Kadi Sarva Vishwavidyalaya
BE SEM-II
Subject: Mechanics of Solids

Date: 01/06/2013 Max. Marks: 70
Time: 3 Hrs

Instruction: (1) Answer each section in separate Answer sheet
(2) Use of Scientific calculator is permitted

Section - I

Q.1 **Each carries equal marks** **[15]**

[A] **1)** Moment of area about its axis is_____ (Three times the area, Zero, Twice the area)
2) Gravitational force between two objects is a _____ (Surface force, Reactive force, Body force)
3) If two forces P & Q (P>Q) act on the same straight line but in opposite direction their resultant is_____ (P+Q, Q-P, P-Q)
4) The magnitude of moment is_____ when a force is applied perpendicular to the lever. (Maximum, Minimum, Zero)
5) The constant of proportionality for a member under shear stress and strain is given by _____(Elasticity, Rigidity, Bulk modulus)

[B] State Pappus-Guldians theorem for surface of revolution.

[C] Define force and discuss its characteristics

OR

[C] State and explain Varigon's theorem

Q.2 **Each carries equal marks** **[10]**

[A] Determine the magnitude and direction of force P which keeps the given system (fig 1) in equilibrium.

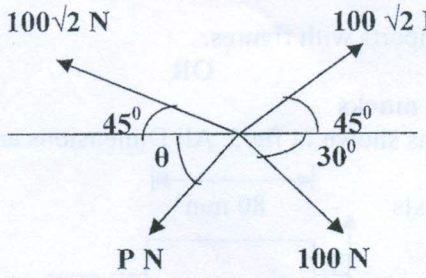

Fig 1 (NOT TO THE SCALE)

[B] Determine the Resultant Force in terms of Magnitude, Direction and Position for the following equilateral triangular force system (fig 2).

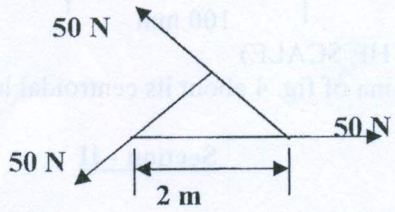

Fig 2 (NOT TO THE SCALE)

OR

Q.2 **Each carries equal marks** **[10]**

[A] Compute the Tension in all strings for the following fig 3.

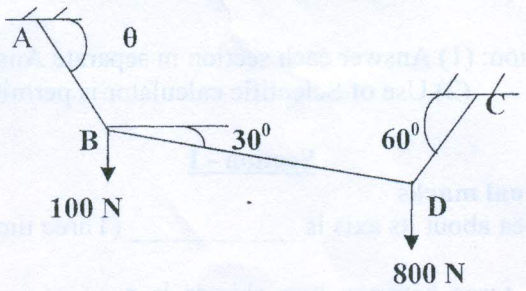

Fig 3 (NOT TO THE SCALE)

[B] Find member forces in all members of the given truss fig 4. Length of all members is 3m.

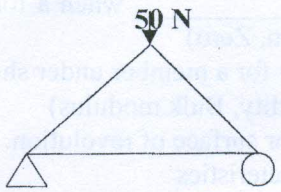

Fig 4 (NOT TO THE SCALE)

Q.3 **Each carries equal marks** **[10]**

[A] A body resting on a rough horizontal plane required a pull of 18 N inclined at 30^0 to the plane to just move it. It was found that the push of 22 N inclined at 30^0 to the plane just moved the body. Determine the weight of the body and coefficient of friction.

[B] Explain types of supports with figures.

OR

Q.3 **Each carries equal marks** **[10]**

[A] Find CG of lamina as shown in fig 5. All Dimensions are in mm.

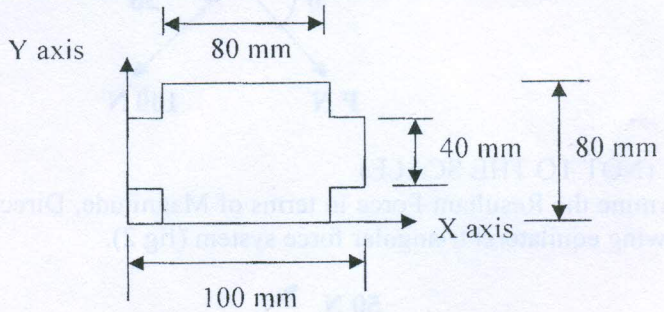

Fig 5 (NOT TO THE SCALE)

[B] Find MI of the lamina of fig. 4 about its centroidal horizontal and vertical axes.

Section - II

Q.4 **Each carries equal marks** **[15]**

[A] Explain types of beams with figures.

[B] Calculate all support reactions for cantilever beam of length 5 m subjected to

10kN/m UDL throughout the span.

[C] Calculate all support reactions for simply supported beam of length 5 m subjected to 10kN.m clockwise moment at centre.

OR

[C] Explain the stress – strain curve of mild steel under tension.

Q.5 **Each carries equal marks** **[10]**

[A] Draw shear force and bending moment diagrams for simply supported beam of span 6m carrying UDL of 6kN/m throughout its span and central point load of 16kN.

[B] Draw shear force and bending moment diagrams for fig. 6

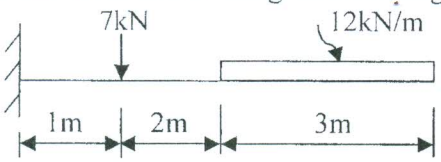

Fig. 6 (NOT TO THE SCALE)

OR

Q.5 **Each carries equal marks** **[10]**

[A] A hollow steel bar of length 2m has a circular cross section of outer diameter 80mm and thickness 10mm. Determine the change in length if it is subjected to an axial pull of 80 kN. Take E = 200 GPa

[B] A reinforced concrete column 300 x 300 mm has 4 reinforcing steel bars of 25 mm diameter in each corner. Find the safe axial load on the column when the concrete is subjected to a stress of 5 N/mm^2. What is corresponding stress in steel?
Take $E_s/E_c = 18$

Q.6 **Each carries equal marks** **[10]**

[A] Prove $M / I = \sigma / y = E / R$

[B] Prove $T_{max} = 1.5\ T_{av}$ for recteangular section, Where T = Shear stress

OR

Q.6 **Each carries equal marks** **[10]**

[A] A high strength steel band saw, 20 mm wide by 10 mm thick runs over a pulley 600 mm in diameter, what maximum flexural stress is developed? What minimum diameter pulley can be used without exceeding a flexural stress of 400 MPa?
Take E = 200 GPa.

[B] A cantilever beam of length 1 m has a circular cross section of diameter 300 mm. Determine the concentrated load that can be applied at the free end to produce a maximum shear stress of 2 N/ mm^2

KADI SARVA VISHWAVIDHYALAYA

BE Semester- I/II

Subject code: **Subject Name: Mechanics of Solids**

Date: 30-12-13 **Time: 3 Hrs.** **Total Marks: 70**

Instructions:

1. **Answer each section in separate Answer sheet.**
2. **Use of Scientific calculator is permitted.**
3. **All questions are compulsory.**
4. **Indicate clearly, the options you attempt along with its respective question number.**
5. **Use the last page of main supplementary for rough work.**
6. **Assume suitable data, if required.**

SECTION-I

Q.1 [A] State and explain principle of superposition and principle of transmissibility. **[05]**

[B] State and prove parallel axis theorem. **[05]**

[C] Resolve the 600 N force of Fig.1 into two components along m axis and n axis. **[05]**

OR

[C] The forces 200 N, 300 N, 400 N, 500 N and 600 N are acting on one of the vertex of a regular hexagon towards other vertices, taken in order. Find the resultant. **[05]**

Q.2 [A] Replace the force and couple system shown in Fig.2 by an equivalent single force and couple at point 'P'. **[05]**

[B] Find moment of inertia of plane area shown in Fig.3 about centroidal horizontal axis. **[05]**

OR

Q.2 [A] Determine the value of θ which will maximize the moment of 250 N force about 'O' and the maximum moment. Refer Fig.4. **[05]**

[B] Find moment of inertia of plane area shown in Fig.5 about centroidal horizontal axis and about base. **[05]**

Q.3 [A] Calculate location of centroid of semi circular area using first principle. **[05]**

[B] Find the forces in all members of the truss shown Fig.6 **[05]**

OR

Q.3 [A] The composite area shown in Fig.7 is rotated about X-X axis to generate a body Calculate volume of the solid generated. **[05]**

[B] Find the forces in members U_2U_4, U_2L_3 and L_1L_3 of the truss shown Fig.8 by method of section. **[05]**

SECTION:II

Q.4 [A] Draw stress- strain curve for mild steel and explain all salient points on it. **[05]**

[B] Draw shear stress distribution diagram across the cross section of a T beam, having flange 100 mm x 12 mm and web 12 mm x 88 mm and carrying shear force 72 KN. **[05]**

[C] A steel bar 150 mm wide, 16 mm thick and 6000 mm long carries a pull of 300 KN. Find the change in all dimensions of the bar under the pull. Take Poisson's ratio is 0.3 and E = 200 GPa. Also find change in volume of the bar, bulk modulus and modulus of rigidity. **[05]**

OR

[C] A steel rod of 16 mm diameter and 5 mm length is connected to two grips at each end at a temperature of 150° C. Find the pull exerted when temperature falls to 40° C., if the ends yield by 1 mm. Take coefficient of thermal expansion is 12×10^{-6} per ° C. **[05]**

Q.5 [A] Find support reaction for the beam shown in Fig.9 **[05]**

[B] Draw shear force and bending moment diagram for the beam shown in Fig.9. **[05]**

OR

Q.5 [A] Find support reaction for the beam shown in Fig.10 **[05]**

[B] Draw Shear force and bending moment diagram for the beam shown in Fig.10. **[05]**

Q.6 [A] A ladder 6 m long rests on horizontal ground and leans against a smooth vertical wall at an angle of 20° with the vertical. Its weight is 900 N acting at its middle. It is on the point of sliding when a man weighing 750 N stands at a distance 1.8 m along the ladder from foot of the ladder. Calculate coefficient of friction. **[05]**

[B] A mass of 50 kg is pulled up a rough inclined plane whose inclination to the horizontal is 30° by a force of 350 N acting parallel to plane. Find the coefficient of friction. **[05]**

OR

Q.6 [A] What load W can just be raised on the block B by the application of a horizontal force of 5000 N on the block A shown in Fig. 11. Take coefficient of friction for all surfaces of contact is 0.25. Neglect the weights of A and B. **[05]**

[B] Define following terms. **[05]**

1. Angle of friction
2. Angle of Repose
3. Ductility
4. Hardness
5. Fatigue

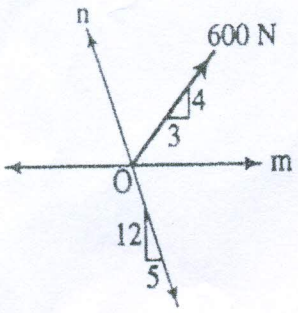

Fig:1, Q.1 (c)

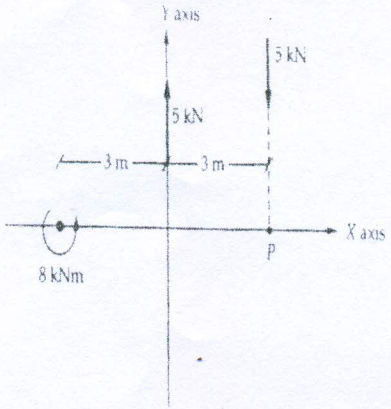

Fig:2, Q.2 (A)

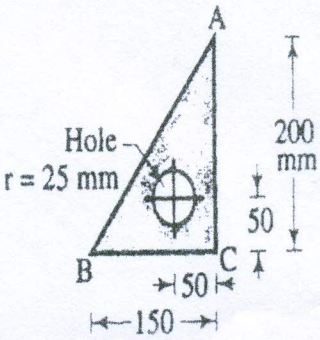

Fig:3, Q.2 (B)

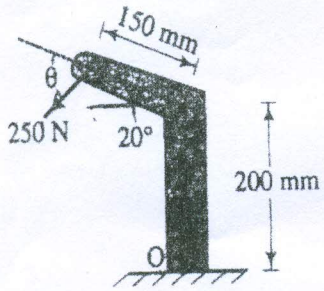

Fig:4, Q.2 (A) OR

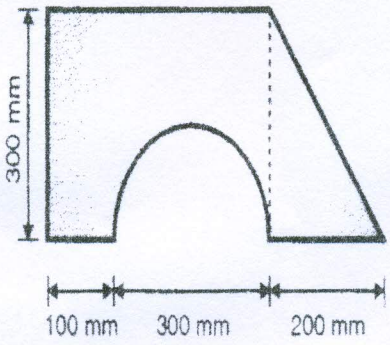

Fig:5, Q.2 (B) OR

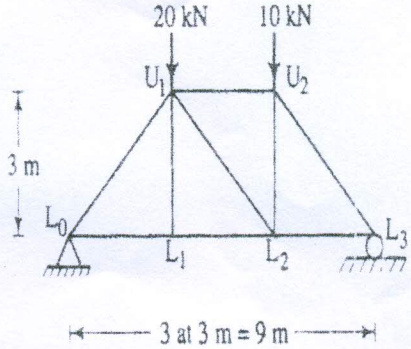

Fig:6, Q.3 (B)

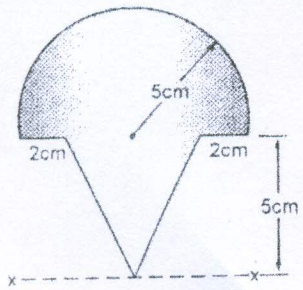

Fig:7, Q.3 (a) OR

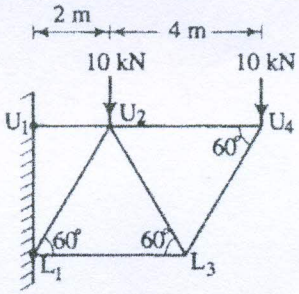

Fig:8, Q.3 (B) OR

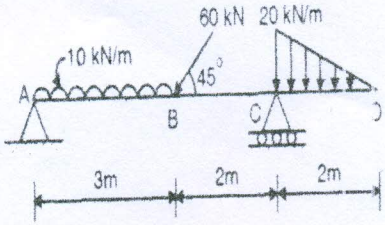

Fig:9, Q.5 (A) & Q.5 (B)

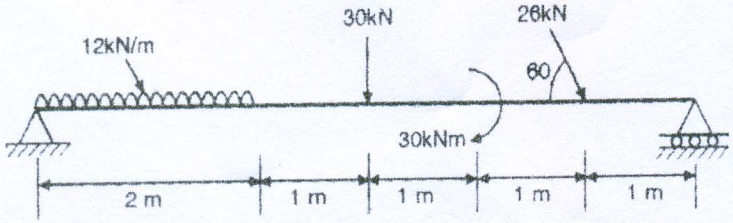

Fig:10, Q.5 (A) & Q.5 (B) OR

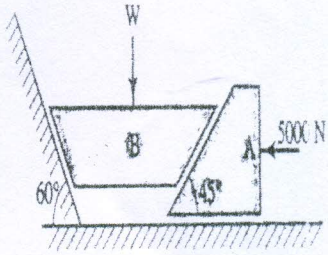

Fig:11, Q.6 (A) OR

KADI SARVA VISHWAVIDHYALAYA

B.E. Semester- I (REGULAR)

Subject Code: CC110 **Subject Name: Mechanics of Solids**

Date: 02/01/2015 **Time: 10:30am to 1:30pm** **Total Marks: 70-**

Instructions:

1. Answer each section in separate Answer sheet
2. Use of Scientific calculator is permitted.
3. All questions are compulsory.
4. Indicate Clearly, the options you attempt along with its respective question number.
5. Use the last page of main supplementary of rough work.

SECTION – I

Q-1	(A)	State and explain "principle of transmissibility of forces".	[05]
	(B)	Find the value of "W" for the equilibrium of the system, also find the tension in cables shown in **fig. 1.**	[05]
	(C)	State and explain "Law of Triangle of forces".	[05]
		OR	
	(C)	State and explain "Law of parallelogram of forces".	[05]
Q-2	(A)	Determine reaction at support for the beam shown in **fig. 2.**	[05]
	(B)	Draw S.F. and B.M. diagram for a beam loaded as shown in **fig. 2.**	[05]
		OR	
Q-2	(A)	Determine reaction at support for the beam shown in **fig. 3.**	[05]
	(B)	Draw S.F. and B.M. diagram for a beam loaded as shown in **fig. 3.**	[05]
Q-3	(A)	Determine the forces in members of the truss using the method of joints shown in **fig. 4.**	[05]
	(B)	**Explain following terms:** 1) Friction 2) Angle of repose 3) Coefficient of friction 4) Limiting friction 5) Cone of friction	[05]
		OR	
Q-3	(A)	Find internal forces in the members of truss CE, CD, DE and DB Shown in **fig. 5** by using method of sections.	[05]
	(B)	A rectangle block of weight 5 KN to be lifted by a wedge as shown in **fig. 6.** If coefficient of friction at all the contacting surfaces is 0.3. Calculate force "P" required to drive the wedge.	[05]
		SECTION – II	
Q-4	(A)	State Pappus-Guldinus theorem for surface of revolution .	[05]
	(B)	Write assumption made in the analysis of a plane truss .	[05]
	(C)	A rod of 1m length and 20mm x 20mm in C/S is subjected to an axial pull of 10KN. If elongation of the rod is 0.12mm, find value of modulus of elasticity. **fig. 7**	[05]
		OR	
	(C)	A Rectangular block is subjected to direct loads as shown in **fig. 8.** Assuming Poisson's ratio 0.25. Find strains in each direction. Take E= $2X10^5$ N/mm^2, find change in volume of the bar.	[05]
Q-5	(A)	Determine moment of inertia of a section shown in **fig. 9** about base.	[10]
		OR	
Q-5	(A)	Calculate moment of inertia of a section shown in **fig. 10** about x_1- x_1 axis.	[10]
Q-6	(A)	Explain : Bulk Modulus and Poisson's ratio.	[05]
	(B)	Explain : stress and Strain.	[05]
		OR	
Q-6	(A)	Draw shear stress distribution diagram for sections of various shapes T, L, I, H, Rectangle.	[05]
	(B)	Define the term: Volumetric Strain ,Elongation, Linear strain, Elasticity, Thermal stress	[05]

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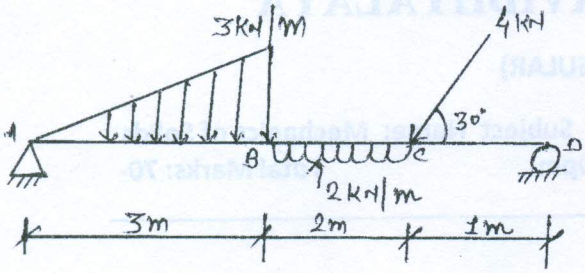

Figure: 2

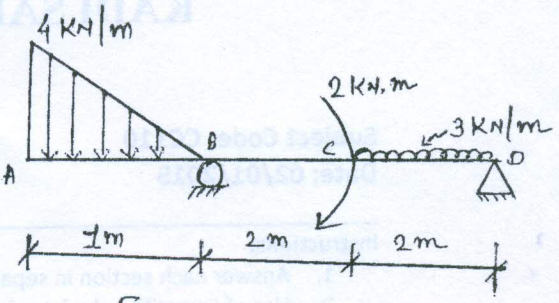

Figure: 3

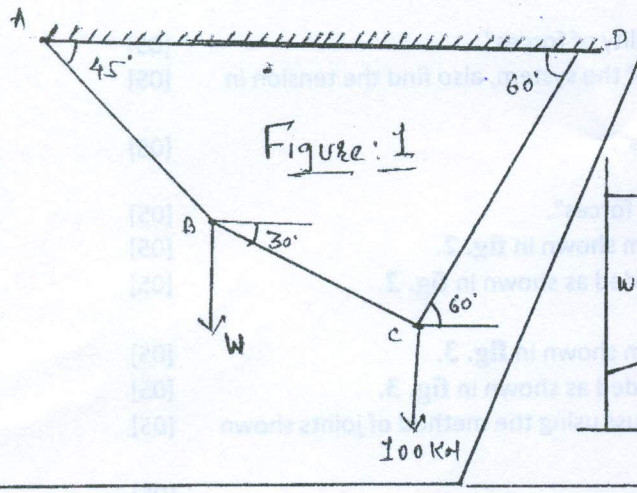

Figure: 1

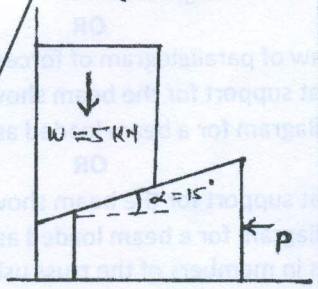

Fig: 6

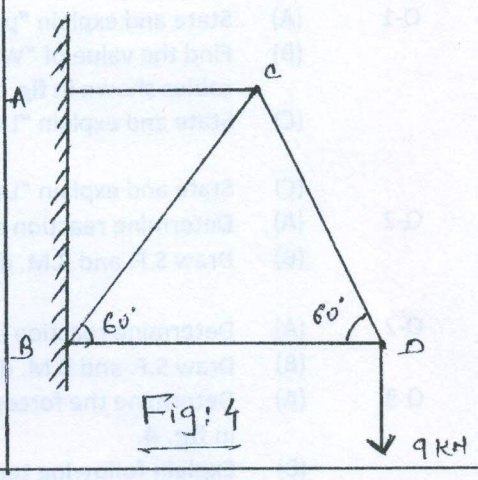

Fig: 4

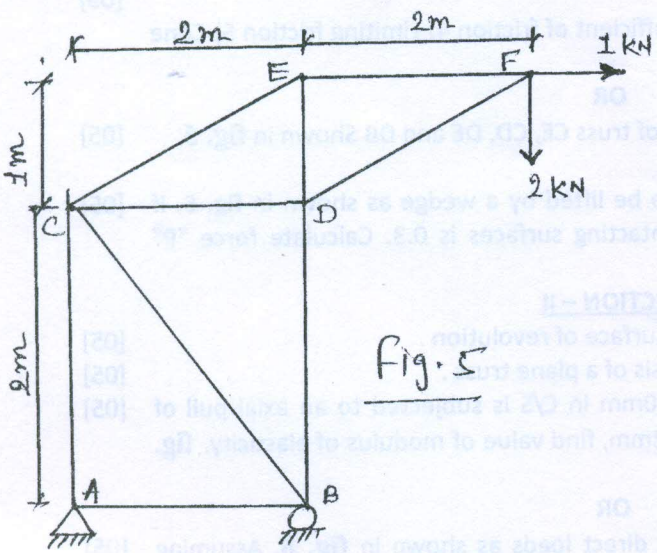

Fig: 5

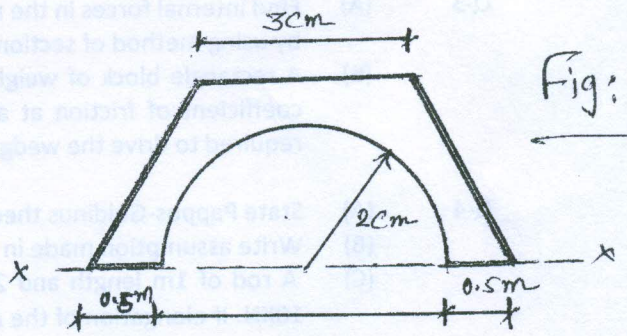

Fig: 9

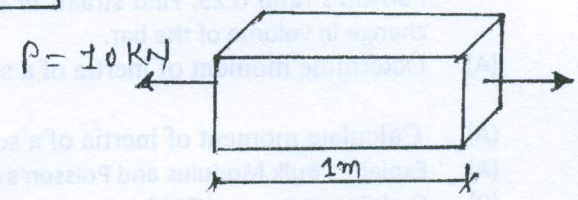

Fig: 7

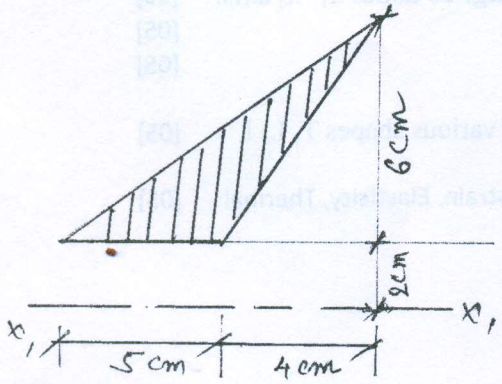

Fig: 10

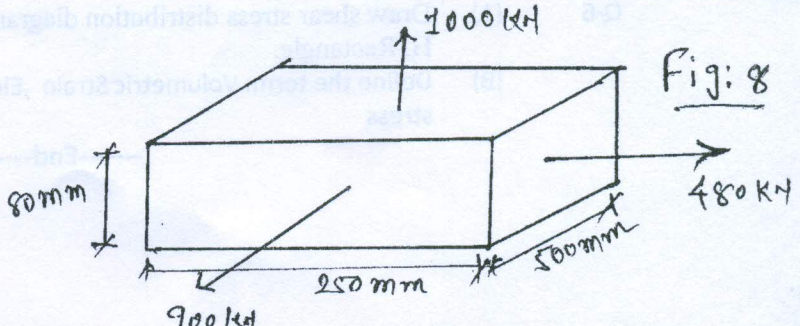

Fig: 8

KADI SARVA VISHWAVIDYALAYA

B.E. (all branch) Semester-I & II Examination, May'2015

Subject Code: CC110 **Subject: Mechanics of Solid**

Date: 02/06/15 **Time: 10:30 am to 1:30 pm** **Total Marks: 70**

Instructions:

(1) Answer each section in separate answer sheet

(2) All questions are Compulsory

(3) Indicate **clearly**, the options you attempt along with its respective questions number.

(4) Use the last page of main supplementary for **rough work**

Section-I

Q-1 **(All Compulsory)**

(A) Give statement of [5]
i) Varignon's theorem ii) Parallel and Perpendicular axis theorem
iii) Pappus Guldinus Theorem

(B) Find resultant of a force system shown in fig.3 [5]

(C) Differentiate between: (1) Moment of couple v/s moment of force (2) angle of repose v/s angle of friction. [5]

OR

(C) A weight 2500 N is suspended with a chain 1.8m long. It is pulled by horizontal force 400 N as shown in fig.4. Find the force in chain and distance "X". [5]

Q-2 **Answer the following Questions**

(A) Find centroid of the wire shown in the fig.1. [5]

(B) Find center of gravity of a lamina shown in the fig.2. [5]

OR

(A) Find Moment of Inertia of a lamina shown in the fig.2 about A-A axis and about X-X axis. [10]

Q-3 **Answer the following Questions**

(A) Locate zero force members in truss shown in the fig.11. Also find axial forces in remaining members by method of joint. [5]

(B) Find magnitude, direction and location of resultant of force system with respect to point 'O' shown in fig. 5. [5]

OR

(A) A 8m long ladder rests against a vertical wall with which it makes an angle of 45°. If a man whose weight is one half of that ladder, climbs it. At what distance along the ladder will be the man when the ladder is about to slip? The coefficient of friction $\mu = 0.3$ between ladder & wall and 0.5 between ladder & floor. [5]

(B) Analyze truss as shown in fig.11. by method of section. [5]

Section-II

Q-4 **(All Compulsory)**

(A) Draw typical stress – strain plot for a tension test results of mild steel bar. Show salient points on it. [5]

(B) Determine change in volume of a steel bar of 120 mm dia. and 700 mm length, when it is subjected to axial pull of 50 kN. Take Es = 200 GPa and Poisson ratio 0.25. [5]

(C) An assembly made up from Aluminium and Steel bars as shown in the fig.9, is initially stress free at temperature 30° C .The assembly is heated to bring its temperature to 80° C. Find the stresses developed in each bar. The coefficient of thermal expansions is 1.20×10^{-5} / ° C & 2.35×10^{-5} / °C for steel and aluminium respectively. Take Es = 200 GPa & Eal = 75 GPa. [5]

OR

(C) An assembly of steel bars as shown in the fig.10 is in equilibrium. Find force P and the net elongation of the assembly. Take Es = 2×10^5 MPa. [5]

Q-5 Answer the following Questions

(A) For the beam shown in fig.6. calculate shear force and bending moments at salient points and draw shear force and bending moment diagrams. Also find the point of contra flexure. [10]

OR

(A) Find support reactions for the beam shown in the fig.7 [5]

(B) Find support reactions for the cantilever beam shown in the fig.8 [5]

Q-6 Answer the following Questions

(A) Sketch shear stress distribution diagrams across the (i) Square (ii) Hollow square (iii) H sections (iv) T section of the beams and (v) I section of the beams. [5]

(B) An assembly of steel bars as shown in the fig.12 is in equilibrium. Find force P and the stresses in each part. Take Es = 2×10^5 MPa. [5]

OR

(A) Draw shear stress distribution diagram across the cross section of a T beam, having flange 250x20 mm and web 10x350 mm and carrying shear force 90kN. [5]

(B) What do you understand by pure bending? Write various assumptions made in theory of pure bending. [5]

***** All the Best*****

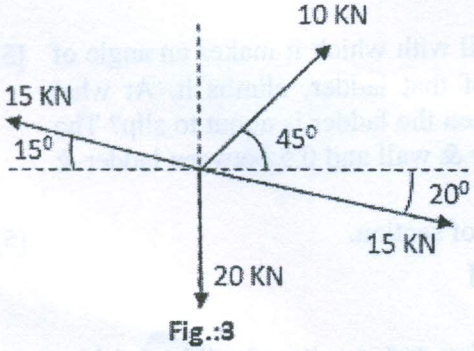

Fig.:3

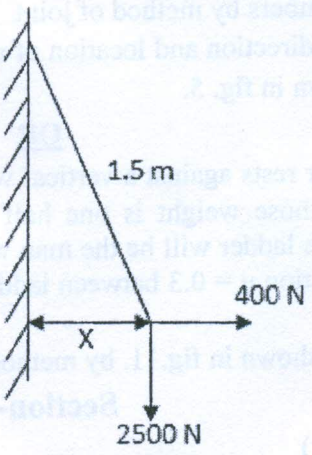

Fig.:4

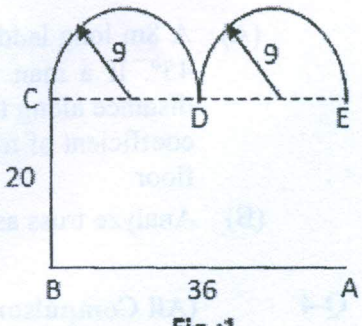

Fig.:1

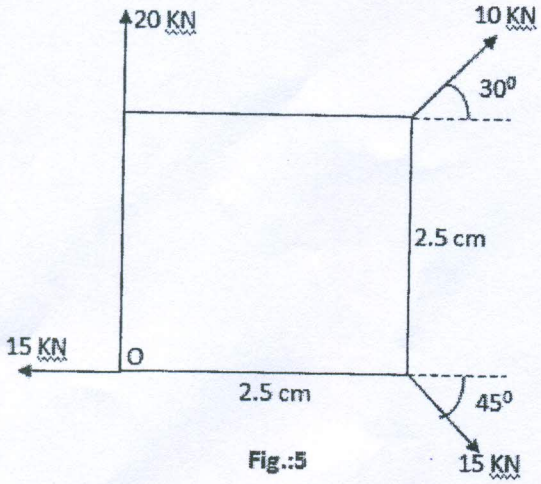

Fig.:5

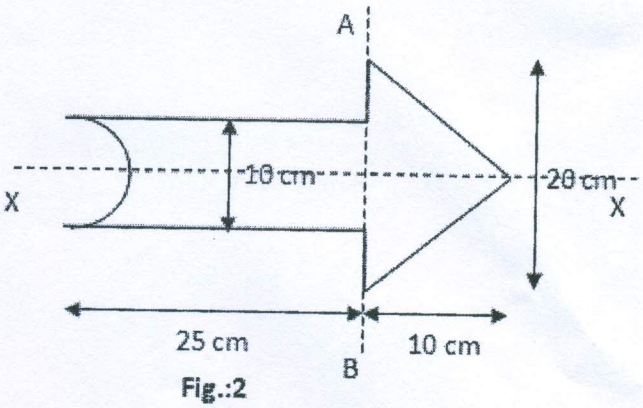

Fig.:2

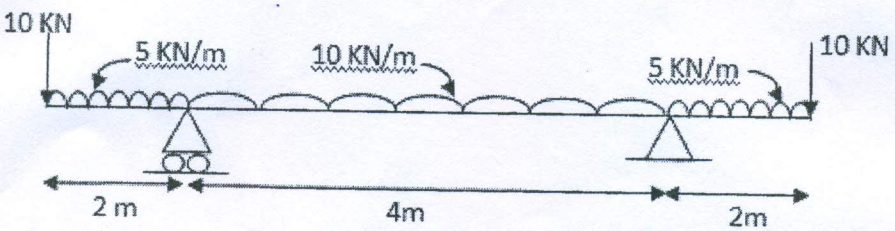

Fig.:6

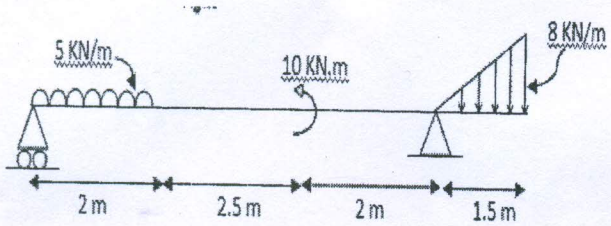

Fig.:7

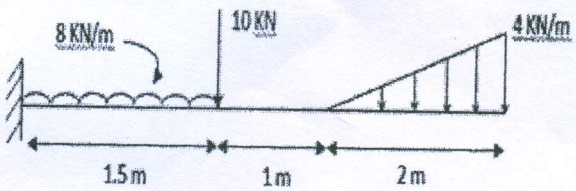

Fig.:8

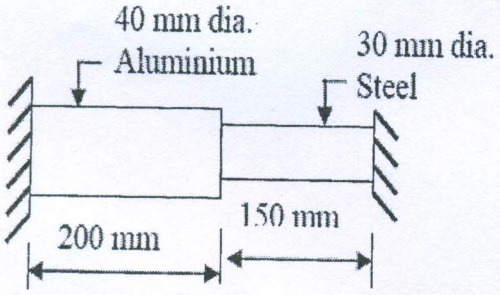

Fig.:9

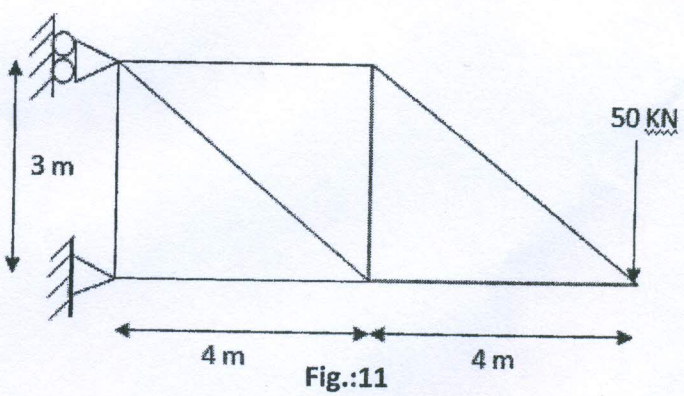

Fig.:11

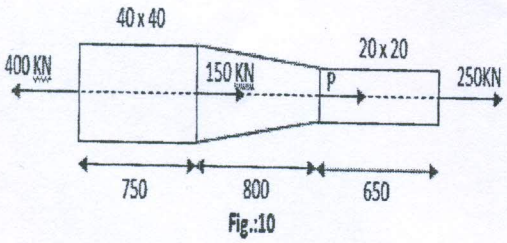

Fig.:10

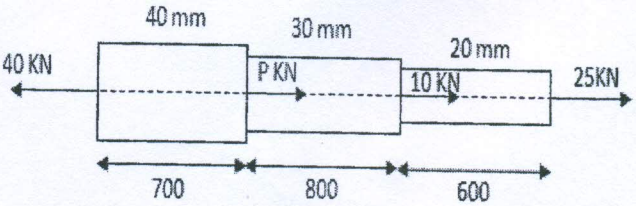

Fig.:12

KADI SARVA VISHWAVIDYALAYA

B.E. (Civil) Semester-I Examination, December 2015

Subject Code: CC-110 **Subject: Mechanics of solid**

Date: 04/01/2016 **Time: 10:30 am to 1:30 pm** **Total Marks: 70**

Instructions:

(1) Answer each section in separate answer sheet

(2) All questions are Compulsory

(3) Assume other required data.

(4) Indicate **clearly**, the options you attempt along with its respective questions number.

(5) Use the last page of main supplementary for **rough work**

Section-I

Q-1 **(All Compulsory)**

(A) Draw characteristic stress-strain curve for mild steel under tension and explain Elastic limit, Hooke's law. [5]

(B) State and explain the Lami's theorem. [5]

(C) Define: Angle of friction, Angle of repose, Coefficient of friction, Angle of friction. [5]

OR

(C) Explain the types of force system. [5]

Q-2 **Answer the following Questions**

(A) Determine the resultant of following force system as shown in **fig. 1.** [5]

(B) For a coplanar non-concurrent force system shown in **fig.2.** Determine the magnitude, direction and position with reference to point "P" of resultant force. [5]

OR

(A) Find the forces in all members of truss as shown in **fig.3** [10]

Q-3 **Answer the following Questions**

(A) Determine centroid of line element as shown in **fig.4** [5]

(B) Determine centroid of element as shown in **fig.5** [5]

OR

(A) Determine moment of inertia of section as shown in **fig.5** about centroidal axis. [10]

Section-II

Q-4 **(All Compulsory)**

(A) Determine support reaction for cantilever beam as shown in **fig.6.** [5]

(B) Determine support reaction for a beam as shown in **fig.7.** [5]

(C) Find deformation in each part of rod shown in **fig.8**. Take $E=2 \times 10^5$ n/mm^2. [5]

OR

(C) Give brief about following properties of material [5]
(A). Strength, (B). Elasticity, (C).Ductility

Q-5 **Answer the following Questions**

(A) A steel rod of 40 mm diameter is placed inside copper tube of external diameter 60 mm, internal diameter 50 mm and length of 1200 mm connected rigidly at ends as shown in **fig.9.** Determine stress in each material and elongation of composite bar .E_{steel}= 200 GPa. E_{copper} =110 GPa. [5]

(B) A rod length of 2 m and dia. 50 mm is elongated by 5 mm, when an axial force of 400 KN is applied to it. Determine stress, strain and modulus of elasticity. [5]

OR

(A) Explain theory of pure bending with sketch. [5]

(B) Draw bending stress distribution diagram for a simply supported beam of 5 m span carrying 50 kN point load at centre. Beam cross section is rectangular having dimension of 230 x 350. [5]

Q-6 **Answer the following Questions**

(A) Define Shear stress and Derive equation for shear stress. [5]

(B) Determine shear stress at important points for rectangular cross section (300 mm X 600 mm) of beam having 7 m span carrying UDL of 20 KN/m throughout span and 10 KN point load at centre. [5]

OR

(A) Draws shear force and bending moment diagrams for beam shown in **fig. 10.** Giving values at all important points. Determine Maximum BM. [10]

***** All the Best*****

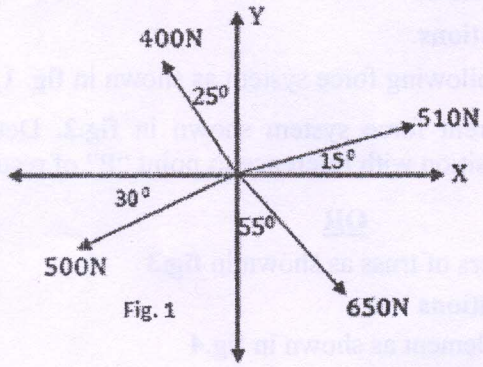

Fig. 1

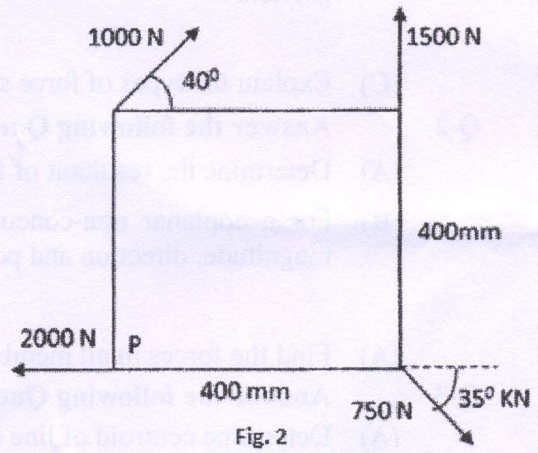

Fig. 2

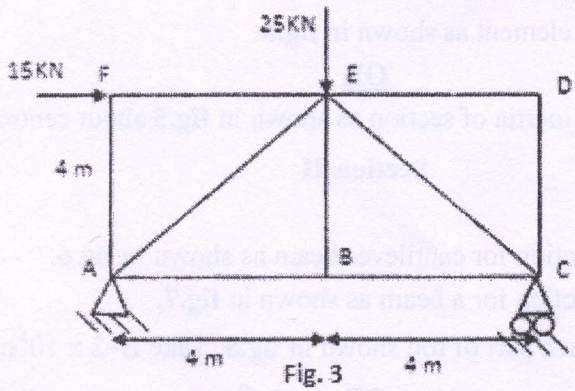

Fig. 3

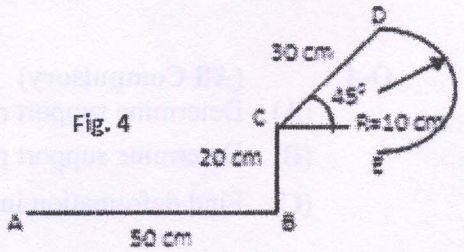

Fig. 4

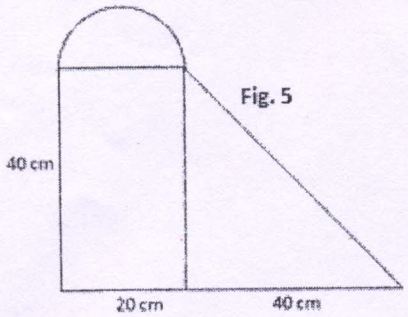

Fig. 5

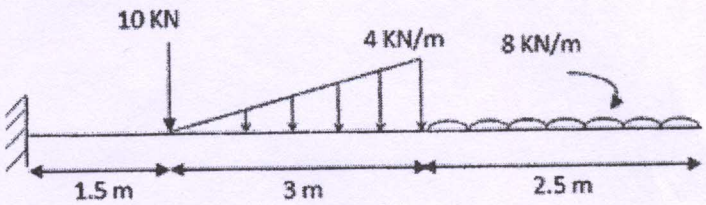

Fig. 6

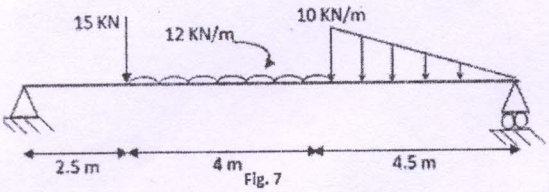

Fig. 7

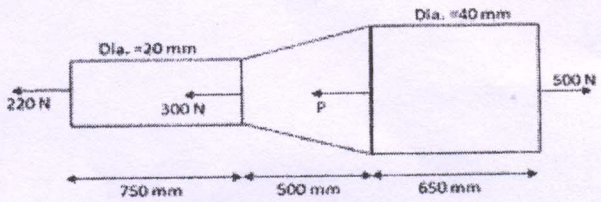

Fig. 8

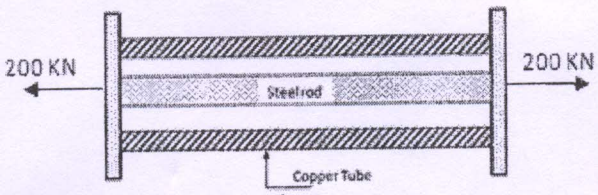

Fig. 9

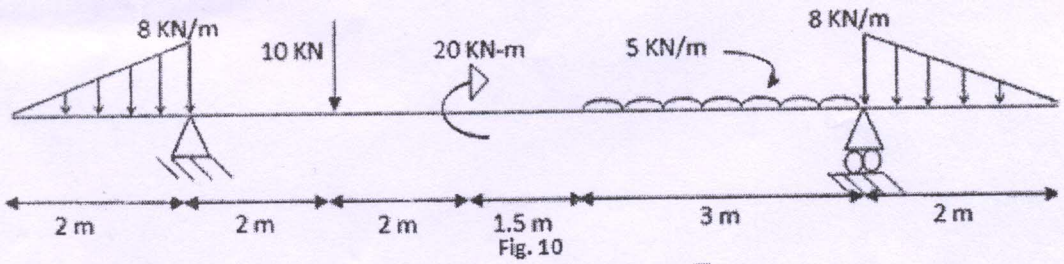

Fig. 10