This document is a part of Main Course File	Document No.: CFM – 8

SARDAR VALLABHBHAI PATEL EDUCATION SOCIETY MANAGED

N. G. PATEL POLYTECHNIC

MECHANICAL ENGINEERING DEPARTMENT

FORMAT FOR ASSIGNMENTS

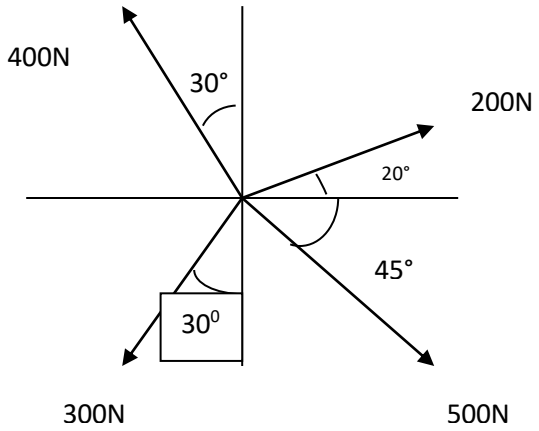
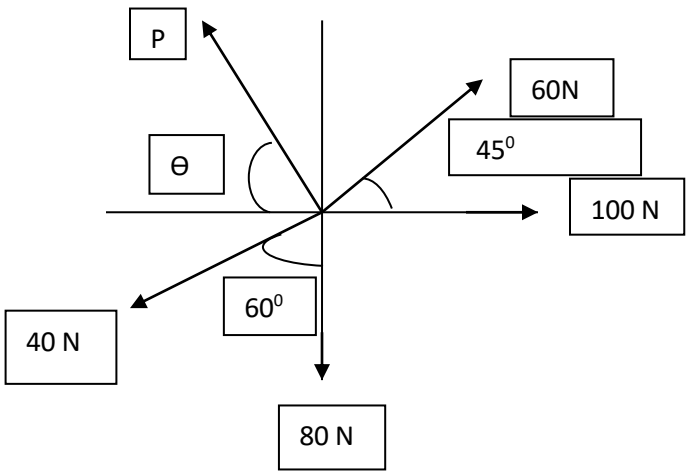
Course Name (With Code):Basics of Applied Mechanics (DI03000201)

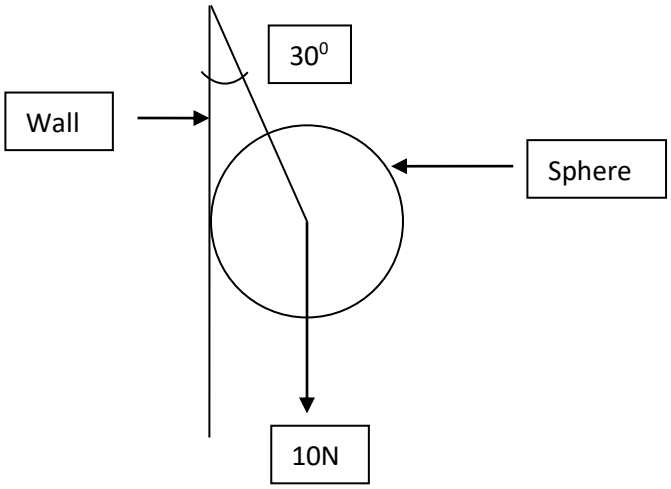
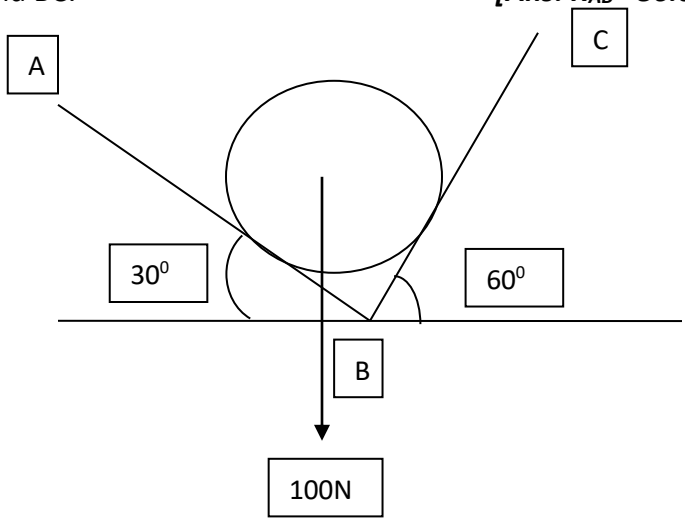
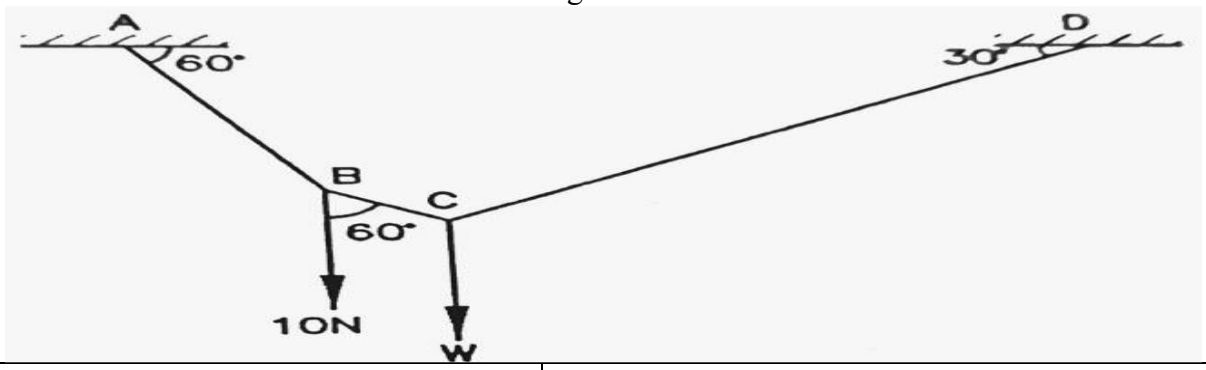
Semester / Year: Third /Second

Assignment Number: 01(Unit-1,Unit-2)

Assignment CO Number:1

Sr. No.	Questions related to Course Outcomes
Part – A	**Questions carrying 3 Marks**
1	Define Statics & Dynamics.
2	Define Kinetics & Kinematics.
3	Define 1 N force & 1 Kgf force .
4	Give units of the following quantities as per S. I. System : (1) Force (2) Velocity (3) Acceleration (4) Density (5) Work (6) Power (7) Pressure (8) Momentum (9) Torque (10) Energy (11) Couple
5	Define Force & its characteristics.
6	Explain classification of system of forces.
7	Explain principle of super position.
8	Explain principle of transmissibility of forces.
9	Resultant force & Equilibrant forces .
10	Resolution of forces & Composition of forces .
11	State and explain Parallelogram law of forces.
12	State and explain triangle law of forces.
13	State and explain polygon law of forces.
14	State and explain Lami's theorem.
15	Explain conditions of equilibrium for coplanar concurrent forces.
16	Find maximum and minimum resultant of two tensile forces 30 KN and 10 KN acting at one point.(R_{max} = 40 KN,R_{min} = 20 KN)
17	Two forces of 100N and 150N are acting simultaneously at a point. What is the resultant of these two forces, If the angle between them is 45°? ***(Ans. R=232N,)***
18	Determine the resultant of two concurrent forces 100N compressive and 60N tensile acting at a point angle between the forces is 60º. Also find angle made by resultant with 60N force. ***(R=85.17N, α =83.41° with 60N)***
19	An electric lamp fixture of 15 N weight is suspended by two strings AC and BC at point C. BC make an angle 60^0 with horizontal while AC makes 45^0 with vertical. Find tensions in strings AC and BC. ***[Ans: T_{BC}= 10.98 N, T_{AC}= 7.76 N]***
Part – B	**Questions carrying 4 Marks**
1	Two tensile forces 40KN and QKN are acting at right angles. If resultant force is 50KN find the value of Q. Also find direction of the resultant with 40KN force. ***(Q=30KN, α=36.86°)***
2	Find magnitude and direction of the resultant for the system shown in figure. ***[Ans: R = 275.83***

	N , ϑ= 46.03^0] 
3	Following forces are acting at a point (I) 500 N force towards North-East. (II) 400 N force towards East. (III) 450 N force inclined at 30^0 west of north. (IV) 200 N force inclined at 60^0 south of west. Find magnitude and direction of the resultant. ***[Ans: R= 713.17 N , ϑ= 53.60^0]***
4	The force system as shown in figure in equilibrium. Find the unknown force P. ***[Ans: P= 122.20 N, ϑ= 28.4*** 
5	A sphere weighing 10 N is hanged as shown in figure. Find tension in the rope and reaction of wall. ***[Ans: T= 11.55 N, R= 5.77 N]***

	
6	A sphere of weight 100KN is resting in a triangular groove as shown in figure. Find reaction on surface AB and BC. ***[Ans: R_{AB}= 86.6 KN, R_{BC}= 50 KN]*** 
Part – D	**Questions carrying 7 Marks**
1	A equilibrium point is pulled by five strings at equal angle. If tensions in three consecutive are 5N,10N and 8N find tension in other two strings.
2	Find value of "W" for forces as shown in fig 

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SARDAR VALLABHBHAI PATEL EDUCATION SOCIETY MANAGED

N. G. PATEL POLYTECHNIC

MECHANICAL ENGINEERING DEPARTMENT

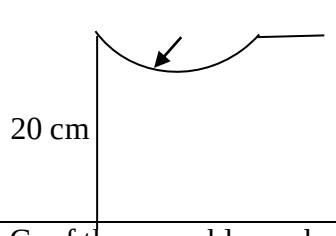
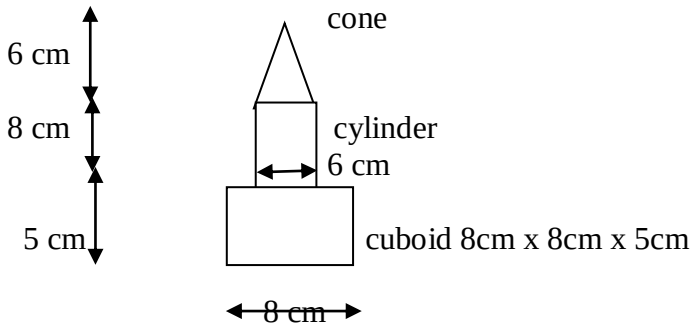
FORMAT FOR ASSIGNMENTS

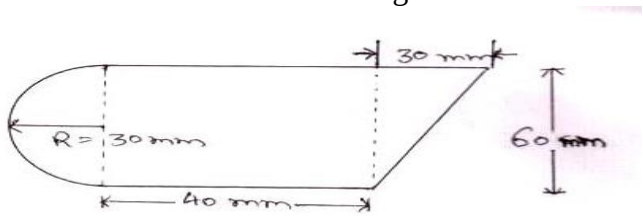
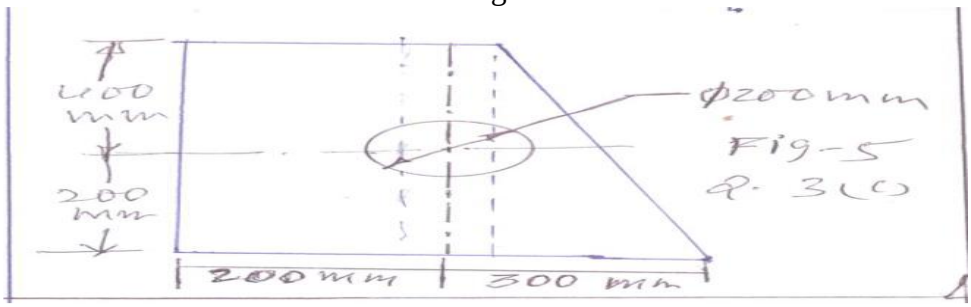
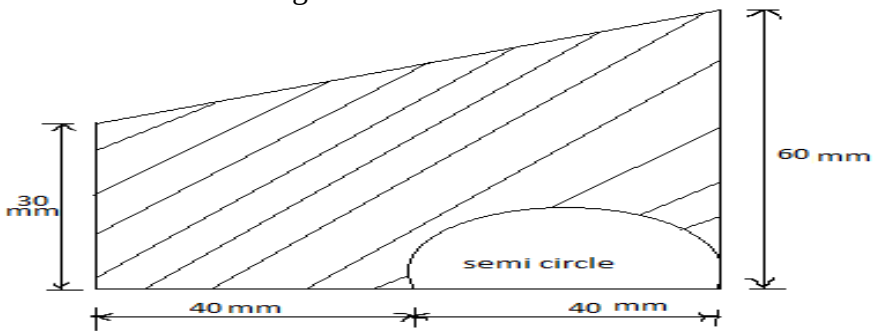
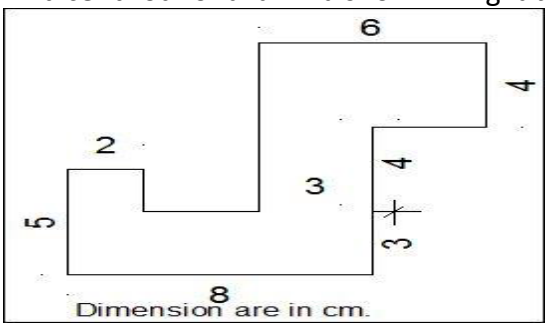
Course Name (With Code): Basics of Applied Mechanics (DI03000201)

Semester / Year: Third /Second

Assignment Number: 02 (Unit-3)

Assignment CO Number:2

Sr. No.	Questions related to Course Outcomes
Part – A	**Questions carrying 3 Marks**
1	Distinguish centroid and centre of gravity.
2	Define Axis of reference & Axis of symmetry
3	State co-ordinates of centroid of semi circle having radius 'r'
4	State co-ordinates of centroid of right angle triangle.
5	State co-ordinates of centre of gravity of hemisphere having radius 'r'
Part – B	**Questions carrying 4 Marks**
1	Find centroid of an Indian Standard Angle (I.S.A.) 90 x 60 x 6 mm with longer leg vertical. **(X = 14.25 mm, Y = 29.25 mm)**
2	Find centroid of the channel section 100 mm x 50 mm x 15 mm. **(X =17.79 mm, Y = 50 mm)**
3	Find the centroid of a T- section having dimension of flange 10cm x 2 cm and web dimension of 15 cm x 2 cm. **(X = 5 cm, Y = 9.76 cm)**
4	An I section has top flage 20 cm x 2 cm, web 30 cm x 2 cm and bottom flange 40 cm x 4 cm. Find centroid of the section**. (X = 20 cm, Y = 11 cm)**
5	Find the centroid of the wire as shown in figure. 
6	Find C.G. of the assembly as shown in figure. 

Part – C	Questions carrying 7 Marks
1	A trapezoidal section has base width 5 m, top width 2 m and height16 m. One side of the section is vertical and other in sloping. Find centroid of the section.
2	Find centroid of lamina as shown in figure. 
3	Find centroid of lamina as shown in figure. 
4	A semi-circular area is removed from a trapezium as shown in figure. Determine the centroid of the remaining area 
5	Find centriod for a lamina shown in fig. about XX and YY axis. 

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SARDAR VALLABHBHAI PATEL EDUCATION SOCIETY MANAGED

N. G. PATEL POLYTECHNIC

MECHANICAL ENGINEERING DEPARTMENT

FORMAT FOR ASSIGNMENTS

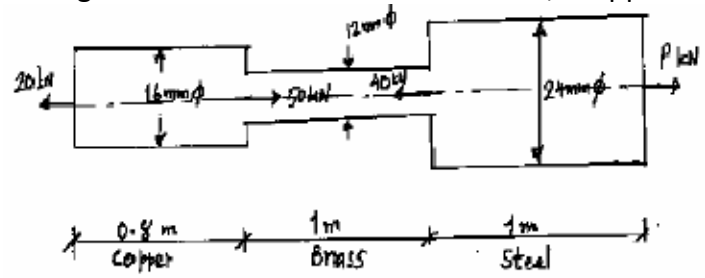
Course Name (With Code): Basics of Applied Mechanics (DI03000201)

Semester / Year: Third /Second

Assignment Number: 03 (Unit-4, Unit-8)

Assignment CO Number:3

Sr. No.	Questions related to Course Outcomes
Part – A	**Questions carrying 3 Marks**
1	Define Stress, Strain(linear strain) and lateral strain
2	State Hooke's Law.
3	Define Poisson ratio, Volumetric strain and Shear strain.
4	Define Modulus of Elasticity (Young's modulus), Bulk modulus and Modulus of rigidity (Shear modulus).
5	Define Composite section, Modular ratio and Factor of Safety.
6	Define Thermal stress and Thermal strain.
7	Define Strain Energy and Proof resilience.
8	Define Resilience and Modulus of resilience.
9	Classify the engineering materials based on physical properties.
10	Define Brittle materials, ductility and malleability.
11	Define Creep, Hardness and Toughness.
9	A Circular rod of diameter 20 mm. and 500 mm long is subjected to a tensile force 45 KN. The modulus of elasticity for steel may be taken as 200 KN/mm^2. Find stress, strain, and elongation of the bar due to applied load ***[Ans: σ = 143.24 N/mm^2, e = 0.0007162, δl =0.358 mm]***
10	A load of 5 KN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. ***[Ans: d=7.98 mm]***
11	A steel rail is 10 meters long at a temperature of 20° C. Estimate the temperature stress in the rail when the temperature increases to 55° C, if (i) no allowance is made for expansion, (ii) an allowance of 2 mm is made for expansion. Take α=0.000012/°C and E=20 x 10^4 N/mm^2. ***[Ans: 84 N/mm^2, 44N/mm^2***]
12	A 2 m long bar is at 15^0 C temperatures. If temperature is increased up to 90^0 C, find extension of the bar. If this deformation is prevented find stress in the bar. E=2 x 10^5 N/mm^2, α=12 x 10^{-6}/0 C ***[Ans: δl=1.8 mm, σ=180 N/mm^2]***
Part – B	**Questions carrying 4 Marks**
1	Draw stress-strain curve for tension test on mild steel and explain important points.
2	Differentiate between Charpy impact test and Izod impact test.
3	Draw neat sketches of test specimen for Charpy impact test and Izod impact test.
4	Explain Izod impact test with neat sketch of specimen.
5	In an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 KN If the specimen was tested

	within the elastic range, what is the value of Young's modulus for the steel specimen? ***[Ans: 201.9 KN/mm^2]***
6	A hollow steel tube 3.5 m long has external diameter of 120 mm. In order to determine the internal diameter, the tube was subjected to a tensile load of 400KN and extension was measured to be 2 mm. If the modulus of elasticity for the tube material is 200 GPa, determine the internal diameter of the tube **.** ***[Ans: d=99.71 mm]***
7	A steel bar is 20 mm in diameter and 1 m long. It is subjected to axial tensile force of 40 KN. E=2 x 10^5 N/mm^2. μ=0.25. Calculate change in length and diameter of the bar. ***[Ans: δl=0.63 mm, δd=0.00318 mm]***
8	An elastic rod is 25 mm in diameter and 150 mm long. It is subjected to tensile force of 52 KN. As a result length increase by 0.1 mm and diameter decrease by 0.003 mm. Find young's modulus and Poisson's ratio. ***[Ans: E=1.59 x 10^5 N/mm^2, μ=0.18]***
9	A stepped bar is loaded as shown in Fig. Calculate the stresses in each part and total change in the length of the bar. Take Esteel= 200 GPa, Ecopper=100 GPa and Ebrass=80 GPa. 
10	A copper bar of 20 mm diameter is tightly fitted inside a steel tube of external diameter 30 mm. The length of composite section is 100 mm. If it is subjected to axial force of 60 KN, find stress in steel and copper. Es=200 KN/mm2, Ec=160 KN/mm^2. ***[Ans: σc=74.53 N/mm^2, σs=93.16 N/mm^2]***
11	A concrete column of 350 mm diameter is reinforced with four bars of 25 mm diameter. Find the stress is steel when the concrete is subjected to a stress of 4.5 MPa. Also find the safe load the column can carry. Take modular ratio is 18. ***[Ans: σs=81 MPa, 592 KN]***
12	A 100 N load falls from a height of 60 mm on a collar attached to a bar of 30 mm diameter and 400 mm long. Find the instantaneous stress and extension produced in the bar. Take E=2 x 10^5 N/mm^2. ***[Ans: σ=92.273 N/mm^2, δl=0.1842 mm]***
13	A weight of 50.8 KN acts suddenly on a bar of 18 mm diameter. Length of bar is 1 m. If E= 2 x 10^5 N/mm^2.Find instantaneous stress and modulus of resilience. ***[Ans: σ=399.26 N/mm^2, um=0.398 N.mm/mm^3]***
Part – C	**Questions carrying 7 Marks**
1	A short compound tube is made up of a copper tube of inner diameter 84 mm and outer diameter 104 mm, inside which there is a steel tube of inner diameter 64 mm and outer diameter 84 mm. The compound tube is subjected to an axial compressive load of 123 KN. Determine the loads shared by the two materials, if E for steel is twice that of copper. ***[Ans: Pc= 47775 N, Ps=75225 N]***
2	List the types of hardness test and explain Brinnel hardness test.

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N. G. PATEL POLYTECHNIC

MECHANICAL ENGINEERING DEPARTMENT

FORMAT FOR ASSIGNMENTS

Course Name (With Code): Basics of Applied Mechanics (DI03000201)

Semester / Year: Third /Second

Assignment Number: 04 (Unit-5)

Assignment CO Number:4

Sr. No.	Questions related to Course Outcomes
Part – A	**Questions carrying 3 Marks**
1	Define and state the importance of moment of inertia.
2	Define Section modulus and Radius of gyration.
3	Explain Parallel axis theorem.
4	Explain Perpendicular axis theorem.
5	Find M.I of 'I' section having Top and bottom flange100 mm x 10 mm and web 280 mm x 10 mm. ***[Ans: $I_{xx}=6.03 \times 10^7$ mm^4, $I_{yy}=16.893 \times 10^5$ mm^4]***
Part – B	**Questions carrying 4 Marks**
1	A T-section has following dimensions Flange = 150 mm x 50 mm, Web = 150 mm x 50 mm Find I_{xx} and I_{yy} ***[Ans: $I_{xx}=53.125 \times 10^6$ mm^4, $I_{yy}=15.625 \times 10^6$ mm^4]***
Part – C	**Questions carrying 7 Marks**
1	Calculate moment of inertia of an ISA 90 x 90 x 8 mm. ***[Ans: $I_{xx}=1.06 \times 10^6$ mm^4, $I_{yy}=1.06 \times 10^6$ mm^4]***
2	Find M.I of Channel section having Top and bottom flange 90 mm x 10 mm and web 90 mm x10 mm. Also find MI at the base of channel. ***[Ans: $I_{xx}=5.22 \times 10^6$ mm^4, $I_{yy}=1.415 \times 10^6$ mm^4, $I_{base}=13.29 \times 10^6$ mm^4]***

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MECHANICAL ENGINEERING DEPARTMENT

FORMAT FOR ASSIGNMENTS

Course Name (With Code): Basics of Applied Mechanics (DI03000201)

Semester / Year: Third/Second

Assignment Number: 05 (Unit-6, Unit-7)

Assignment CO Number:5

Sr. No.	Questions related to Course Outcomes
Part – A	**Questions carrying 3 Marks**
1	Define Torsion , Torque and Angle of twist.
2	Define Polar moment of inertia, Polar section modulus and Torsional rigidity.
3	Write assumptions made in theory of Torsion.
4	Write down equation of Torsion and explain each term.
5	Define Simple machine, Compound machine and ideal machine.
6	Define Mechanical advantage, Velocity ratio and Efficiency.
7	Define Input , Output and Effort lost
8	Define Reversible machine & Non reversible machine or Self-locking machine.
9	Larger and smaller diameter of a differential axles are 8 cm and 7 cm respectively. If diameter of wheel is 24 cm, find velocity ratio. **(VR=48)**
10	Explain about condition of reversibility. Or Prove that for reversible machine $\eta > 50$ %.
11	In a lifting machine, an effort of 30 kg just lifts a load of 720 kg what is the mechanical advantage, if efficiency of machine is 40% at the load? Calculate velocity ratio of machine. ***[M.A.=24, V.R.=80]***
12	In a machine an effort of 80 N was able to raise a load of 2.24 KN. The effort was found to move through a distance of 20 m. when the load moved through a distance of 50 c.m. Find (i) Mechanical advantage (ii) Velocity ratio (iii) Efficiency ***[M.A.=28, V.R.=40, η=70%,]***
Part – B	**Questions carrying 4 Marks**
1	Find out power transmitted in KW for a 50 mm diameter shaft rotating with 200 rpm. Safe shear stress is 80 N/ mm^2 ***[Ans:Power = 41.1 KW***
2	Find out diameter of the shaft rotating with 200 rpm and transmitting 120 KW power. Safe shear stress is 80 N/ mm^2 ***[Ans:D = 72 mm]***
3	Explain law of machine.
4	Calculate maximum mechanical advantage & maximum efficiency of a machine having law of machine P=1/20W+135 & VR=25. Also find the effort required & efficiency for lifted 1250 N load. ***[M.A.=20, η_{max}=80%, P= , η=]***
5	In a lifting machine an effort of 90 N lift a load of 950 N & an effort of 450 N can lift a load of 5.70 KN. Find effort required to lift a load of 10 KN**.** **(P = 775.08 N)**
6	For a screw jack, pitch is 10 mm and mean diameter of thread is 60 mm.Length of lever is 50 cm. If efficiency of screw jack is 40%, find an effort required to lift a load of 10 KN.

	(P=79.5N)
Part – C	**Questions carrying 7 Marks**
1	On a propeller shaft of 4 M length and external diameter of 400 mm & internal diameter 200mm, is subjected to twisting moment of 50 KN-M. Find out twisting angle and shear stress induced in the shaft.(Take modulus of rigidity G = 0.8 X 10^5 N/mm^2) ***[Ans.- fs = 4.24 N/mm^2, Θ= 0.00106 radian]***
2	hollow circular shaft having outer diameter 200 mm and thickness 20 mm is transmitting powerat 180 RPM. If angle of twist in a length of 3 meter is not to exceed 0.70 0, calculate shear stressand power in KW. Take C= 0.8 x 10^5 N/mm^2 ***(Ans: T = 30.168 x 10^6 N.mm, fs = 32.55 N.mm^2, P = 568.65 KW)***
3	In a simple lifting machine an effort of 2 KN raised a load of 60 KN & an effort of 3 KN raised a load of 100 KN. The velocity ratio of machine is 50. Calculate (i) Effort required to lift a load of 160 KN. (ii) Maximum efficiency of machine. (iii) State this machine is reversible or self locking. (iv) Law of machine ***[P=4.5KN, η_{max}=80%, P=0.025W+0.5]***
4	A single purchase crabe winch has the following details: 1.Length of lever = 70 cm 2.Number of teeth on pinion = 16 3. Number of teeth on spur wheel = 96 4.Diameter of load axle = 20 cm It is observed that an effort of 60 N lifts aload of 1800 N and an effort of 120 N lifts a load of 3960 N. a) Establish the law of machine. b) Find the efficiency in any one case of above. c) Find maximum M.A. d) Find maximum efficiency.**(P=0.0277 W + 10.14, η=71.42%,MA max= η_{max}= %)**

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