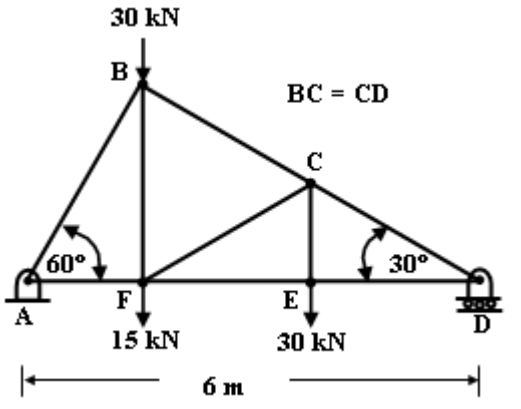
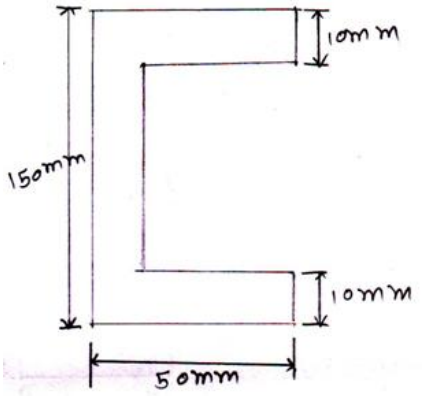
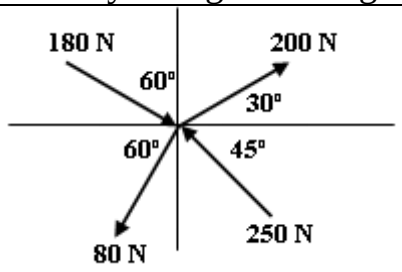
BE Semester-_IST YEAR (CIVIL, MECH, AUTO, CHEM, RUBBER, PLASTIC, ENV,TT,AERO)

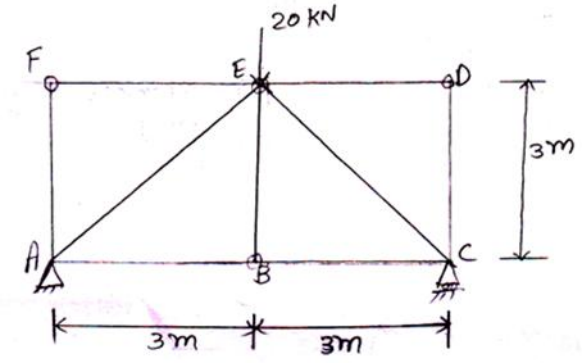
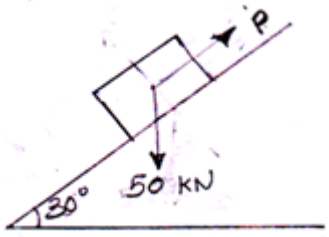
ENGINEERING MECHANICS - Question Bank

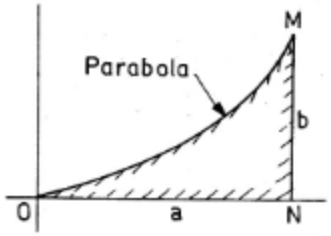
All questions carry equal marks(10 marks)

Q.1	Define space ,time matter and force, scalar and vector quantities. Using parallelogram law, resolve a force of 250N along OA and OB if the angle between force and OA is 60 and force and OB is also 60.as shown in figure 1
Q.2	A cylinder of 300 N is resting in a groove as shown in ***figure 2*** Find the reactions offered by the surfaces.
Q.3	A chord supported at A and B carries a load of 50 N at D and a load of W at C as shown in ***figure 3***. Find the value of W such that CD remains horizontal.
Q.4	Find the resultant of the force system as shown in ***figure 4***.
Q.5	Find the value of unknown force P if the system of forces shown in ***figure 5*** is in equilibrium.
Q.6	Determine the position of the centroid for the plain lamina as shown in ***figure 6***.
Q.7	Find the reactions for the beam as shown in ***figure 7*** and ***figure 8***.
Q.8	Determine the moment of inertia at base and the axis parallel to base through centroid for the plain lamina as shown in ***figure 9***.
Q.9	Analyse the truss as shown in ***figure 10*** for the member forces.
Q.10	A 5 m long ladder weighing 200 N is placed against a vertical wall and rested on a horizontal floor. The bottom end of the ladder is 3 m away from the wall. The coefficient at wall and floor are 02 and 0.3 respectively. A man weighing 600 N is standing on the ladder at 3 m from the lower end. Calculate minimum horizontal force required at the lower end to avoid slip.
Q.11	The equation of motion of particle moving in a straight line is given by $S = 18\ t + 3\ t^2 - 2\ t^3$, where S is in m and t in s. Find the velocity and acceleration at start. Also find the time then particle reaches the maximum velocity.
Q.12	A motorist is driving with 72 km/h on a curve of 400 m radius. He suddenly applied the brakes that causes the decrease in speed at constant rate and reaches to 54 km/h in 8 s. Determine normal and tangential component of acceleration at both speeds.
Q.13	A car moving along S-E at 72 km/h crosses a railway crossing. At the same tine a train also passes at 54 km/h along a railway in due East.

	Determine the relative velocity of car w.r.t. train.
Q.14	1) Derive the equation for work-energy principle. 2) Derive the equation for relation between impulse and change in momentum.
Q.15	In a simple machine required effort of 60 N and 100 N to lift the load of 500 N and 1 kN respectively. Find the law of machine. If the velocity ratio is 20, calculate maximum efficiency and check the reversibility at this efficiency.
Q.16	Define static and dynamic friction.A 60 kg block is resting on a horizontal floor. Determine the magnitude of horizontal force required to push the block with the acceleration of 0.4 m/s^2. The angle of friction for block and surface is 15°.
Q.17	A system of forces is made of two forces of equal magnitude. Determine, using the triangle law of forces, the angle between two forces if magnitude of resultant force is equal to the magnitude of one of the forces.
Q.18	A single purchase crab winch has number of teeth on pinion and spur wheel as 25 and 100 respectively. The diameter of effort wheel and load drum is 25 cm and 6.25 cm respectively. The load of 240N can be raised by 20 N. Determine (i) Velocity ratio (ii) Mechanical Advantage (iii) Efficiency (iv) Ideal effort (v) Frictional effort (vi) Ideal load (vii) Frictional load.
Q.19	For a plane truss, check determinacy and calculate magnitude and nature of each member force and reactions for given loading on the truss. Tabulate all member forces showing their magnitude and nature. 
Q.20	State the assumptions made for truss and define deficient, perfect and redundant trusses. Show each case of above truss with examples
Q.21	Determine moment of inertia of a section about horizontal centroidal axis for triangle with base at top and apex at bottom.

Q.22	Determine the location of centroid and moment of inertia of the given lamina in figure about centroidal Y axis. 
Q.23	Determine the magnitude direction and position of resultant force of the force system given in figure 6 with reference to point A
	
Q.24	(a) Write the SI units of following quantities and also mention whether it is scalar or vector: (i) Force (ii) Moment (iii) Density (iv) Pressure (v) Work (b) State: 1) Variganon's theorem 2) Lami's theorem
Q.25	(a) State Law of parallelogram of forces (b) Given two forces of magnitude 10 KN and 20 KN, are having a resultant of 15 KN. Find the angle between two forces and the direction of the resultant.
Q.26	(a) Differentiate between ***Resultant & equilibrant*** (b) State the conditions of Equilibrium for concurrent forces (c) Define: (i) Moment (ii) Couple
Q.27	(a) Explain with suitable figure: 1) Types of support 2) Types of loads 3) Types of beam (b) Define following force system 1) Concurrent non coplanar forces 2) Non-concurrent co-planner forces
Q.28	(a) Define: Moment of inertia of lamina (b) Differentiate between Centroid and Center of gravity (c) Locate the centroid of the I section with depth 240mm and having top flange 100mmx20mm and bottom flange 200mmx20mm.

Q.29	(a) Write down the basic assumption made in analysis of truss. (b) Distinguish between perfect, redundant and deficit truss.
Q.30	Calculate member forces in simply supported truss shown in fig. 
Q.31	(a) Define: Angle of Friction and Cone of Friction (b) State the Laws of Friction (c) A block weighing 50KN is placed on a rough plane inclined at 30° to horizontal. If coefficient of friction is 0.25. Find out the force applied on the block as shown in **fig.** parallel to the plane. So that the block is just on the point of moving up the plane. Also find angle of friction. 
Q.32	Define following terms: Mechanics, statics, dynamics, force and its system, kinematics and kinetics, free body and rigid body.
Q.33	In a wheel and axle , the diameter of the larger axle is 200 mm and of the smaller one 150 mm . The effort is applied at the end of a handle 450 mm long .Find the velocity ratio. If an effort of 100 N lifts a load of 2000 N, what is the efficiency at this load and effort lost in friction?
Q.34	The velocity ratio of a lifting machine is 20.The initial frictional resistance of the machine is 35N and it increases uniformly at the rate of 16N per 1000N load. Find the effort needed to lift a load of 6000N and the efficiency at this load.
Q.35	A particle has velocity of 5 m/s and slowing down in such manner that the relation between v and t in meter-second units is given by v=5-t-1/6t3.calculate the average retardation, the average velocity and the distance traveled in first two seconds.
Q.36	**1** .The centre of gravity of a triangle is at the point where three

	A. medians of the triangle meet B. perpendicular bisectors of the sides of the triangle meet C. bisectors of the angle of the triangle meet D. none of these **2**. The forces which meet at one point and have their lines of action in different planes are called A. coplaner non-concurrent forces B. non-coplaner concurrent forces C. non-coplaner non-current forces D. intersecting forces E. none of these. **3**. At a given instant ship A is travelling at 6 km/h due east and ship B is travelling at 8 km/h due north. The velocity of B relative to A is A. 7 km/hrs B. 2 km/hrs C. 1 km/hrs D. 10 km/hrs E. 14 km/hrs. **4**. The equation of motion of a particle starting from rest along a straight line is x = t3 - 3t2 + 5. The ratio of the accelerations after 5 sec and 3 sec will be A. 2 B. 3 C. 4 D. 5 **5**. The c.g. of the shaded area of the below figure whose curve OM is a parabola from y-axis, is  A. a/4 B. 3a/4 C. 3b/4 D. 3a/10 E. 3a/5
Q.37	**1.** The unit of Moment of Inertia of a body, is A. m

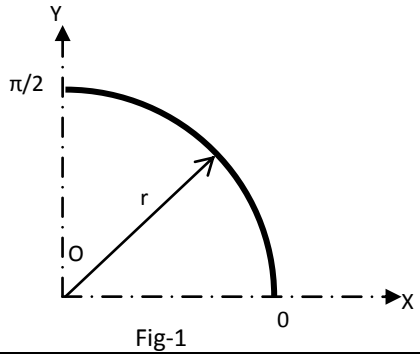
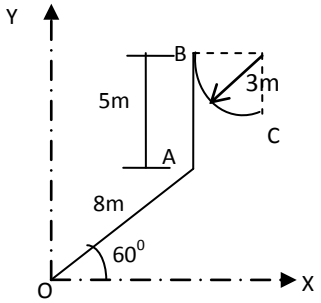
B. m^2
C. m^3
D. m^4
E. none of these.

2. If a body moves in such a way that its velocity increases by equal amount in equal intervals of time, it is said to be moving with
A. a uniform retardation
B. a uniform acceleration
C. a variable acceleration
D. a variable retardation
E. none of these.

3. If the gravitational accelerational at any place is doubled, the weight of a body, will
A. be reduced to half
B. be doubled
C. not be affected
D. none of these.

4. A cable loaded with 0.5 tonne per horizontal metre span is stretched between supports in the same horizontal line 400 m apart. If central dip is 20 m, the minimum tension in the cable, will be
A. 200 tonnes at the centre
B. 500 tonnes at the centre
C. 200 tonnes at the right support
D. 200 tonnes at the left support.

5. The Law of Polygon of Forces states that
A. if a polygen representing the forces acting at point in a body is closed, the forces are in equilibrium
B. if forces acting on a point can be represented in magnitde and direction by the sides of a polygon taken in order, then the resultant of the forces will be represented in magnitude and direction by the closing side of the polygon
C. if forces acting on a point can be represented of a polygon taken in order, their sides of a polygon taken in order, their resultant will be represented in magnitude and direction by the closing side of the polygon, taken in opposite order
D. if forces acting on a point can be represented in magnitude and direction by the sides of a polygon in order, the forces are in equilibrium.

Q.38	A body of mass 300kg is acted upon by a force of 200N for 90 sec. if the initial velocity of body is 20 m/sec determine the velocity of the body: (i) when the force act in the direction of motion and (ii) when the force act in opposite direction of the motion. [(i) 80 m/s ; (ii) -40 m/s]
Q.39	Determine centroid of following line elements Fig-1, Fig-2  Fig-1  Fig-2
Q.40	Find moment of inertia for rectangular section of size 300mmx600mm with central hole of 100mm dia.

B

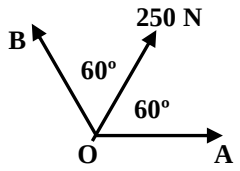


Figure 1

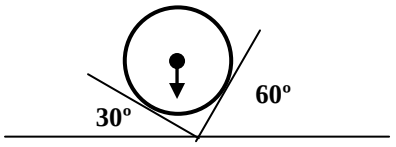


Figure 2

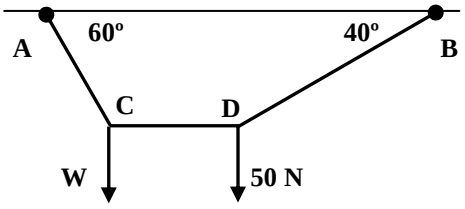


Figure 3

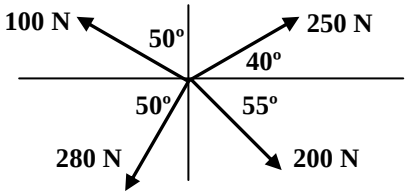
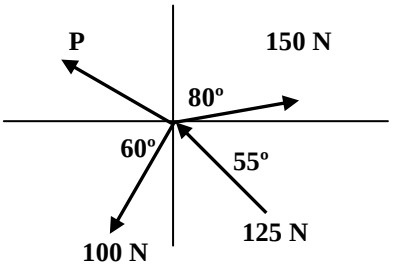


Figure 4



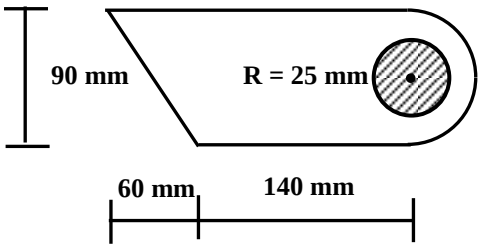


Figure 5

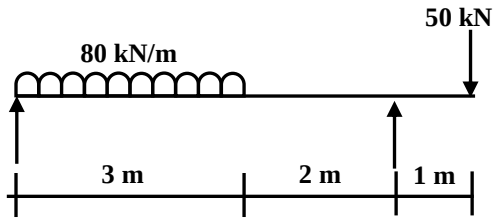


Figure 7

Figure 6

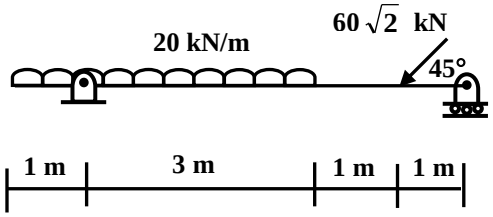


Figure 8

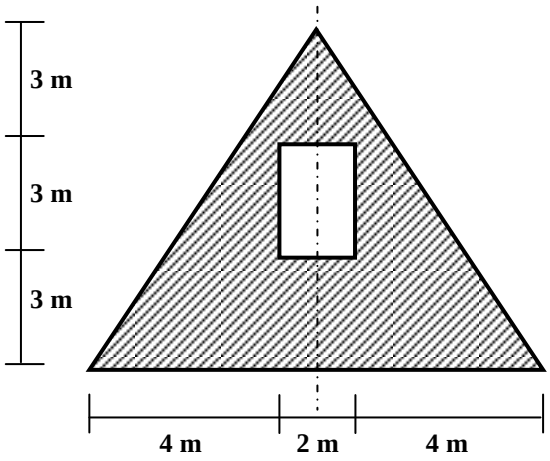
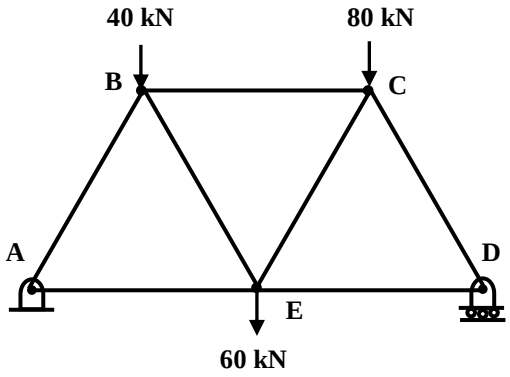


Figure 9



Each member is 2 m long.

Figure 10