NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (H.P)
End Semester Examination, Odd Semester 2020–21

Year and Semester: B.Tech. 1st Year and 1st Sem.
Course Name: Applied Mechanics
Duration: 2 hrs.
Total number of pages: 4

Section: A, B, C, D and E
Course Code: CE-101
Max Mark.: 50

Instructions:

a) **Attempt any six questions from PART-A and all questions from PART-B.**
b) All dimensions (Distance & Force Units) are in 'm' & 'kN' except when specified otherwise (S.I Units)
c) Assume necessary data wherever required and clearly mention it in the answer-sheet

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(PART-A: Attempt any Six Questions)

(Q.1) Locate the Center of Gravity with respect to x and y axis for the **built-up cross section** as shown in Fig.1. Also, compute the Moment of Inertia about *x'-x'* and *y'-y'* axis (Centroidal axis). **(6 Marks)**

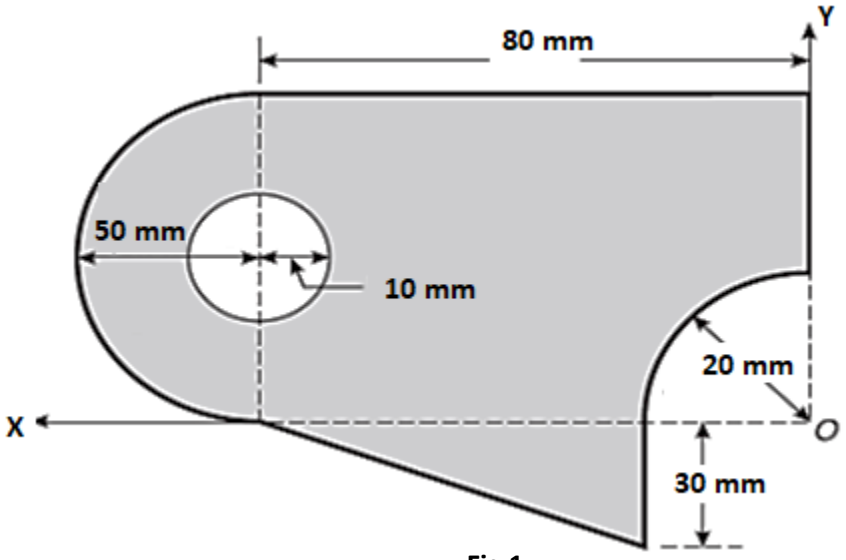


Fig.1

(Q.2) Using the Method of Potential Energy, determine the magnitude of force P required (in Fig.2**)** for keeping the mechanism in position. The self-weight of member AB, and BC is 9 N (each). The spring is unstretched at $\theta = 45^0$. **(6 Marks)**

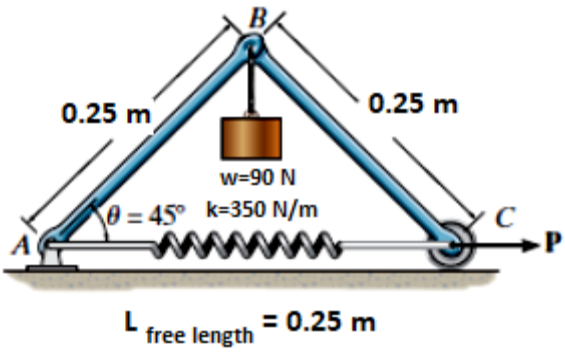


Fig.2

(Q.3) Determine the smallest horizontal force P required to move the block A (Fig.3). **(6 Marks)**

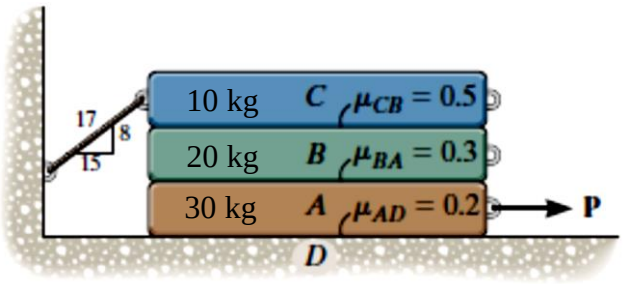


Fig.3

(Q.4) Two masses are interconnected with an inextensible cord as shown in Fig.4. Considering coefficient of friction at the contiguous surface μ=0.25, determine the acceleration and the tension in the string. Take m_1=15 kg and m_2=8 kg. **(6 Marks)**

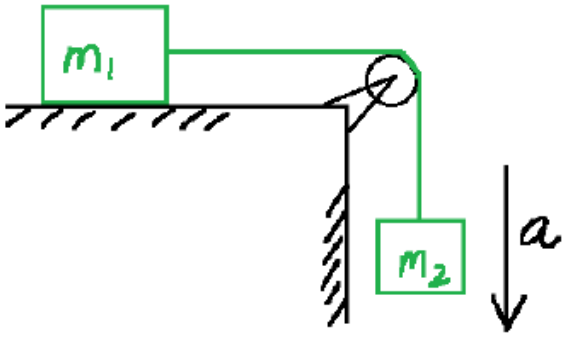


Fig.4

(Q.5) The 60 kg box is pulled by the constant force P. If the box starts from rest and achieves a speed of 10 m/s in 5 sec. Determine the magnitude of P in Fig. 5, if the co-efficient of kinetic friction between the box and the ground is μ_k = 0.2. **(6 Marks)**

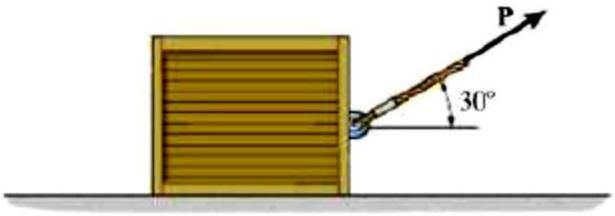


Fig.5

(Q.6) Construct the **Shear Force, Axial Force and Bending Moment** diagrams for the **Over Hanged beam as** shown in Fig.6. **(6 Marks)**

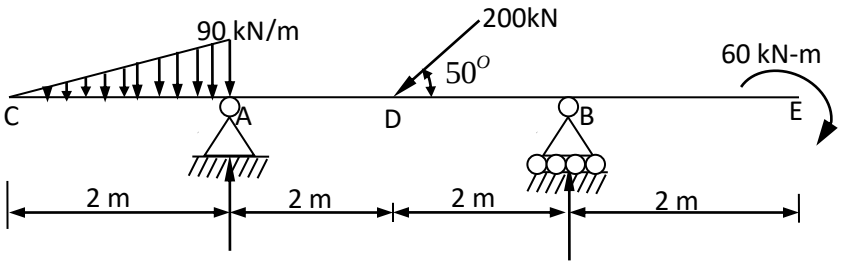


Fig.6

(Q.7) Construct the **Shear Force, Axial Force and Bending Moment** diagrams for the **frame** as shown in Fig. 7. **(6 Marks)**

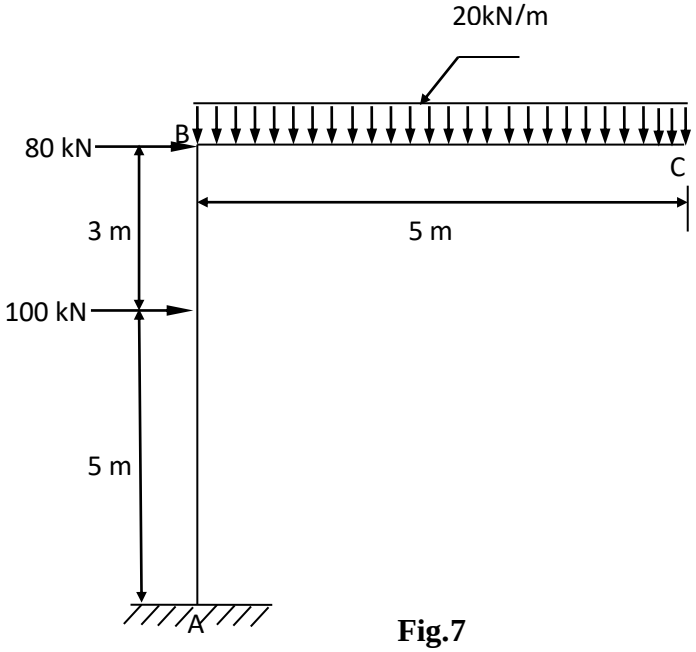


Fig.7

(Q.8) A solid steel shaft carries the torques T_1=500 N-m and T_2 =1000 N-m (Fig. 8). Using L_1=L_2=3 m and G=80 GPa, Determine the smallest allowable diameter of the shaft if the shear stress is limited to 60 MPa and the angle of rotation of the free end is not to exceed 4°. **(6 Marks)**

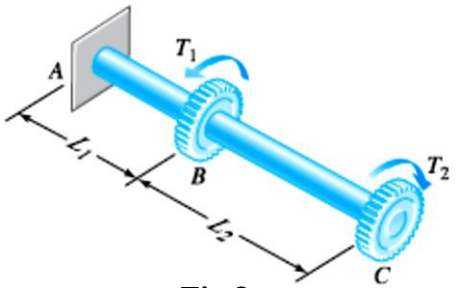


Fig.8.

(Q.9) A solid rod is subjected to axial load as shown in Fig.9. Determine the Axial Displacement of point B, C & D. Take E = 200 GPa. **(6 Marks)**

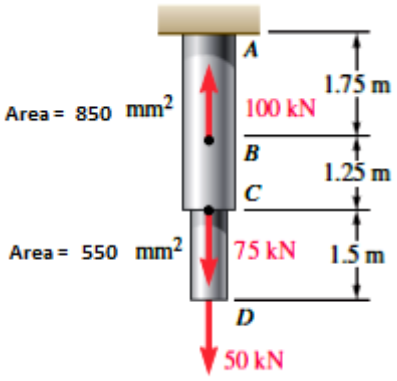


Fig.9

(PART-B: All questions are mandatory)

(Q.10) A truss having the length of each member 4 m is loaded as shown in Fig.10. (a) Compute the internal force of all the members of truss using **Method of Joints.** (b) Compute the internal force in member BE of the truss using **Method of Section.** **(5+2=7 Marks)**

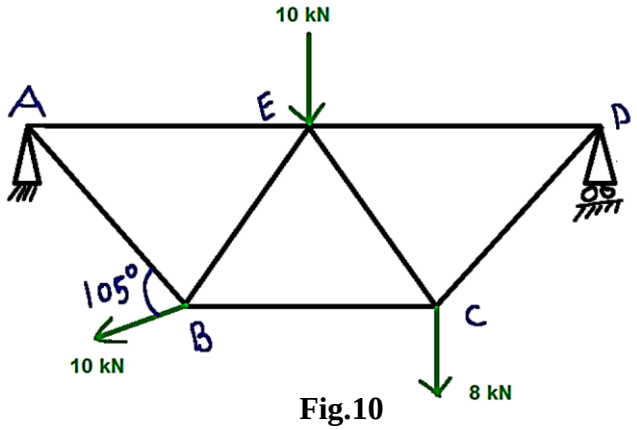


Fig.10

(Q.11) A beam is subjected to maximum bending moment 200 kN-m and maximum shear force 100 kN (Fig.11). Draw **the bending stress** and **shear stress distribution** over the cross section of the beam if the thickness of web and flange is 5 mm. **(7 Marks)**

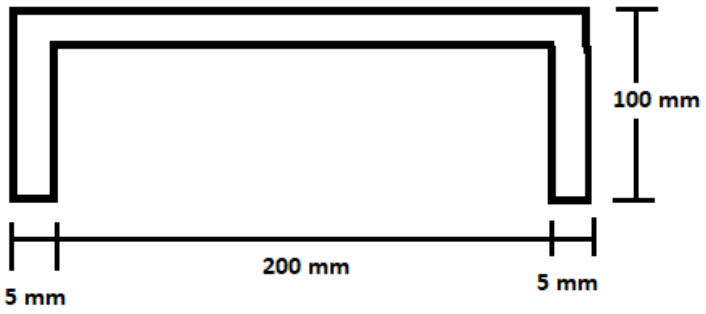


Fig. 11 Cross-Section of beam

(E) 7/12/17 (Rajesh Sharma) F1 (314)

Roll No.....

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B. Tech. Examination, December 2017

Branch: Mechanical Engineering **Semester** I

Title of the course: Engineering Mechanics and Strength of Material **Course Code**: MED-114

Time: 3 Hours Maximum Marks: 60

Note: Attempt all the questions; assume missing data, if any.
Use of Non-Programmable calculator is allowed

I [4, 4]

a. Determine the centroid of the object shown in Fig. 1
b. In a bell crank lever shown in Fig. 2, W=600 N, determine the value of P and the reaction of the fulcrum B on lever.

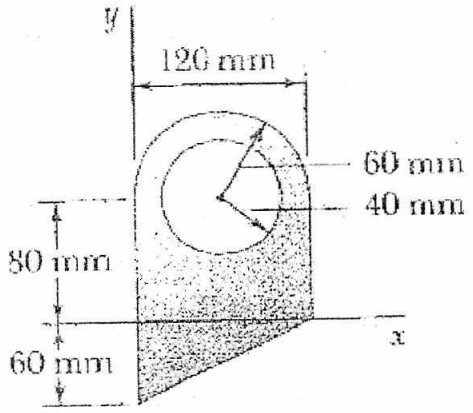


Fig. 1

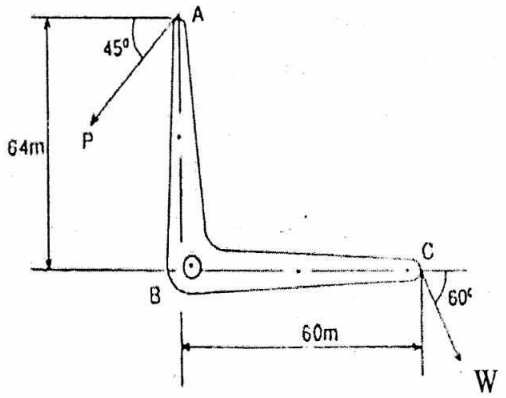
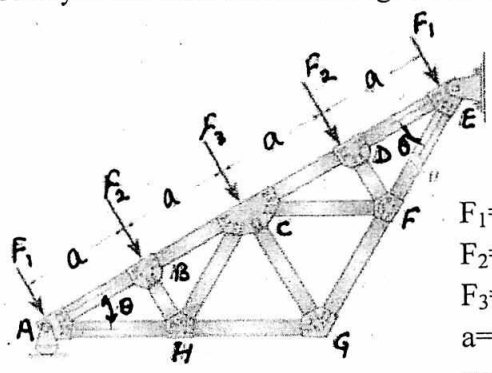


Fig. 2

II [8]

Analyze the truss shown in Fig. 3 and determine the forces in Members GC, FC, and FD.



F_1=500 N,
F_2=1 kN,
F_3=1 kN,
a=2.5 m,
θ=30°

Fig. 3

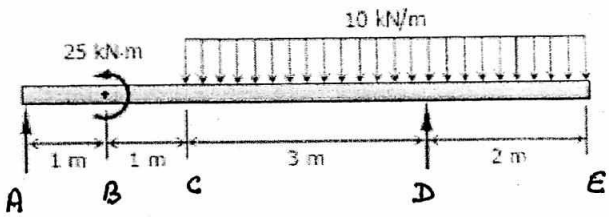


Fig. 4

III [8]

Draw the shear force and bending moment diagram of the beam shown in Fig. 4 after due calculations.

IV [5, 5]

a. A bar having a cross-sectional area of 700mm^2 is subjected to axial loads at the positions indicated in Fig. 5. Find the value of stresses and corresponding strains in all the segments. Take modulus of elasticity as 200 GPa.

b. A plane element is subjected to following stresses σ_x = 80MPa (compressive), σ_y = 50 MPa (tensile) and τ_{xy} = 25MPa (clockwise when considered on x-axis) find: (i) Principal stress and their direction; (ii) Maximum shear stress and angular position.

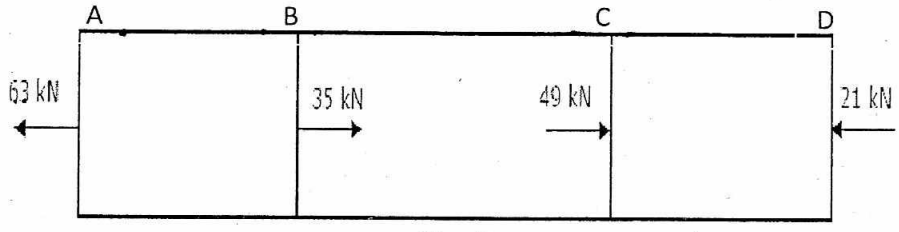


Fig. 5

V [10]

Find the maximum tensile and compressive stresses in a simply supported beam of cross-section shown in Fig. 6. Indicate the stresses based on nature on respective faces.

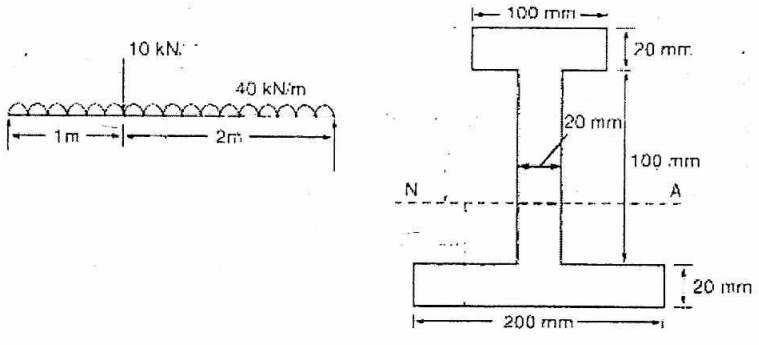


Fig. 6

VI [5, 5]

a. Determine the maximum torque that can be applied to a hollow circular steel shaft of 100-mm outside diameter and an 80-mm inside diameter without exceeding a shearing stress of 60 MPa or a twist of 0.5 deg/m. Use G = 83 GPa.

b. In a close coiled spring, the diameter of the coil is 10 times that of the wire of the spring and the maximum shear stress is not to exceed 60MPa. Maximum permissible deflection under load of 400 N is 100mm. Determine the number of coils and the energy stored in the spring if shear modulus is 9x10^4 N/mm^2.

VII [6]

A cylindrical shell is 3 m long, 1.5 m internal diameter and 20 mm thick is subjected to an internal pressure of 2 N/mm^2. Calculate the change in the dimensions of the cylindrical shell subjected to internal pressure by taking E=0.2 x10^6 N/mm^2 and Poisson ratio =0.3. Also calculate the change in volume.

Roll No.....

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B. Tech. Examination, December 2018

Branch: Mechanical Engineering **Semester** I

Title of the course: Engineering Mechanics and Strength of Material **Course Code**: MED-114

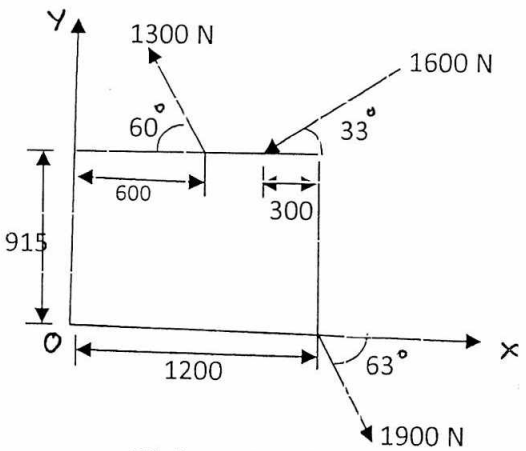
Time: 3 Hours Maximum Marks: 60

Note: Attempt all the questions; assume missing data, if any.
Use of Non-Programmable calculator is allowed.

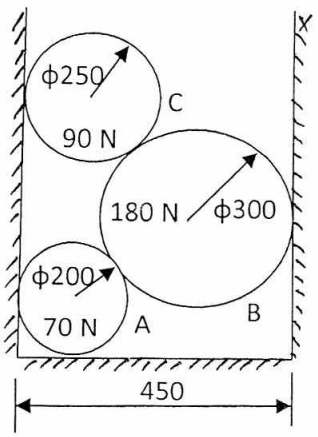
1. [5, 5]

a. Determine the resultant of the forces shown in Fig. 1 (a) and its position/location.

b. Three cylinders rest in a rectangular channel as shown in Fig. 1 (b), find reactions at the points of contact.



All dimensions in mm
Fig. 1 (a)



All dimensions in mm
Fig. 1 (b)

2. [10]

Determine the forces in members CF, FD, and DG for the truss shown in Fig. 2

3. [5, 5]

a. Find the centroid of the shaded segment shown in Fig, 3.

b. Find the Principal stresses, Maximum shear stress and respective angular positions for the stress element shown in Fig. 4.

4. [10]

Three rods of diameter 20 mm each carry the load acting on the beam as shown in Fig. 5. What will be the distance of load P acting on the beam so as to maintain the position of beam horizontal? Take Modulus of elasticity as 200 GPa, 100 GPa, and 60 GPa for steel, brass, and aluminium respectively.

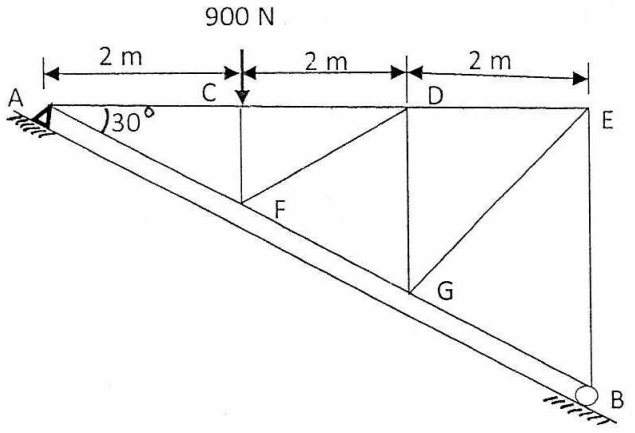


Fig. 2

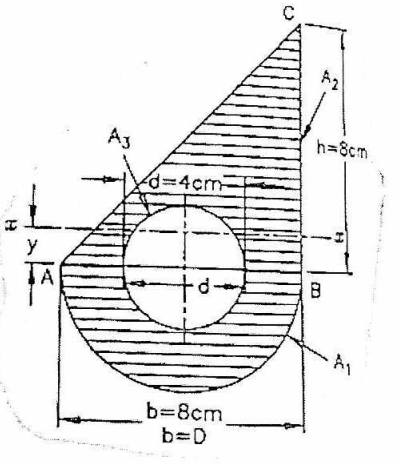


Fig. 3

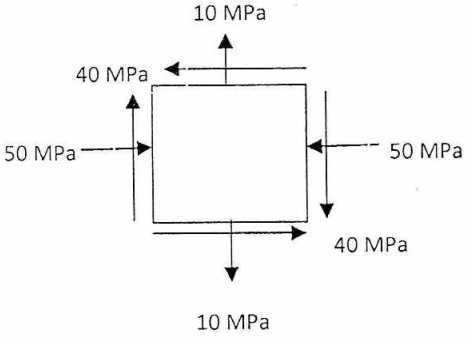


Fig. 4

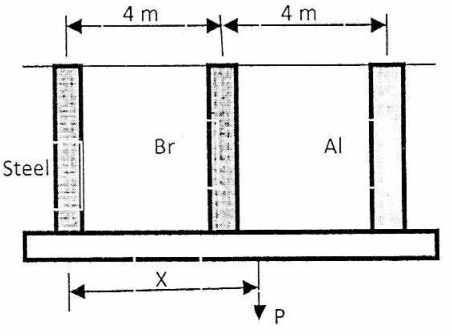


Fig. 5

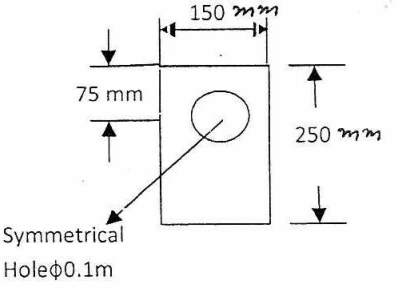


Fig. 6

5. [10]

A simply supported beam of span 4 m carries udl of 2500 N/m over the entire span length. It also carries a point load of 1000 N at a distance of 1.2 m from left hand support. The cross-section of the beam is shown in Fig. 6. Draw the bending moment diagram and find the maximum stress acting on the beam.

6. [5]

A close coil helical spring having 8 coils of mean coil diameter 80 mm and wire radius 5 mm is acted upon by a twisting moment of 10 Nm. Determine the bending stress induced, angle of twist and the change in the number of coils after the action of twisting moment if the modulus of elasticity is 200 GPa.

7. [5]

A cylindrical shell of internal diameter 300 mm, wall thickness 10 mm and length 1.5m is filled by a fluid at atmospheric pressure. If an additional fluid of 300 cc is pumped in the cylindrical shell, what will be the pressure exerted by the fluid and other stresses induced. Take modulus of elasticity as 200 GPa and Poisson' ratio as 0.3.

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR Roll No.....

End Semester Examination for I[st] Year B.Arch in Architecture (II SEMESTER) 2018 – 2019

MECHANICS OF STRUCTURES

Course No: ARD 125

Duration: 9.00 P.M -12.00P.M

Date: 03. 05. 2019, Day: Fri day

Max. Marks: 60

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Instructions:

(a) Answer the any of the **SIX QUESTIONS** only

(b) Each question **strictly solved by mentioned/specified method only**

#(c) Assume necessary data wherever required.

(d) All Dimensions (Distance & Force units) are in "m &N" expect when specified otherwise (S.I Units).

(Q.1). The centre of gravity of the 1360kg car is at G. The car is parked on an incline with the parking brake engaged, which locks the rear wheels. Find (a) the normal forces (perpendicular to the incline) acting under the front and rear pairs of wheels; and (b) the friction force (parallel to the incline) under the rear pair of wheels. (Fig.1) **[10]**

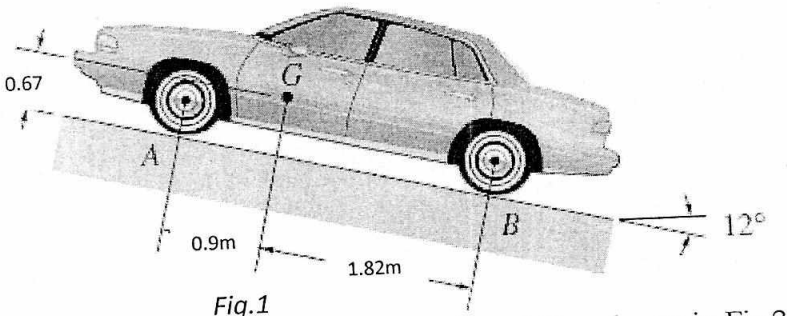

Fig.1

(Q.2).Determine the reactions at contact points for spheres A, B, and C as shown in Fig.2. It is given that: $W_A = W_B = 4$ kN, $W_C = 6$ kN, $d_A = d_B = 500$ mm, $d_C = 800$ mm (Fig.2) **[10]**

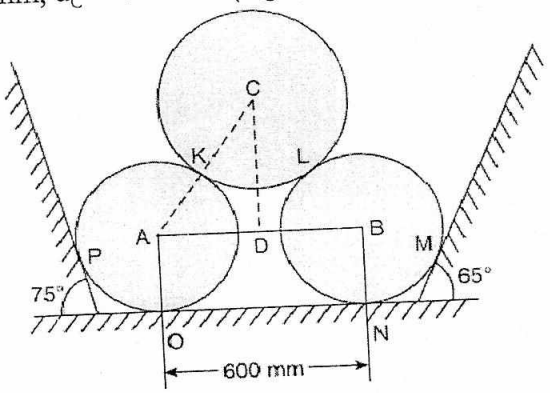

Fig.2

(Q.6) Construct the Shear force, Axial force (Horizontal Thrust)diagrams and Bending moment diagrams for the following loaded over hanging beam structures as shown in Fig.6. [10]

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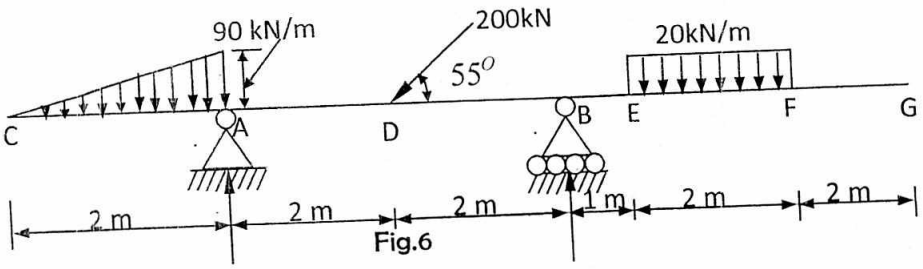

Fig.6

(Q.7).A Compound bar consisting of Bronze, Aluminium, and Steel segments isolated axially as shown in the Fig.7. Determine the maximum allowable value of P if the change in length of the bar is limited to 2 *mm* and the working stresses prescribed in the Table.1 are not to be exceeded. [10]

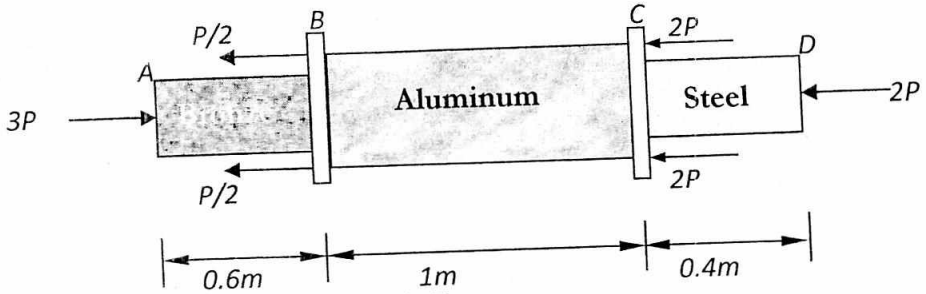

Fig.7

Table.1

Segment	Bronze	Aluminium	Steel
A(mm^2)	450	600	300
E(*GPa*)	83	70	200
τ_{xx} (*MPa*)	120	80	140

(Q.8).The compound bar, composed of the three segments as shown in Fig.8, is initially stress free. Compute the stress in each material if the temperature drops 25°C. Assume that the walls do not yield and use the following data: [10]

	A (mm^2)	α (/°C)	E (GPa)
Bronze segment	2000	19.0×10^{-6}	83
Aluminum segment	1400	23.0×10^{-6}	70
Steel segment	800	11.7×10^{-6}	200

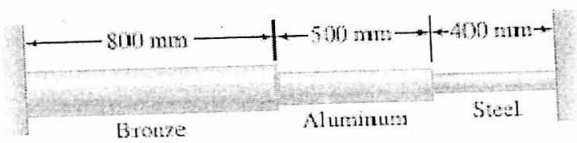

Fig.8

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National Institute of Technology, Hamirpur (HP)

Civil Engineering Department

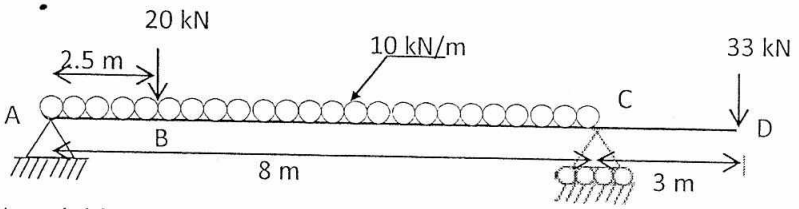
Name of the Examination: End-term Examination (Dec. 2019)

Year: First Year
Semester: First Semester
Course Name: Applied Mechanics
Time: 3:00 hr.

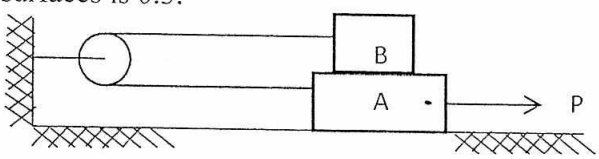
Branch: Group A to Group E

Course Code: CE-101
Maximum Marks: 50

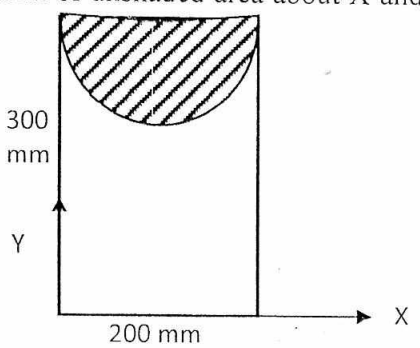
Q.1. Using the method of virtual work, determine the reaction at A of the beam shown in Fig. **6**



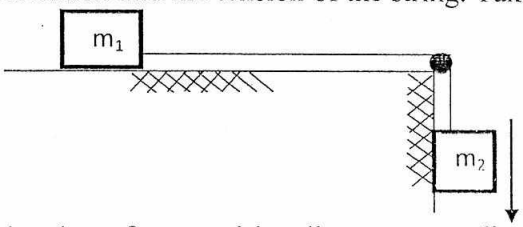
Q.2. Block A weighing 240 kg resting on a rough floor supports block B weighing 120 kg as shown in Fig. below. Both the blocks are connected with a rope passing over a smooth frictionless pulley. Compute the magnitude of force P at impending motion and the tension induced in rope, if the coefficient of friction for all contiguous surfaces is 0.3. **6**



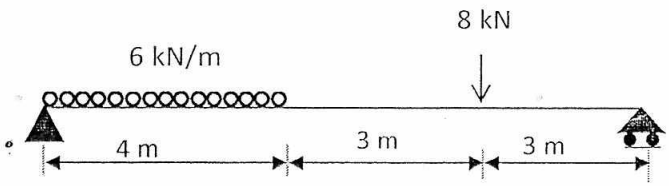
Q.3. Determine the second moment of unshaded area about X and Y-axes as shown in Fig. **6**



Q.4. Two masses are interconnected with an inextensible cord as shown in Fig. Considering coefficient of friction in the contiguous surfaces $\mu = 1/3$, determine the acceleration and the tension of the string. Take $m_1 = 12$ kg and $m_2 = 6$ kg. **6**

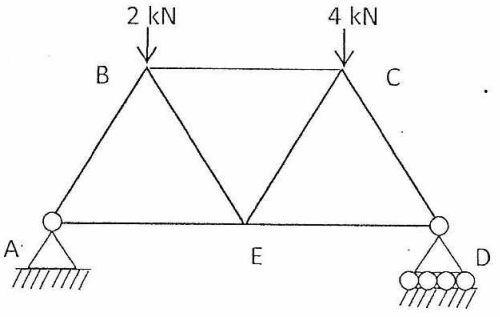


Q.5. Draw the shear force and bending moment diagram for the beam shown in the Figure. **6**

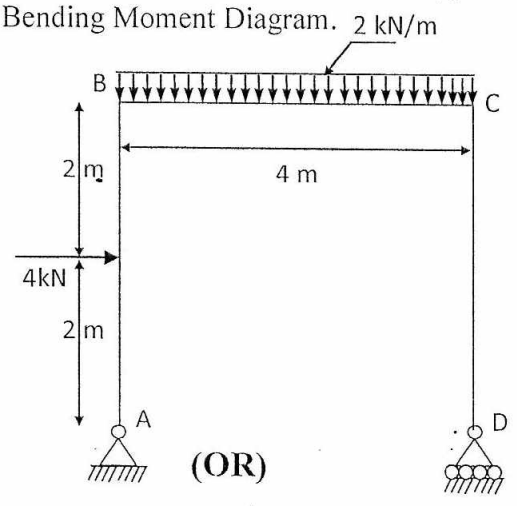


PTO

Q.6. A Warren truss consists of seven members each of 3 m length and simply supported as shown in Figure. The truss is loaded at B and C as shown. Find the forces in all the members of the truss, indicating whether the forces are compressive or tensile using any method. **(6)**



Q.7. For the rigid jointed Frame shown in Figure determine support reactions and draw Shear Force and Bending Moment Diagram. **(8)**



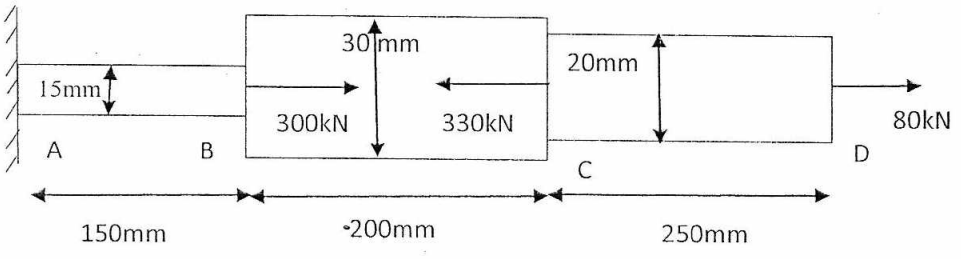
(OR)

For the bar system shown in Figure below, Calculate

(i) Total elongation of the bar system.

(ii) Length of middle segment, for zero elongation of bar system.

(iii) Diameter of last segment, for zero elongation of bar system.



Q.8. A simply supported beam of span 6 m has a cross-section 300 mm wide and 600 mm deep. If the permissible stress is 30 N/mm^2. **(6)**

(a) Find maximum intensity of UDL it can carry

(b) Find the value concentrated load P if applied at 2 m from the one end

(c) Find the radius of curvature. If E= 200 GPa