate the position of centre of gravity of the remaining solid. 10

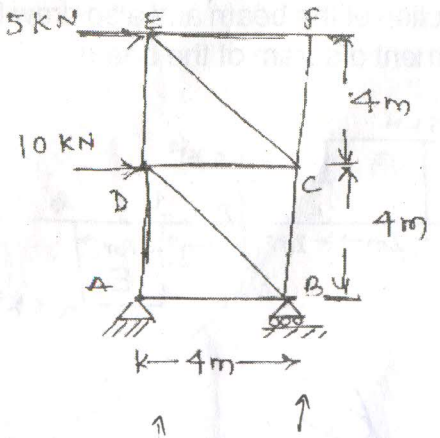
(b) State and prove the : 10

(i) parallel axis theorem

(ii) perpendicular axis theorem

3. (a) The length of connecting rod and crank in a reciprocating engine are 1000mm and 225nm respectively. The crank is rotating at 360 rpm. Find the velocity of cross head when the crank is turned through 30^0 with the line joining the centres.

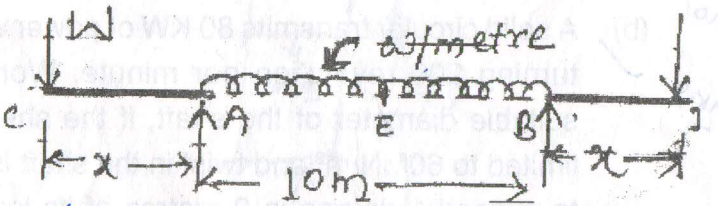
(b) Find out the axial forces in all members of a truss with with loading as shown in figure.



4. (a) Find the mass moment of inertia of the solid sphere with radius 'R'. 10

(b) The spring in a gun is held in vertical position and compressed by 0.25m. A ball of 40N weight is placed on the compressed spring which is subsequently released. Calculate the height to which the ball will rise and the velocity it will attain at a height of 2m. It may be pre-assumed that the spring has a stiffness of 5000N/mm.

5. (a) A simply supported beam with over-hanging ends carries transverse loads as shown in figure. If W=10w, what is the over-hanging length on each side, such that bending moment at the middle of beam is zero? Sketch the shear force and bending moment diagram. 10



(b) Determine the minimum angle q at which a uniform ladder can be placed against a wall without slipping under its own weight. The coefficient of friction for all surfaces is 0.2. 10

6. (a) A tension test bar is found to taper-from (D + a) diamter to (D – a) diameter. Show that the error involved in using mean diameter to calculate Young's modulus of elasticity is

$$\left(10\frac{a}{b}\right)^2 \text{ percent.}$$ 10

(b) Two blocks of masses m_1 = 25 kg and m_2=20 kg are connected by a light in extensible string which passes over a 25cm diameter pulley of 2.5kg mass. Neglecting friction, work out the accelaration of system and tension in the string when the masses are released from rest. Assume radius of gyration of the pulley to be equal to its radius. 10

7. (a) Derive the bending equation. State clearly the assumptions involved. 10

(b) A solid circular transmits 80 KW of power while turning 200 revolution per minute. Workout suitable diameter of the shaft, if the shear is limited to 60MN/m² and twist in the shaft is not to exceed 1 degree in 2 metres of its length. Assume the uniform turning moment and take modulus of rigidity for the shaft material

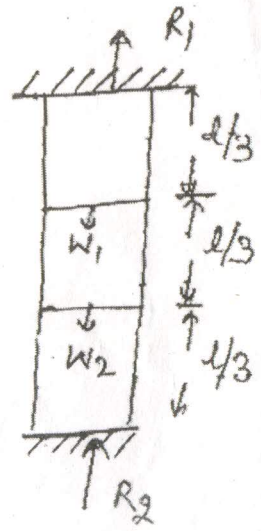
$C = 100\ GN/m^2$

8. (a) State the conditions for no reverse stress area in a :

(i) Circular section

(ii) reactangular section subjected to eccentric loading. 10

(b) A vertical bar of uniform section fixed at both ends is axially loaded at two intermediate sections by forces w_1 and w_2 as shown in figure. Determine the reactions R_1 and R_2 if W_1 = 1.5N, W_2 = 4500N. 10



586

B.Tech. Examination, 2014

(Second Semester)

(C.S. & I.T. Branch)

Paper - II

ENGINEERING MECHANICS

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any five questions.

Q. 1. (a) Classify the two dimensional force system and explain with suitable figures.

(b) A mass of 40 kg is suspended from a weightless bar AB which is supported by a cable CB and a pin at A as shown in Fig. 1. Determine the reaction at pin A.

AB = 280 mm, AC = 125 mm

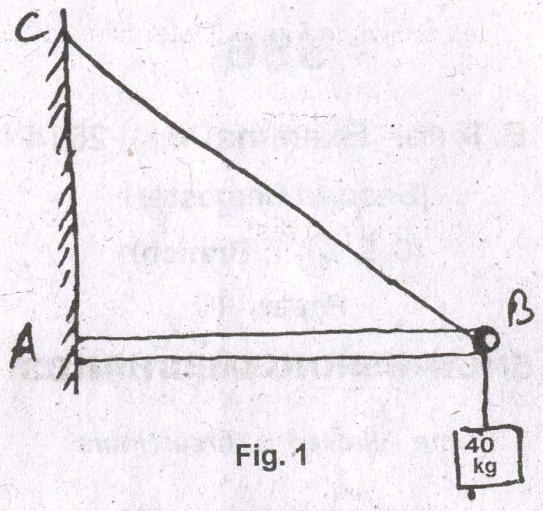


Fig. 1

Q. 2. (a) If P_1 and 500 N force as shown in Fig.2 sum vectorially to P_T, determine P_1 and P_T.

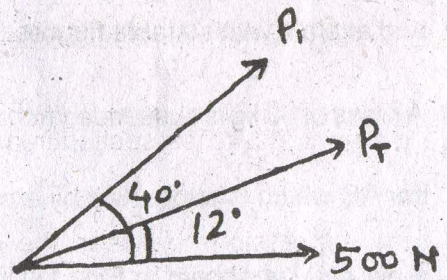


Fig. 2

(b) A small block of mass 100 kg is placed on a 30° inclined with a coefficient of friction of 0.25

as shown in Fig. 3. Determine the horizontal force to be applied on it in order to keep it in equilibrium at rest.

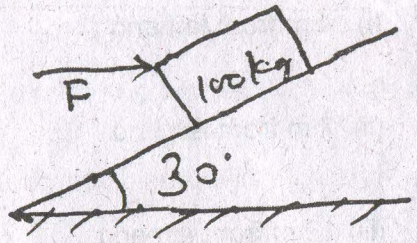


Fig. 3

Q. 3. (a) Define the terms shear force and bending moment at a cross-section in a beam. Derive the expressions between the distribution of the loading, the shear force and the bending moment.

(b) For the beam shown in Fig. 4. What is the shear force and bending moment at following positions ?

(i) 4 m from left end

(ii) 7 m from left end

(iii) 12 m from left end

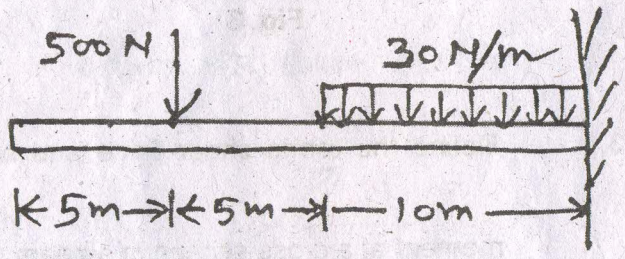


Fig. 4

Q. 4. (a) Determine the forces in members BC and BE of the given truss (Fig. 5) AB = 5 m, AF = 3 m, FB = 4 m, CD = 5 m, DE = EF = 3 m.

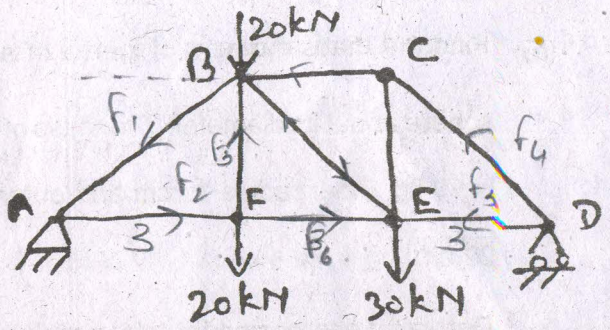


Fig. 5

(b) Determine the centroid of the area bounded by the x-axis, the line x = 9 m and the parabola $y^2 = 4x$.

Q. 5. (a) Find the moment of inertia of T-section as shown in fig. 6 about the centroidal x-axis and y-axis. All dimensions are in mm.

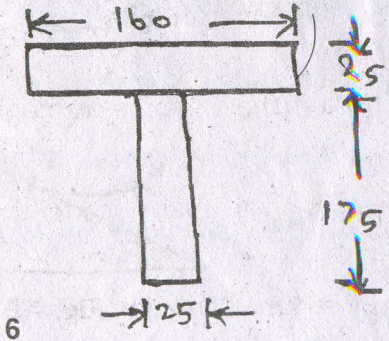


Fig. 6

(b) Find the mass moment of inertia of a hollow sphere about its diameter. The mass of sphere is 10 kg, inner radius 10 cm and outer radius 20 cm.

Q. 6. (a) Derive an expression for total acceleration of a point on a rigid body in pure rotation.

(b) A wheel of radius 0.5 m rolls without slip down on an incline plane as shown in Fig. 7. At the instant of interest, the velocity and the acceleration of the center of mass are 10 m/s and 5 m/s^2 respectively. Determine the velocities of the points P and Q on the periphery.

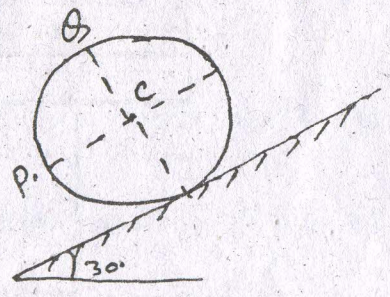


Fig. 7

Q. 7. (a) A uniform rod of mass 20 kg and length 5 m is pivoted at one end and is rotated with an angular speed of 10 rad/s in horizontal plane. Find the force on the pivot due to rod.

(b) A rectangular bar having uniform cross-section of 4 cm × 2.5 cm and of length 2.2 m is hanging vertically from a rigid support. It is subjected to an axial loading of 10 kN. If the density of material of the bar is 8000 kg/m^3 and E = 200 GPa, find the maximum stress and elongation of the bar.

Q. 8. (a) A rectangular wooden beam is subjected to a bending moment of 5 kNm. If the depth of the section is to be twice the width and stress in wood is not to exceed 60 N/cm^2, find the dimension of the cross-section of the beam.

(b) Calculate the minimum diameter of a solid steel shaft which is not allowed to twist more than 3° in 6 m length when subjected to a torque of 12 kNm. Also calculate the maximum shearing stress developed.

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B.Tech. Examination, 2014

(First Semester)

(M.E. and E.C. Branch)

ENGINEERING MECHANICS

Paper - II

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any five questions. All questions carry equal marks.

Q. 1. (a) State the varignon's principle. Also give the proof of varignon's principle. **10**

(b) The shear force diagram (SFD) of a simply supported beam is given in fig. Calculate the

support reactions of the beam and also draw the bending moment diagram of the beam. **10**

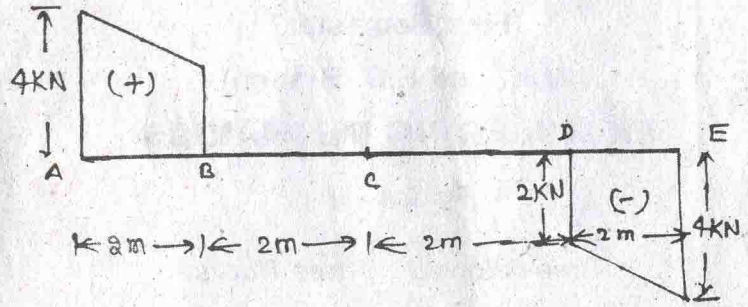
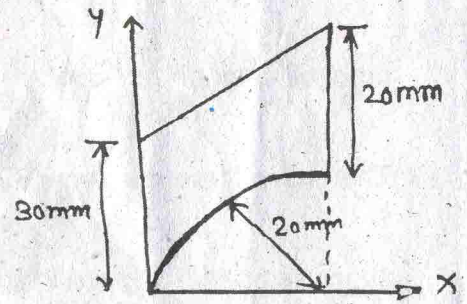


Fig. - SFD

Q. 2. (a) Determine the area moment of inertia of the composite area shown in fig. about x and y-axis. **10**

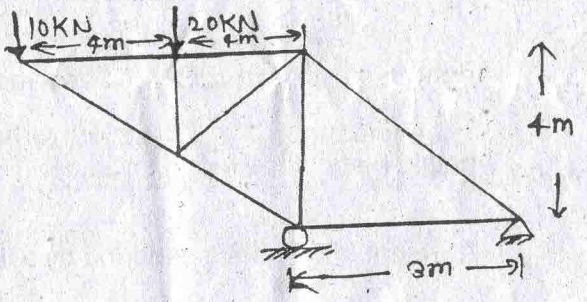


(b) State and prove the : **10**

(i) Parallel axis theorem

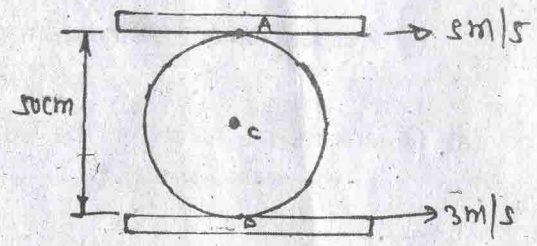
(ii) Perpendicular axis theorem

Q. 3. (a) Determine the forces in the truss shown in fig. **10**



(b) A cylindrical roller, 50 cm in diameter is in contact with two conveyor belts at its top & bottom. If the belt run at the uniform speed of

5m/s & 3m/s, find the linear and angular velocity of the roller. 10



Q. 4. (a) Determine the mass moment of inetia of a right circular solid cone of base radius R & height h about the axis of rotation. 10

(b) A weight of 5 N is suspendend by a light rope wound round a pulley of weight 5 N & radius 30 cm, the other end of the rope being fixed to the periphery of the pulley. If the weight is moving down words, determine : 10

(i) Aceleration of the weight 5N, &

(ii) Tension in the string, Take g = 9.80 m/s^2.

Q. 5. (a) Draw the S.F. and B.M. diagram for the overhanging beam carrying u.d.l. of 2 kN/m over the entire length of beam and a point load of 2 kN as shown in fig. Locate the point of contraflexure. 10

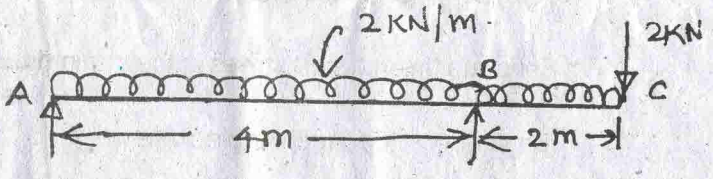


Fig. - Loaded Beam

(b) A ladder 5m long and 250 N weight is placed against a vertical wall in a position where its inclination to the vertical is 30°. A man

weighing 800 N climbs the ladder. At what position will he induce slipping ? The coefficient of friction for both the contact surfaces of the ladder is 0.2. **10**

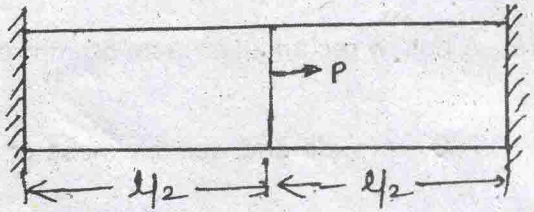
Q. 6. (a) A crane-chain whose sectional area is 6.25 cm^2 carries a load of 10 kN. As it is being lowered at a uniform rate of 40 m per minute, the chain gets Jammed suddenly, at which time the length of the chain is unwound is 10 m. Estimate the induced stress in the chain due to the sudden stoppage. Neglect the weight of the chain. Take $E = 2.1 \times 10^5$ N/mm^2. **10**

(b) Derive an expression for the shear stress produced in a circular shaft which is subject to torsion. What are the assumptions made in the derivation ? **10**

Q. 7. (a) A hollow rectangular beam 50 mm deep and 200 mm wide and wall thickness of 5 mm is simply supported over a span of 6 m. Determine the maximum bending stress in the beam if a uniformly distributed load of 11 kN/m is applied over a span of the beam. The bending stress is not to exceed 90 N/mm^2. **10**

(b) Draw the stress-strain diagram for a ductile material and explain all salient points on it. **10**

Q. 8. (a) A bar of uniform cross-section fixed at both ends is loaded as shown in fig. Determine the reactions at the support. **10**



(b) Determine the diameter of a solid shaft which will transmit 300 kW at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 & angle of twist should not be more than 1° in a shaft of 2 m. Take modulus of rigidity = 1×10^5 N/mm^2. **10**

H

Shivkumar Arora

2005

B. Tech. Examination, 2012

(First Semester)

M. E. and E. C. Branch

ENGINEERING MECHANICS

Paper II

Time : Three Hours] [Maximum Marks : 100

Note :– Attempt any **five** questions. All questions carry equal marks.

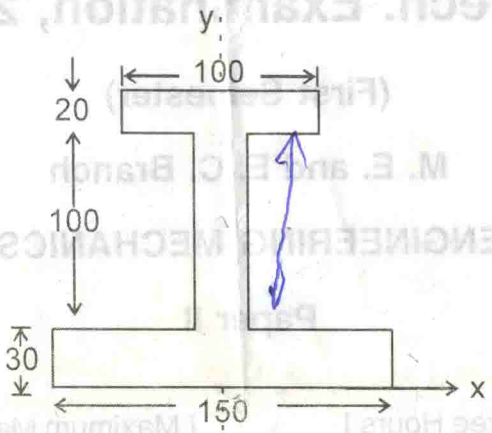
1. (a) State and prove Lami's theorem.

(b) A simply supported beam AB is carrying a linearly varying load of intensity zero at support A to a load of w per unit length at support B. Draw the shear force and bending moment diagrams. Locate the position of maximum bending moment.

[P. T. O.

2 (a) Distinguish between statically determinate and indeterminate beams.

(b) Determine the centroid of the I-section shown in figure 1.



All dimensions are in mm.

Fig. 1

3. (a) Find the mass moment of inertia of the solid cone of height h and base radius R about its axis of rotation.

(b) A block weighing 130 N is on an inclined plane whose slope is 5 vertical to 12 horizontal. Its initial velocity down the inclined plane is 2.4 m/s. What will be its velocity 5 seconds later? Take the coefficient of friction at contact surface = 0.3.

4. (a) The angular acceleration of a flywheel is given by the expression $\alpha = 6t - t^2$ where α is in rad/s^2 and t is in seconds. When will the flywheel stop momentarily prior to reversing the direction, given that the flywheel starts from rest. How many revolutions are made during this time?

(b) A steel flat plate of thickness 10mm tapers uniformly from 60 mm at one end to 40 mm. at the other end in a length of 600 mm. If the bar is subjected to a load of 80 kN, find its extension. Take $E = 2 \times 10^5$ MPa. What is the percentage error if the average area is used for calculating extension?

5. (a) A ladder of length L rests against a wall, the angle of inclination being 45°. If the coefficient of friction between the ladder and the ground and that between ground and the wall is 0.5 each, what will be the maximum distance on the ladder to which a man whose weight is 1.5 times the weight of ladder, may ascend before the ladder begins to slip?

(b) Bring out the differences among perfect, deficient and redundant trusses. Enlist the assumptions made in the analysis of pin jointed trusses.

6. (a) A pulley of weight 400 N has a raduus of 0.6 m. A block of 600 N is suspended by a tight rope wound round the pulley, the other end being attached to the pulley as shown in fig. 2. Determine the resulting acceleration of the weight and the tension in the rope.

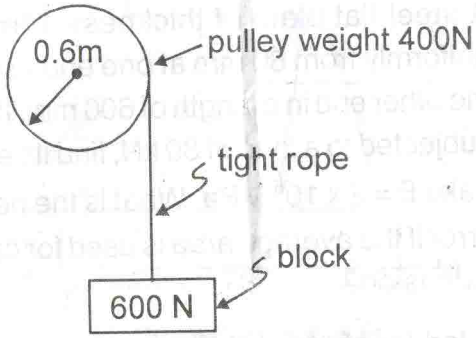


Fig. 2

(b) Draw a labelled stress-strain diagram for mild steel specimen and explain the salient points, when it is subjected to tensile loading.

7. (a) The resultant of two forces one of which is double the other, is 260 N. If the direction of the larger force is reversed and the other remains unaltered, the resultant reduces to 180 N. Determine the magnitude of the forces and the angle between the forces.

(b) Derive the expression for variation of bending stress for a beam.

(i) Of reactagular cross section of width b and depth d.

(ii) Of hollow rectangular section with symmetrically placed opening.

8. (a) Determine the diameter of solid shaft which will transmit 450 kW at 300 rpm. The angle of twist must not exceed one degree per metre length and the maximum torsional shear stress is th be limited to 40 N/mm^2. Assume modulus of rigidity as 80 kN/mm^2.

(b) Derive the relationship between tension on tight side and slack side in belt - pulley drive system.