Registration No: | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech**

15BE2104

1st Semester Back Examination 2017-18

MECHANICS

BRANCH : AEIE, AUTO, CHEM, CIVIL,
CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, IEE, IT, MECH, MME, PE, TEXTILE

Time : 3 Hours

Max Marks : 100

Q.CODE : B926

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions: multiple type or dash fill up type** **(2 x 10)**

a) If the sum of all the forces acting on a body is zero, then the body may be in equilibrium
provided the forces are
(a) Concurrent (b) Parallel
(c) Like parallel (d) Unlike parallel

b) The centre of gravity of hemisphere lies at a distance of .....form its base measured along the vertical radius.

c) The moment of inertia of a circular section of diameter (d) is given by the relation……

d) The moment of inertia of a triangular section of base (b) and height (h) about an axis through its c.g. and parallel to the base is given by the relation……..

e) The centre of gravity of an equilateral triangle with each side (a) is ..... from any of the three sides.

f) The Lami's Theorem is applicable only for
(a) Coplanar forces (b) Concurrent forces
(c) Coplanar and concurrent forces (d) Any type of forces

g) The torque acting on a body of moment of inertia (I) and angular acceleration (α) is…….

h) One watt is equal to
(a) 0.1 J/s (b) 1 J/s
(c) 10 J/s (d) 100 J/s

i) The potential energy of a mass (m) kg raised through a height (h) metres is
(a) mh newtons (b) gh newtons
(c) mgh newtons (d) none of these

j) If the moment of inertia (I) of a pulley is doubled, then the acceleration of a body tied to a string and passing over it is
(a) Halved (b) Remains the same
(c) Doubled (d) None of these

Q2 **Answer the following questions: Short answer type** **(2 x 10)**

a) Differentiate between 'Resultant' and 'Equilibrant'

b) State Varignon's theorem.

c) Define principle of transmissibility

d) Define free Body Diagram (FBD) and draw FBD of Hinged, Fixed & Roller support.

e) State Lami's theorem with a sketch.

f) Write the equations of equilibrium of a coplanar system of forces

g) Differentiate truss and frame.

h) Explain D-Alembert principle.
i) Explain why a man feels weightless while coming down in a elevator?
j) What are impulse and momentum?

Q3 **a)** Two identical rollers each of weight 50N are supported by an inclined plane and a vertical wall as shown in figure-1. Find the reactions at the points of supports A, B, and C. **(10)**

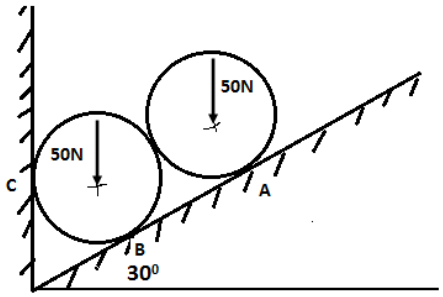


Figure-1

b) A weight of 40 kN is suspended by two cables as shown in the figure-2. Find the tensions T_1 & T_2 in the cables. **(5)**

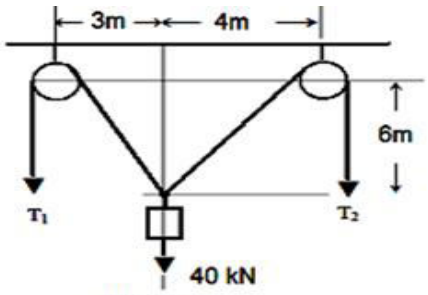


Figure-2

Q4 **a)** A ball of weight Q= 53.4 N rest in a right-angle trough, as shown in figure- 3. Determine reactions at D & E if all surface are perfectly smooth. **(10)**

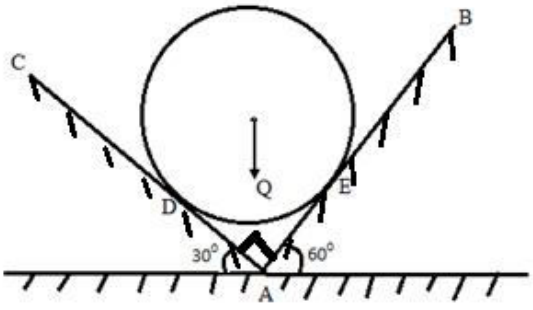


Figure-3

b) A roller of weight 500 N has a radius of 120 mm and is pulled over a step of height 60 mm by a horizontal force P. Find magnitudes of P to just start the roller over the step. **(5)**

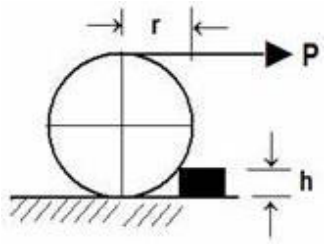


Fig.4

Q5 **a)** A uniform ladder of 4 m. length rests against a vertical wall which it makes an angle 45^0. If a man, whose weight is half of the ladder, ascends it, how high will it be when the ladder slips? **(10)**
(Take μ=0.4 (between ladder and wall) and μ=0.5 (between ladder and floor))

b) Find the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the centre of gravity of the section. **(5)**

Q6 **a)** Find the centroid of one quarter of ellipse whose major diameter is 2a and minor diameter is 2b. **(10)**

b) Two beams AC (= 5 m.) and CD (7 m.) are hinged internally at C and simply supported at A & D. When it is subjected to transverse loading at point P (3.5 m. from A) and Q (2 m. from D) 5 kN and 6 kN respectively. Using principle of virtual work, find the reaction at the third support B (i.e. 4.5 m. from D). **(5)**

Q7 **a)** A flywheel of mass 8 tonnes starts from rest, and gets up a speed of 180 rpm in 3 minutes. Find the average torque exerted on it. Take radius of gyration is 60 cm.) **(10)**

b) A car starts moving (without slipping) from rest along a 14^0 inclined plane. After 9 m. it hits the block B (of same weight of car). After impact, car and block will move at single body. If μ=0.39 at contact surfaces, determine the distance where it will come to rest. **(5)**

Q8 **a)** Train A passes a certain station at velocity 72 kmph and moves 20 km at this speed and then comes to rest at next station 24 km away from the first one. Train B, starts from the first station, in accelerate and then decelerate and finally reaches the second station. Time taken by B is twice of the time taken by A. Determine the maximum speed attained by B. **(10)**

b) Explain the laws of friction. **(5)**

Q9 **a)** A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find : **(10)**
1. The greatest elevation above the ground reached by the projectile ; and
2. Horizontal distance from the gun to the point, where the projectile strikes the ground.

b) A bullet of mass 30 g is fired into a body of mass 10 kg, which is suspended by a string 0.8 m long. Due to this impact, the body swings through an angle 30°. Find the velocity of the bullet. **(5)**

Registration No : | | | | | | | | | | |

Total Number of Pages : 02

B.Tech
15BE2104

1st Semester Back Examination 2019-20
MECHANICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Max Marks : 100
Time : 3 Hours
Q.CODE : HB855

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part-I

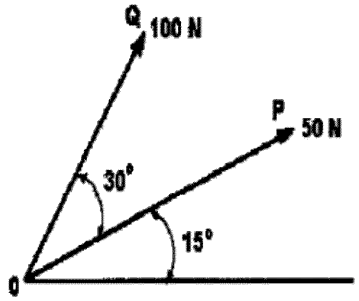
Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Define free body diagram.
b) What do you mean by coplanar concurrent force system?
c) Write the equilibrium equations for a body in space.
d) State Lami's theorem.
e) Define coefficient of friction and limiting friction.
f) State the theorem of perpendicular axis applied to moment of inertia.
g) State principle of virtual work.
h) State D'Alembert's Principle.
i) Define the coefficient of restitution.
j) What is law of conservation of momentum?

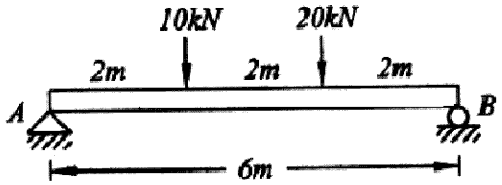
Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Two forces are acting at a point 'O' as shown in figure. Determine the resultant in magnitude and direction of the force.



b) State and prove parallelogram law of forces.
c) State and prove second theorem of pappus.
d) Distinguish between static friction and dynamic friction.
e) Determine the reactions at supports as shown in figure using the principle of virtual work.



f) Prove the parallel axis theorem in the determination of moment of inertia of areas withthe help of a neat sketch.
g) Differentiate between centroid and center of gravity.

h) A block weighing 100 N is resting on a rough plane inclined 200 to the horizontal. It is acted upon by a force of 50N directed upward at angle of 140 above the plane. If the block is about to move up the plane, determine the co-efficient of friction.

i) A hammer of mass 0.5 kg hits a nail of 25 g with a velocity of 5 m/s and drives it into a fixed wooden block by 25 mm. Find the resistance offered by the wooden block.

j) An aero plane is travelling with a velocity of 450 km/hr. in a curve of radius 1000 m. Find the angle at which it must incline with the horizontal. Take g= 9·8 m/s^2.

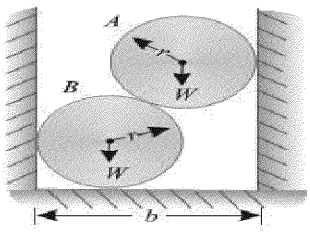
k) Derive an expression for the maximum height and range of a projectile traversed by astone, thrown with an initial velocity of 'u' and an inclination of 'α'.

l) The acceleration of a particle in rectilinear motion is defined by the relation a = 25 – $4S^2$,where 'a' is expressed in m/$sec^2$and 'S' is position coordinate in meters. The particlestarts with no initial velocity at the position S = 0. Determine the velocity when S = 3 m and also the position where the velocity is maximum.

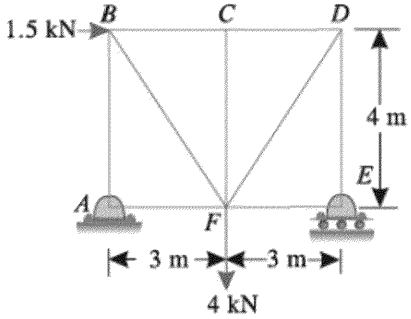
Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two smooth spheres of weight Wand radius reach are in equilibrium in a horizontalchannel of Aand Bvertical sides as shown in Figure. Find the force exerted by each sphere on the other. Calculate these values, if r= 250 mm,b= 900 mm and W= 100 N. **(16)**

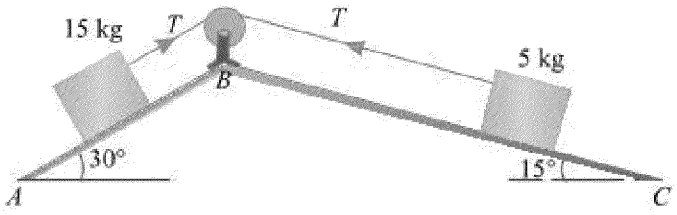


Q4 A truss shown in Figure is subjected to two points loads at B and F. Find the forces in all the members of the truss and tabulate the results. **(16)**



Q5 The masses of two balls are in the ratio of 2:1 and their velocities are inthe ratio of 1:2, but in the opposite direction before impact. If the coefficient of restitution be 5/6,prove that after the impact,each ball will move back with 5/$6^{th}$of its original velocity. **(16)**

Q6 Two rough planes inclined at 30º and 15º to the horizontal and of the sameheight are placed back to back as shown in Figure. Two bodies of masses of 15 kg and 5 kg are placed on the faces and connected by a string over the top of the planes. If the coefficient of friction be 0.3, find the resulting acceleration. **(16)**



Registration no: | | | | | | | | | | |

Total Number of Pages: 02

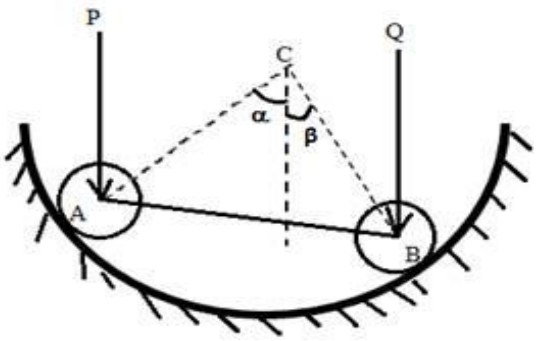
B.Tech
BE2104

1ST Semester Back Examination 2017-18
MECHANICS
BRANCH: AEIE, AERO, AUTO, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, FASHION, IEE, IT, MECH, MINING, MME, PE, PLASTIC, TEXTILE
Time: 3 Hours
Max Marks: 70
Q.CODE: B1088
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

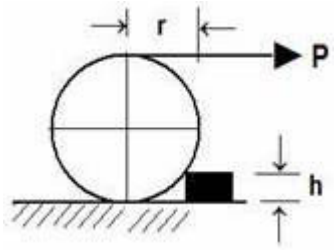
a) State Lami's theorem and demonstrate the same by an example.
b) State Varignon's theorem.
c) Using Papus theorem find the area of circle.
d) State laws of coulomb friction of sliding bodies.
e) Define principle of transmissibility
f) State the principle of conservation of momentum.
g) If the speed of a particle along a curved path is constant, what is the value of tangential acceleration?
h) Differentiate truss and frame.
i) What are impulse and momentum?
j) What is the location of centroid of a cone height 'h' and radius 'r'?

Q2 **a)** Two roller of weights "P" = 222.5N and "Q" = 445N are connected by a rigid bar at its ends & supported inside a circular ring in a vertical plane as shown in figure. The length of the bar "AB" is such that radii "AC" and "BC" form right-angle at center of the circular ring "C". Neglecting friction and weight of the bar, find the compressive force in the bar "AB". **(5)**



b) A roller of weight 500 N has a radius of 120 mm and is pulled over a step of **(5)**

height 60 mm by a horizontal force P. Find magnitudes of P to just start the roller over the step.



Q3 **a)** A uniform ladder of 4 m. length rests against a vertical wall which it makes an angle 45^0. If a man, whose weight is half of the ladder, ascends it, how high will it be when the ladder slips? (Take μ=0.4 (between ladder and wall) and μ=0.5 (between ladder and floor)) **(5)**

b) A quarter of circle area is removed from square. Find out the centroid of remaining area. The radius of the circle is same as the side of square. **(5)**

Q4 **a)** A bullet is fired upward at an angle of 30^0 to the horizontal from a point P on the hill. It strikes the target, which is 80 m lower than P. The initial velocity of bullet is 100 m/sec. calculate the actual velocity with which the bullet strikes the target. **(5)**

b) Train A passes a certain station at velocity 72 kmph and moves 20 km at this speed and then comes to rest at next station 24 km away from the first one. Train B, starts from the first station, in accelerate and then decelerate and finally reaches the second station. Time taken by B is twice of the time taken by A. Determine the maximum speed attained by B **(5)**

Q5 **a)** A bullet of mass 30 gm is fired into a body of mass 10 kg, which is suspended by a string 0.8 m. long. Due to this impact, the body swings through an angle 30^0. Find the initial velocity of bullet. **(5)**

b) State and explain the principle of virtual work with an example. **(5)**

Q6 **a)** Find the maximum constant speed of a car can move (without skidding) around a curve. (Take R=350 meters and μ=0.3 (between tyre & road)) **(5)**

b) A flywheel of mass 8 tonnes starts from rest, and gets up a speed of 180 rpm in 3 minutes. Find the average torque exerted on it. Take radius of gyration is 60 cm.) **(5)**

Q7 Find the moment of inertia of a T-section with flange as 200 mm × 60 mm and web as 200 mm × 60 mm about X-X and Y-Y axes through the centre of gravity of the section. **(10)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Parallel axis theorem
b) Co-efficient of restitution
c) D-Alembert principle
d) Radius of gyration

Registration No : | | | | | | | | | | |

Total Number of Pages : 02

B.Tech
BE2104

1st Semester Back Examination 2019-20
MECHANICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Max Marks : 70
Time : 3 Hours
Q.CODE : HB958

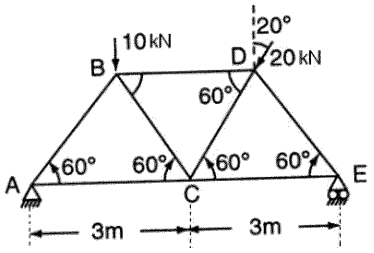
Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

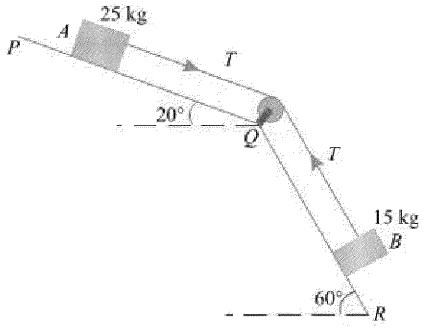
a) What are the methods for finding out the resultant force for a given system of forces?
b) State the Varignon's principle of moments.
c) Define the term 'Centre of gravity'.
d) State the laws of friction.
e) Write the expression for horizontal range of a projectile.
f) State principle of virtual work.
g) State the second theorem of pappus.
h) State D'Alembert's Principle.
i) Define the coefficient of restitution.
j) Write the impulse momentum equation.

Q2 a) State and prove parallel axis theorem of area moment of inertia. **(5)**
b) Compute moment of inertia of hemisphere about its diametral base of radius'R' **(5)**

Q3 a) What are the assumptions made for forces in members of a perfect truss? **(5)**
b) Find the forces in all the members of the truss as shown in the figure using method of joints. **(5)**



Q4 a) Two bodies A and B are connected by a light inextensible cord as shown in Figure. If both the bodies are released simultaneously, what distance do they move in 3 seconds? Neglect friction between the two bodies and the inclined surfaces. **(5)**



b) An industrial vehicle of mass 1 tons is moving on a newly constructed road whose coefficient of friction is 0·55. Determine the maximum possible acceleration of the vehicle, if it is driven by both the pairs of wheels. **(5)**

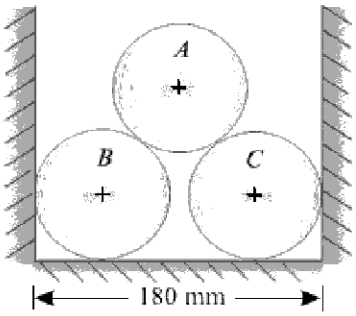
Q5 **a)** If $m_1$and $m_2$are the masses of two bodies, $u_1$and u_2, $v_1$and $v_2$are the velocities of the bodies before and after the impact respectively and 'e' the coefficient of restitution, show that the loss of a kinetic energy due to direct impact is given by: **(5)**

$$0.5\ \frac{m_1 m_2}{m_1 + m_2}(u_1 + u_2)^2(1 - e^2)$$

b) In a circus show, a motor cyclist is moving in a spherical cage of radius 3 m. The motor cycle and the rider together has mass of 750 kg. Find the least velocity, with which the motor cyclist must pass the highest-point on the cage, without losing contact inside the cage. **(5)**

Q6 A body is projected upwards with a velocity of 50 m/s at angle of 50°withthe horizontal. What will be its (i) velocity and(ii) direction at a height of 30 m from the point of projection. **(10)**

Q7 Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Figure. Determine the pressure exerted by (i) the cylinder A on B at the point of contact and (ii) the cylinder B on the base. **(10)**



Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Triangle law of forces
b) Theorem of perpendicular axis
c) Principle for curvilinear motion

Registration No :

Total Number of Pages : 04

B.Tech
REM2B001

2nd Semester Regular / Back Examination: 2021-22
ENGINEERING MECHANICS
BRANCH(S): AEIE, AERO, AG, AME, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIME, CST, ECE, EEE, EIE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ENV, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PLASTIC, PT
Time : 3 Hour
Max Marks : 100
Q.Code : J748

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions :** **(2 × 10)**

a) What is cone of static friction?
b) State law of transmissibility of forces.
c) The position of a particle moving along a straight line is defined by the relation, $x=2t^3-5t^2+10t+20$, where x is expressed in meters and t in seconds. Determine the acceleration of the particle at t=5sec.
d) For a perfect plane truss the number of nodes is 5. How many members are there?
e) What is the difference between moment of a force and moment of a couple?
f) What is the maximum number of components a vector can have ?
g) What is D'Alemberts principle?
h) State virtual work principle.
i) State work energy principle.
j) Define impact and mention types.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Two identical rollers, each of weight Q= 445N, are supported by an inclined plane and a vertical wall as shown in Fig.1. Assuming smooth surfaces, find the reactions induced at the points of supports A, B and C.

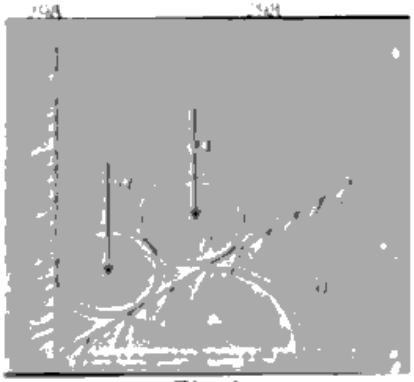


Fig.1

b) Two identical prismatic bars AB and CD are welded together in the form of a rigid T and suspended in a vertical plane as shown in Fig.2. Calculate the angle α that the bar CD will make with the vertical when the vertical load F=44.5N is applied at B

The weight of each bar is Q=22.25N shown.

Fig.2

c) State and prove Pappus theorems

d) Compute the reactions at the supports B and C of the beam AC loaded as shown in Neglect the weight of the beam itself.

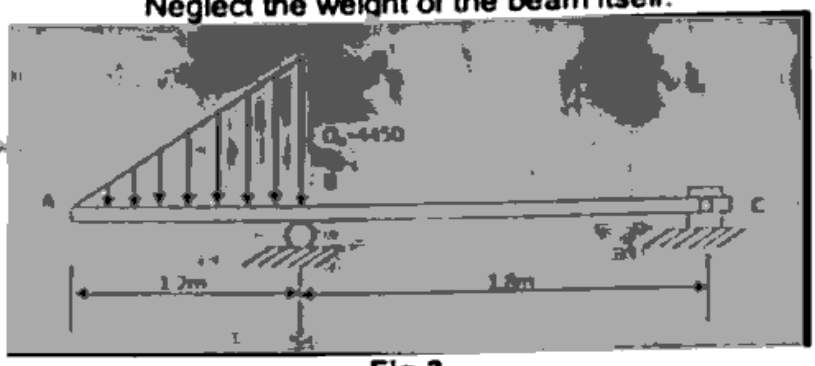


Fig.3

e) A particle travels with constant speed v along a parabolic path defined by the equation

$v = kx^2$, where k is a constant. Find the maximum acceleration of the particle.

f) Determine the force *S* in the bar CD of the simple truss supported and loaded as shown in Fig.4. The triangle ABC is equilateral.

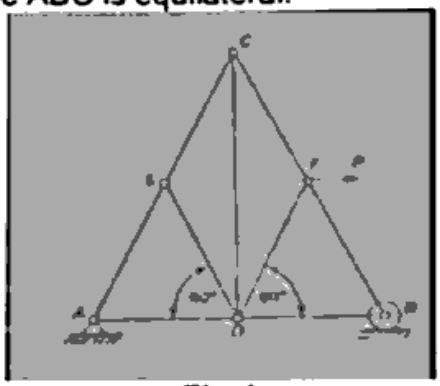


Fig.4

g) The coefficient of friction between wet asphalt pavement and the tyres of an automobile is found to have the value of $\mu = 0.20$. At what constant speed v can the automobile travel around a curve of radius $r = 240$m without skidding if the road is level?

h) A mortar having muzzle velocity $v_0 = 212.1$ m/sec fires for maximum range across a level plain. Neglecting air resistance, calculate the time of flight of the shell.

i) A 667.5 N man sits in a 333.75 N canoe and fire a rifle bullet horizontally directly over the bow of the canoe. Neglecting the friction of water, find the velocity v with which the canoe will move after the shot if the rifle has a muzzle velocity of 660 m/s. The weight of the bullet is 0.28 N.

j) A circular ring has a mean radius $r = 500$ mm and is made of steel for which $w = 77.12$ kN/m^3 and for which the ultimate strength in tension is 413.85 MPa. Find the uniform speed of rotation about its geometric axis perpendicular to the plane of the ring at which it will burst.

b) Referring to Fig.8, determine the coordinates x_c and y_c of the center of a 100 mm diameter, circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area. (8)

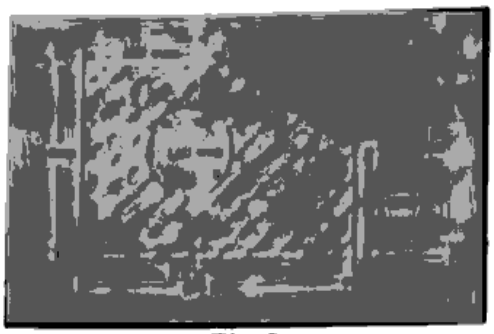


Fig.8

Q5 **a)** A rope AB is attached at B to a small block of negligible dimensions and passes over a pulley C so that its free end A hangs 1.5m above the ground when the block rests on the floor (Fig.9). The end A of the rope is moved horizontally in a straight line by a man walking with a uniform velocity v_0 =3m/s. (i) plot the velocity-time diagram for the motion of the block B.(ii) Find the time required t for the block to reach the pulley if h = 4.5 m and the pulley is negligibly small. (8)

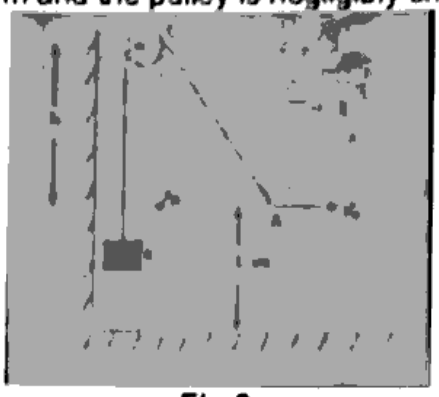


Fig.9

b) A solid right circular cylinder of weight W = 44.5 N and cross-sectional area A = 112.5 cm^2 is suspended by a spring of constant k = 178 N/m and hangs partially submerged in water $(w = \rho g = 10.29kN/m^3)$.Calculate the period T for small vertical oscillations. Neglect the inertia of water (8)

Q6 **a)** A stuntman likes to cross the ditch as shown in Fig.10. Find the minimum velocity required at P. Also determine the direction and magnitude of velocity of the stuntman just at the instant of clearing the ditch. (8)

Fig.10

b) Determine the dynamical deflection δ that will be produced at the centre of a simply supported beam by allowing a 17.8 kN weight to drop onto it from a height of 100mm. When gradually applied, the same load produces a static deflection of 2.5 mm. Neglect mass of the beam. (8)

k) The motion of a particle of mass m in the xy plane is defined by the equations $x = a \cos pt$, $y = b \sin pt$ where a, b and p are constants. Calculate the moment of momentum of the particle with respect to the origin O.

l) Find the proper super-elevation e for a 7.2 m highway curve of radius r = 600 m in order that a car travelling with a speed of 80Kmph will have no tendency to skid sidewise.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 (a) In Fig.5, three smooth right circular cylinders, each of radius r and weight P, are arranged on smooth inclined surfaces as shown. Determine the least value of angle α that will prevent the arrangement from slipping. **(8)**

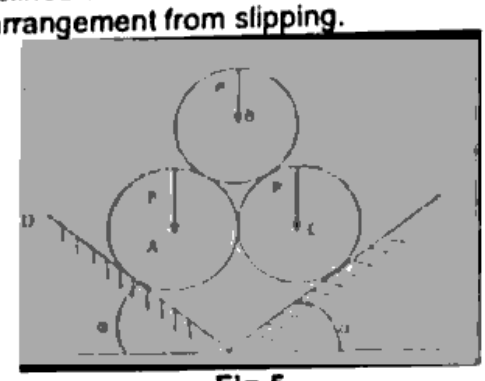


Fig.5

b) Two blocks connected by a horizontal link AB are supported on two rough planes as shown in Fig. 6. The coefficient of friction for block A on the horizontal plane is μ = 0.4.The angle of friction for block B on the inclined plane is ϕ = 15°. What is the smallest weight W of block A for which equilibrium of the system can exist? **(8)**

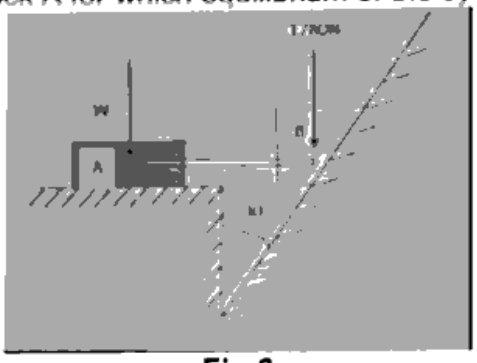


Fig.6

Q4 a) i) Resolve the 4000 N force shown in Fig.7 into two parallel components P and Q acting, respectively, along aa and bb. **(8)**
ii) Resolve the same force into parallel components P and Q acting, respectively, along bb and cc.
iii) Resolve the same force into a force P at B and a couple. Represent the couple by forces F, along bb and cc.
Assume each small square is one unit.

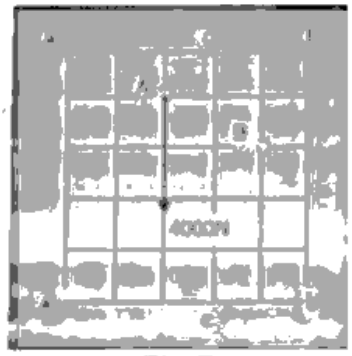


Fig.7

Registration No : | | | | | | | | | | |

Total Number of Pages : 04 **B.Tech.**
15BE2104

2nd Semester Back Examination 2017-18
MECHANICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : C1037
Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Part – A (Answer all the questions)

Q1 **Answer the following questions:** **(2 x 10)**

a) The force that cancels the effect of the force system acting on a body is known as
(i) Resultant (ii) Equilibrant
(iii) Balancing Force (iv) Neutral Force

b) The reaction from an ideal smooth plane must be directed along the _____ at the point of contact.

c) A body of weight Q is placed on an inclined rough plane. The inclination of the plane with the horizontal is less than the angle of friction. The body will
(i) Be in motion (ii) be in equilibrium
(iii) move downwards (iv) move upwards

d) The algebraic sum of moments of two parallel forces with respect to any moment centre in their plane of action is equal to the moment of their resultant with respect to the same moment centre. This statement is known as
(i) Superposition Theorem (ii) Theorem of Transmissibility
(iii) Varignon's Theorem (iv) None of these

e) In the method of sections for analysis of a plane truss,
(i) The section can be cut through any set of members.
(ii) The section should only cut three bars, since only three unknowns can be determined from three equations of equilibrium.
(iii) The section should only cut two bars, since only two unknowns can be determined from three equations of equilibrium.
(iv) None of these

f) When a net force act on a body, it produces acceleration in the body in the direction of the net force which is directly proportional to the net force acting on the body and inversely proportional to its mass. This statement is called
(i) newton's 2nd law of motion (ii) newton's 1st law of motion
(iii) newton's 3rd law of motion (iv) None of these

g) A body of mass 10 kg is moving with the velocity of 15 m/s. The force required to stop it in 3 seconds should be :
(i) 50N (ii) 100N
(iii) 75N (iv) 170N

h) A bullet of mass 30g is fired from a gun with a muzzle velocity 90m/s. If its mass is 4 kg then the recoil of the gun will be
(i) -0.34m/s (ii) 0.54m/s
(iii) -0.54m/s (iv) 0.34m/s

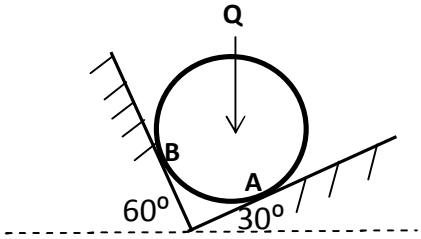
i) A brick of mass 100g is attached to a rope 1m long. The brick is rotating in a circle with 5m/s speed. The tension in rope will be :
(i) 3N (ii) 2.5N
(iii) 4N (iv) 1.5N

j) A ball of mass m moving at a speed of v collides with another ball of mass 3m at rest. The lighter ball comes to rest after the collision. The coefficient of restitution is
(i) ½ (ii) 1/3
(iii) 2/3 (iv) None of these

Q2 **Answer the following questions: *Short answer type*** **(2 x 10)**

a) State and explain Law of Superposition with a neat sketch.

b) Draw the Free Body Diagram of the following problem.



c) State theorem of Transmissibility.

d) Write the applications of 1st theorem of Pappus.

e) What do you understand by Limiting equilibrium?

f) Write Principle of Conservation of Momentum.

g) What do you understand by an ideal system?

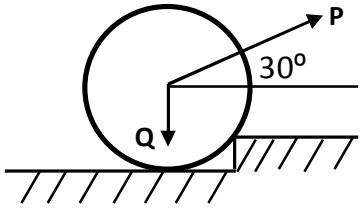
h) Write the equation of work-energy for rectilinear motion of a particle.

i) What do you understand by Coefficient of Restitution?

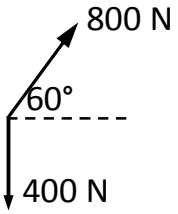
j) What is the advantage of D'Álembert's Principle as compared to Newton's Second Law of motion?

Part – B (Answer any four questions)

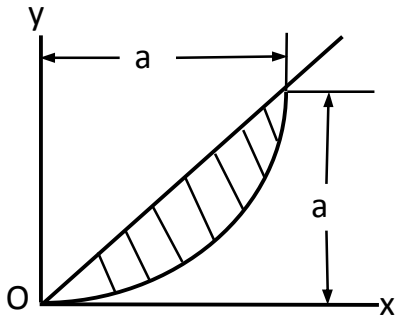
Q3 **a)** Determine the magnitude of the force P applied at the centre C of the roller of weight Q = 1000 N and radius r = 200 mm which will be necessary to pull it over a 50 mm curb as shown in the figure. **(10)**



b) Two forces are acting at a point as shown in the figure. Find the resultant. **(5)**

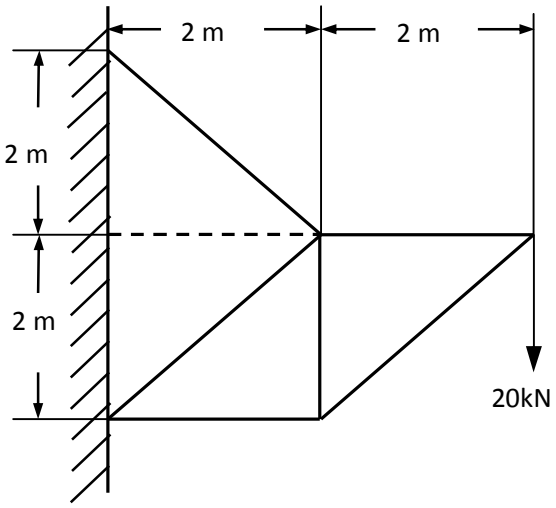


Q4 **a)** Find the centroid of the area between the parabola $y = x^2/a$ and straight line $y = x$ as shown in the figure below. **(10)**

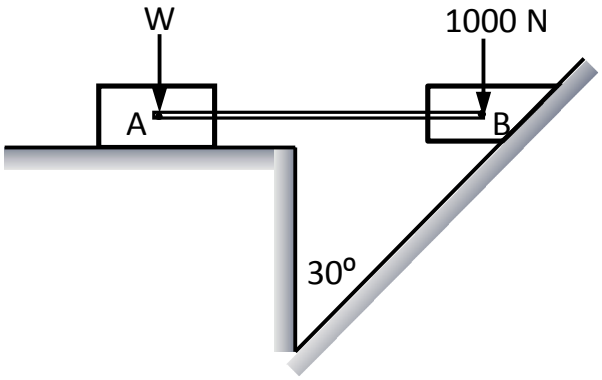


b) State and prove Parallel Axis theorem. **(5)**

Q5 Determine the force in each member of the truss as shown in the Figure. **(15)**



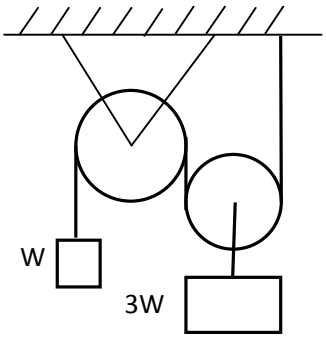
Q6 **a)** Two blocks connected by a horizontal link AB are supported on two rough planes as shown in the figure. The coefficient of friction for block A on the horizontal plane is $\mu = 0.4$. The angle of friction for block B on the inclined plane is $\varphi = 15^o$. What is the smallest weight W of the block A for which the equilibrium of the system exists. **(10)**



b) Explain virtual displacement, virtual work and Principle of Virtual Work with a neat sketch. **(5)**

Q7 **a)** A ball is thrown vertically upward from a point on a tower located 25m above the ground. Knowing that the ball strikes the ground 3s after release, determine the speed with which the ball (s) was thrown upward (b) strikes the ground. **(5)**

b) Two weights W and 3W are supported in a vertical plane by a string and pulley arranged as shown in figure. Find an additional weight Q applied on the left block W which will give a downward acceleration of $1m/s^2$ to the weight W. **(10)**



Q8 **a)** A block of weight 12N falls from a height of 0.75m on top of a spring. Determine the spring constant if it is compressed by 150mm to bring the weight momentarily to rest. **(7.5)**

b) A shot is fired with a bullet with an initial velocity of 40m/s from a point 20m in front of a vertical wall 10m height. Find the angle of projection with horizontal to enable the shot to just clear the wall. **(7.5)**

Q9 **a)** A spherical ball of 60kg moving with a velocity of 20m/s collides with another ball of mass 45kg moving with 1m/s in the same direction. If e=0.5, find the final velocities after collision. **(5)**

b) A pulley weighs 500 N and has a radius of 0.75 m. A block weighing 400 N is supported by inextensible wire wound around the pulley. Determine the velocity of the block 2 sec after it is released from rest. Assume the motion is under constant acceleration. **(10)**

Registration No : | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech.**
BE2104

2nd Semester Back Examination 2017-18
MECHANICS
BRANCH : AEIE, AERO, AUTO,
BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC,
FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA,
METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 70
Q.CODE : C1123

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer the following questions:** **(2 x 10)**

a) State and explain Parallelogram Law.

b) What is the condition for two coplanar forces to be in equilibrium?

c) State theorem of Varignon.

d) Differentiate between angle of repose and angle of friction.

e) State and explain Law of Superposition with a neat sketch.

f) State the difference between Newton's 2nd Law of motion and D'Alembert's Principle.

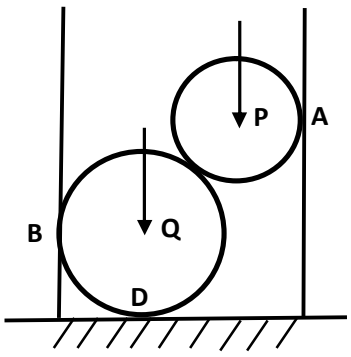
g) What do you understand by conservation of momentum?

h) What do you understand by coefficient of restitution?

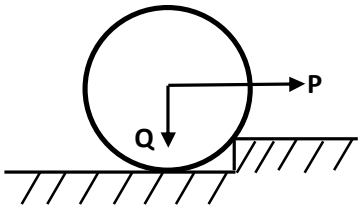
i) What do you understand by moment of momentum?

j) Write the expression of equation of motion for a rigid body under rotation explaining each term.

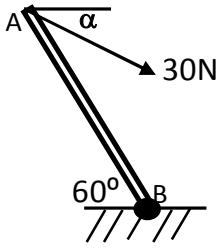
Q2 **a)** Two spheres P and Q rest inside a hollow cylinder, which is resting on a horizontal plane as shown in the figure. If P=10kN and Q=20kN, find the reaction at D, the point of contact of Q with the ground. **(5)**



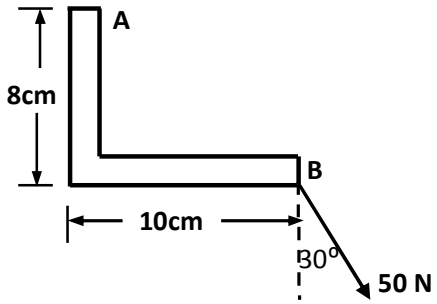
b) Determine the magnitude of the horizontal force P applied at the centre C of the roller of weight Q = 2500 N and radius r = 200 mm which will be necessary to pull it over a 50 mm curb as shown in the figure. **(5)**



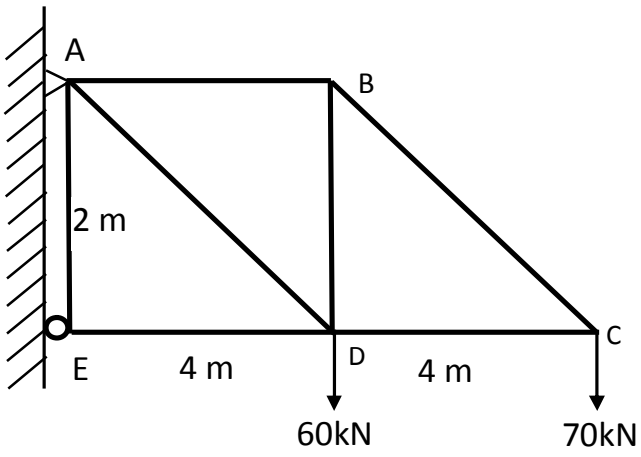
Q3 **a)** A 30N force is applied to the control rod AB as shown. Knowing that the length of the rod is 30cm and that α=30°, determine the moment of the force about point B. **(5)**



b) A 50 N force is applied for a corner plate as shown. Determine an equivalent force-couple system acting at A. **(5)**

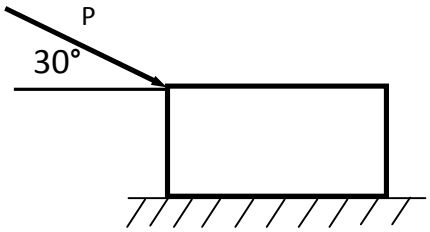


Q4 Determine the force in each member of the truss as shown in the Figure. **(10)**



Q5 **a)** State and prove the 1st theorem of Pappus. **(5)**

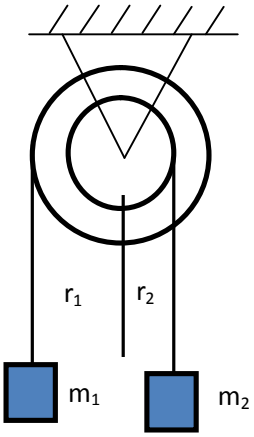
b) A 100kg block is resting on a horizontal plane. Find the magnitude of the force required to give the block an acceleration of $3m/s^2$ to the right. The coefficient of kinetic friction between the block and plane is 0.25. **(5)**



Q6 **a)** A stone is thrown from the top of a building of 30m height upward at an angle of 40° to the horizontal with an initial speed of 30m/s. Determine the horizontal distance from the point of projection to the point where it strikes the ground and the velocity at that point of time. **(5)**

b) A motorist travelling at a speed of 90km/h suddenly applies the brakes and comes to a stop after skidding 50m. Determine (a) the time required for the car to stop (b) the coefficient of friction between the tires and the pavement. **(5)**

Q7 The mass of the two step pulley as shown is 180kg and radius of gyration is 180mm. Knowing that m_1=225N, m_2=100N, r_1=250mm, r_2=100mm, find the acceleration of m_1. **(10)**



Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Principle of Virtual Work

b) Parallel Axis and Perpendicular Axis theorem

c) Different methods of truss analysis

d) Short notes on Impulse and Momentum

Registration No :

Total Number of Pages : 04

B.Tech
REM2B001

2nd Semester Regular / Back Examination: 2021-22
ENGINEERING MECHANICS
BRANCH(S): AEIE, AERO, AG, AME, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIME, CST, ECE, EEE, EIE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ENV, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PLASTIC, PT
Time : 3 Hour
Max Marks : 100
Q.Code : J748

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions :** **(2 × 10)**

a) What is cone of static friction?
b) State law of transmissibility of forces.
c) The position of a particle moving along a straight line is defined by the relation, $x=2t^3-5t^2+10t+20$, where x is expressed in meters and t in seconds. Determine the acceleration of the particle at t=5sec.
d) For a perfect plane truss the number of nodes is 5. How many members are there?
e) What is the difference between moment of a force and moment of a couple?
f) What is the maximum number of components a vector can have ?
g) What is D'Alemberts principle?
h) State virtual work principle.
i) State work energy principle.
j) Define impact and mention types.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Two identical rollers, each of weight Q= 445N, are supported by an inclined plane and a vertical wall as shown in Fig.1. Assuming smooth surfaces, find the reactions induced at the points of supports A, B and C.

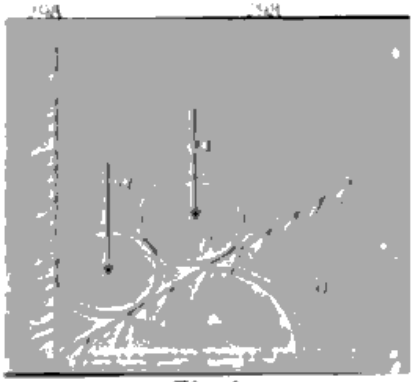


Fig.1

b) Two identical prismatic bars AB and CD are welded together in the form of a rigid T and suspended in a vertical plane as shown in Fig.2. Calculate the angle α that the bar CD will make with the vertical when the vertical load F=44.5N is applied at B

The weight of each bar is Q=22.25N shown.

Fig.2

c) State and prove Pappus theorems

d) Compute the reactions at the supports B and C of the beam AC loaded as shown in Neglect the weight of the beam itself.

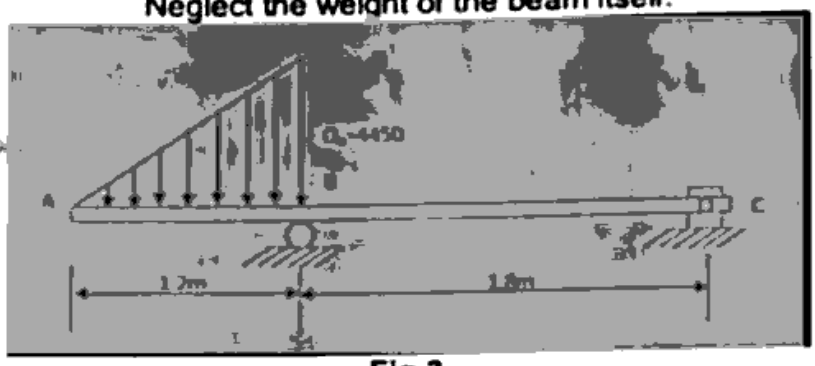


Fig.3

e) A particle travels with constant speed v along a parabolic path defined by the equation

$v = kx^2$, where k is a constant. Find the maximum acceleration of the particle.

f) Determine the force *S* in the bar CD of the simple truss supported and loaded as shown in Fig.4. The triangle ABC is equilateral.

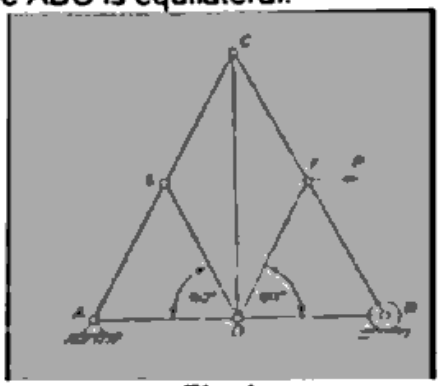


Fig.4

g) The coefficient of friction between wet asphalt pavement and the tyres of an automobile is found to have the value of $\mu = 0.20$. At what constant speed v can the automobile travel around a curve of radius $r = 240$m without skidding if the road is level?

h) A mortar having muzzle velocity $v_0 = 212.1$ m/sec fires for maximum range across a level plain. Neglecting air resistance, calculate the time of flight of the shell.

i) A 667.5 N man sits in a 333.75 N canoe and fire a rifle bullet horizontally directly over the bow of the canoe. Neglecting the friction of water, find the velocity v with which the canoe will move after the shot if the rifle has a muzzle velocity of 660 m/s. The weight of the bullet is 0.28 N.

j) A circular ring has a mean radius $r = 500$ mm and is made of steel for which $w = 77.12$ kN/m^3 and for which the ultimate strength in tension is 413.85 MPa. Find the uniform speed of rotation about its geometric axis perpendicular to the plane of the ring at which it will burst.

b) Referring to Fig.8, determine the coordinates x_c and y_c of the center of a 100 mm diameter, circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area. (8)

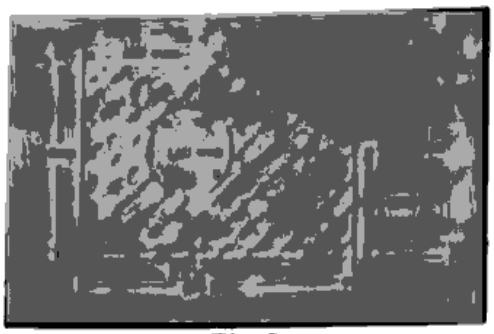


Fig.8

Q5 **a)** A rope AB is attached at B to a small block of negligible dimensions and passes over a pulley C so that its free end A hangs 1.5m above the ground when the block rests on the floor (Fig.9). The end A of the rope is moved horizontally in a straight line by a man walking with a uniform velocity v_0 =3m/s. (i) plot the velocity-time diagram for the motion of the block B.(ii) Find the time required t for the block to reach the pulley if h = 4.5 m and the pulley is negligibly small. (8)

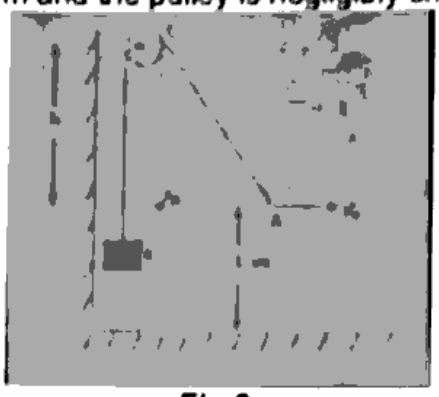


Fig.9

b) A solid right circular cylinder of weight W = 44.5 N and cross-sectional area A = 112.5 cm^2 is suspended by a spring of constant k = 178 N/m and hangs partially submerged in water $(w = \rho g = 10.29kN/m^3)$.Calculate the period T for small vertical oscillations. Neglect the inertia of water (8)

Q6 **a)** A stuntman likes to cross the ditch as shown in Fig.10. Find the minimum velocity required at P. Also determine the direction and magnitude of velocity of the stuntman just at the instant of clearing the ditch. (8)

Fig.10

b) Determine the dynamical deflection δ that will be produced at the centre of a simply supported beam by allowing a 17.8 kN weight to drop onto it from a height of 100mm. When gradually applied, the same load produces a static deflection of 2.5 mm. Neglect mass of the beam. (8)

k) The motion of a particle of mass m in the xy plane is defined by the equations $x = a \cos pt$, $y = b \sin pt$ where a, b and p are constants. Calculate the moment of momentum of the particle with respect to the origin O.

l) Find the proper super-elevation e for a 7.2 m highway curve of radius r = 600 m in order that a car travelling with a speed of 80Kmph will have no tendency to skid sidewise.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 (a) In Fig.5, three smooth right circular cylinders, each of radius r and weight P, are arranged on smooth inclined surfaces as shown. Determine the least value of angle α that will prevent the arrangement from slipping. **(8)**

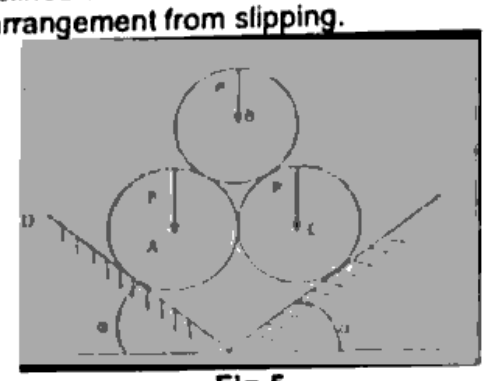


Fig.5

b) Two blocks connected by a horizontal link AB are supported on two rough planes as shown in Fig. 6. The coefficient of friction for block A on the horizontal plane is μ = 0.4.The angle of friction for block B on the inclined plane is ϕ = 15°. What is the smallest weight W of block A for which equilibrium of the system can exist? **(8)**

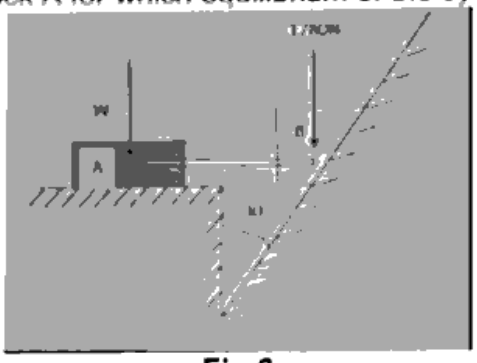


Fig.6

Q4 a) i) Resolve the 4000 N force shown in Fig.7 into two parallel components P and Q acting, respectively, along aa and bb. **(8)**
ii) Resolve the same force into parallel components P and Q acting, respectively, along bb and cc.
iii) Resolve the same force into a force P at B and a couple. Represent the couple by forces F, along bb and cc.
Assume each small square is one unit.

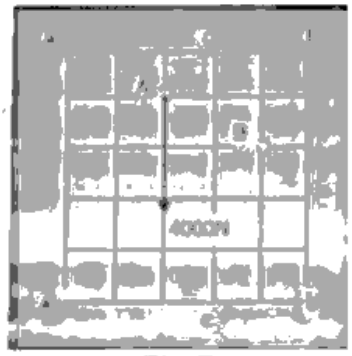


Fig.7

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Total Number of Pages : 04 B.Tech

BE2104

2nd Semester Back Examination 2018-19

MECHANICS

BRANCH : AERO, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, IT, MECH, MME

Time : 3 Hours

Max Marks : 70

Q.CODE : F091

Answer Question No.1 which is compulsory and any FIVE from the rest.

The figures in the right-hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) What is law of transmissibility? State its limitations.

b) What is cone of static friction?

c) State Varignon's theorem.

d) Write the specifications of a force.

e) What is the difference between the moment of a force and moment of a couple?

f) State principle of Virtual work.

g) Resolve a force into another force and a couple.

h) What is the angle to get maximum range for a projectile?

i) Write the laws of friction.

j) Explain what you mean by plane truss.

Q2 a) Two identical rollers, each of weight Q=445N, are supported by an inclined plane and a vertical wall as shown in Fig.1. Assuming smooth surfaces, find the reactions induced at the points of support A, B and C. **(5)**

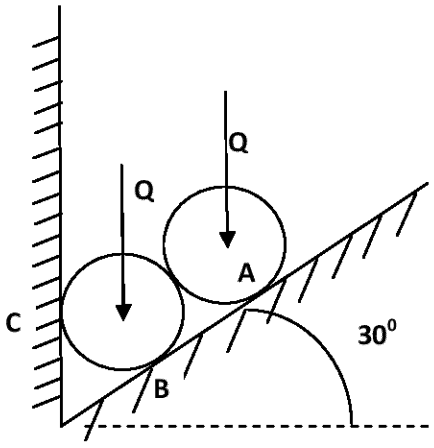

Fig. 1

b) A ball of weight 50N rests in a right-angled trough, as shown in Fig.2. Determine the forces exerted on the sides of the trough at C and D if all surfaces are perfectly smooth **(5)**

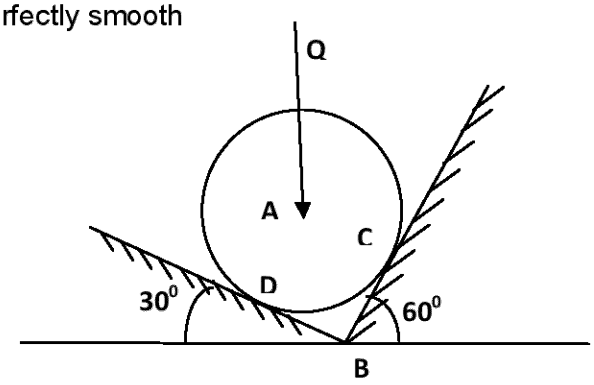

Fig. 2

Q3 **a)** i) Resolve the 4000 N force shown in Fig.3 into two parallel components P and Q acting, respectively, along a-a and b-b. **(5)**

ii) Resolve the same force into parallel components P and Q acting, respectively, along b-b and c-c.

iii) Resolve the same force into a force P at B and a couple.

Assume each small square is one unit.

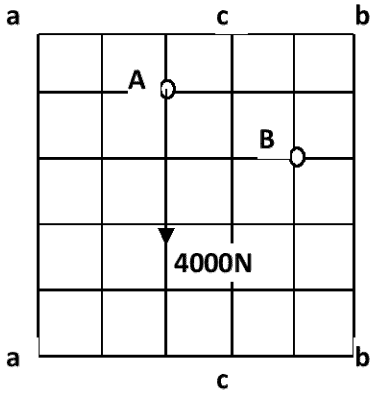

Fig. 3

b) Two beams are arranged as shown in Fig.4. Determine the reaction produced at the support C due to the action of a vertical load P applied to the beam AB as shown. **(5)**

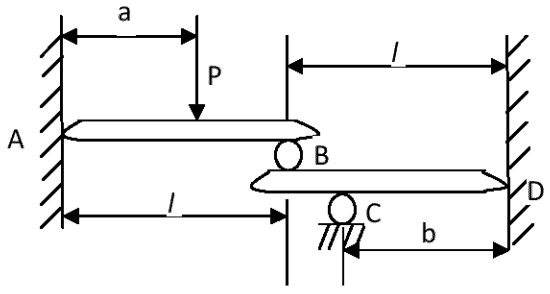

Fig. 4

Q4 **a)** Compute the reactions at the supports A and B of the beam loaded as shown in Fig. 5 if q_a =1500 N/m, and q_b =3000N/m. **(5)**

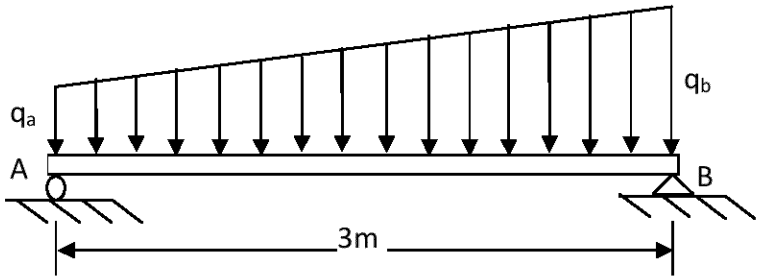

Fig. 5

b) Determine the force *S* in the bar CD of the simple truss supported and loaded as shown in fig.6. The triangle ABC is equilateral. **(5)**

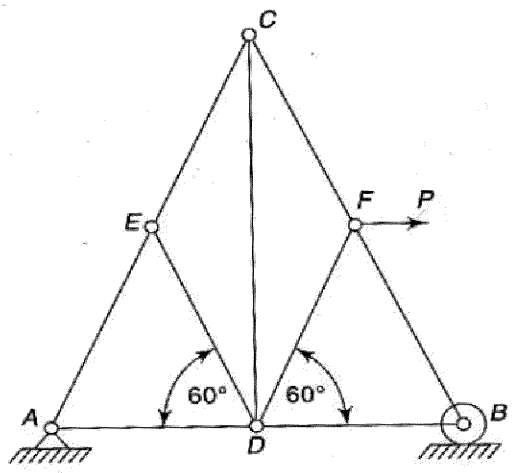

Fig. 6

Q5 **a)** A wood block weighing 50 N rests on a rough horizontal plane, the coefficient of friction between the two being μ=0.4. If a bullet weighing 0.5 N is fired horizontally into the block with muzzle velocity *V*=500m/s, how far will the block be displaced from the initial position? Assume that the bullet remains inside the block. **(5)**

b) Determine the dynamical deflection δ that will be produced at the centre of a simply supported beam by allowing a 17.8 kN weight to drop onto it from a height of 100mm. When gradually applied, the same load produces a static deflection of 2.5 mm. Neglect mass of the beam. **(5)**

Q6 **a)** A stuntman likes to cross the ditch as shown in Fig.7. Find the minimum velocity required at P. Also determine the direction and magnitude of velocity of the stuntman just at the instant of clearing the ditch. **(5)**

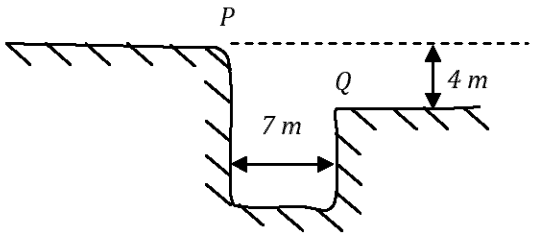

Fig. 7

b) A particle travels with constant speed v along a parabolic path defined by the equation $v = kx^2$, where k is a constant. Find the maximum acceleration of the particle. **(5)**

Q7 **a)** The position of a particle moving in a straight line is defined in the form $x = 5t^2 + 7t + 9$. Where x is in meter and t is in second. Determine it's displacement, velocity and acceleration at time t=0 and t=5 second. **(5)**

b) Neglecting friction and inertia of the two-step pulley shown in Fig.8, find the acceleration a of the falling weight P. Assume P=40N, Q=55N and $r_2=2r_1$. **(5)**

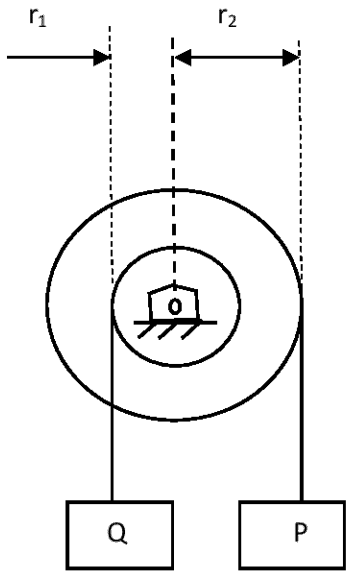

Fig.8

Q8 **a)** State and explain Pappus theorem- I and II using suitable examples. **(5)**

b) Locate the centroid C of the shaded area of circular segment BD shown in Fig. 9 **(5)**

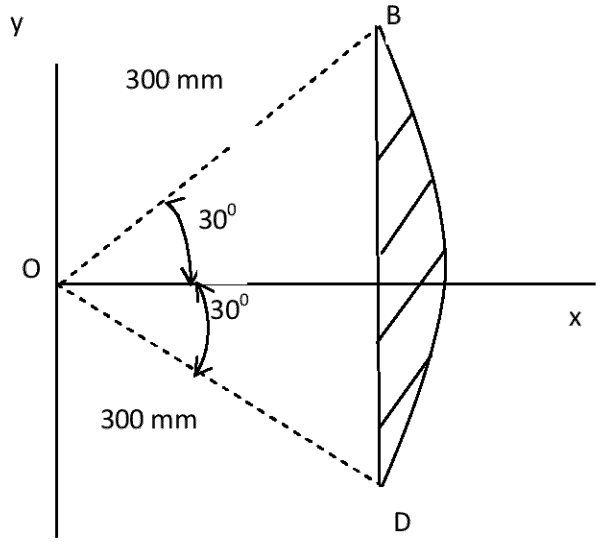

Fig. 9

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Total Number of Pages : 04

B.Tech/
Integrated Dual Degree (B.Tech and M.Tech)
REM2B001

2nd Semester Regular/Back Examination: 2022-23
Engineering Mechanics
AERO, AE, AEIE, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CST, CSEAI, CSEDS, CSE, CSIT, CSEAIME, ELECTRICAL & C.E, EEE, ELECTRICAL, ECE, ETC, EIE, IT, MANUTECH, MECH, MME, METTA, MINERAL, MINING, PLASTIC, ELECTRONICS & C.E

Time : 3 Hour
Max Marks : 100
Q.Code : M310

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

a) State Lami's theorem.
b) Find the resultant of two forces equal to 50 N and 30 N acting at an angle of 60°.
c) State the Varignon's principle of moments.
d) What is a couple? What is the arm of a couple and its moment ?
e) What is a free-body diagram?
f) Define coefficient of friction and limiting friction.
g) State the perpendicular axis theorem.
h) What do you understand by perfect truss, deficient truss and redundant truss structure?
i) State D' Alembert's Principle.
j) A body is moving with a velocity of 3 m/s. After five seconds the velocity of the body becomes 13 m/s. Find the acceleration of the body.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 × 8)

a) Define and explain the following terms:
   (i) Coplanar and non-coplanar forces
   (ii) Collinear and concurrent forces
   (iii) Parallel and non-parallel forces.
b) A uniform plank ABC of weight 30 N and 2 m long is supported at one end A and at a point B 1.4 m from A as shown in Fig 1. Find the maximum weight W, that can be placed at C, so that the plank does not topple.

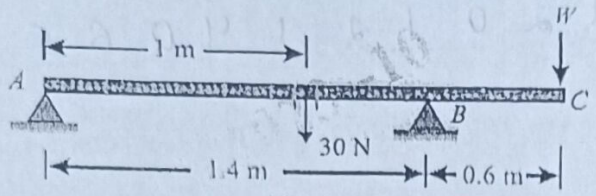

Fig. 1

c) Two identical rollers P and Q, each of weight W, are supported by an inclined plane and a vertical wall as shown in Fig. 2. Assume all the surfaces to be smooth. Draw the free body diagrams of:
(i) roller Q, (ii) roller P and (iii) rollers P and Q taken together.

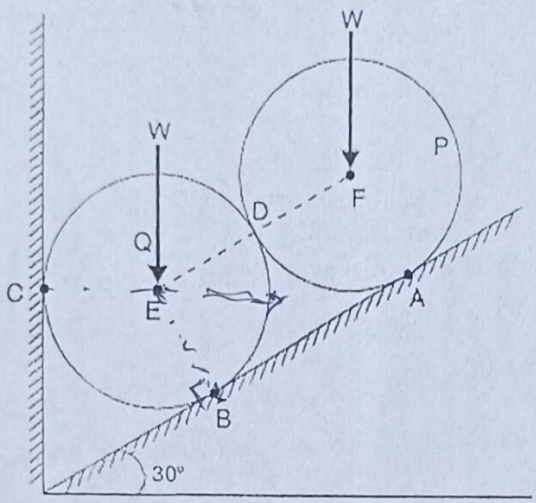

Fig. 2

d) The force required to pull a body of weight 40 N on a rough horizontal plane is 15 N. Determine the co-efficient of friction if the force is applied at an angle of 20° with the horizontal.

e) Consider the triangle ABC of base 'b' and height 'h'. Determine the distance of centroid from the base.

f) Find the centroid of a 100 mm × 150 mm × 30 mm T-section as shown in Fig. 3.

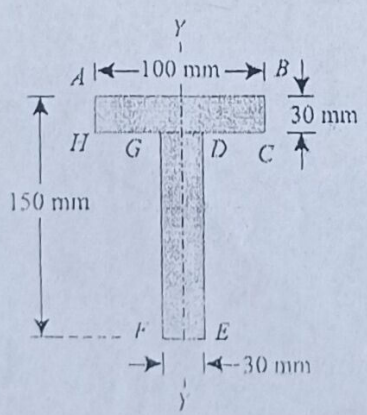

Fig. 3

g) Find the moment of inertia of a rectangular section 60 mm wide and 40 mm deep about its centre of gravity.

h) State and prove the theorem of parallel axis.

i) State the principle of virtual work. Explain the application of the principle of virtual work in case of lifting machines.

j) The equation of motion of a particle moving in a straight line is given by

$$s = 18t + 3t^2 - 2t^3$$

where s is the total distance covered from the starting point is metres at the end of t seconds. Find:
(i) the time, when the particle reaches its maximum velocity
(ii) the maximum velocity of the particle.

k) A particle is thrown with a velocity of 5 m/s at an elevation of 60° to the horizontal. Find the velocity of another particle thrown at an elevation of 45° which will have (a) equal horizontal range, and (b) equal maximum height.

l) A body of mass 50 kg, moving with a velocity of 6 m/s, collides directly with a stationary body of mass 30 kg. If the two bodies become coupled so that they move on together after the impact, what is their common velocity.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two smooth spheres of weight 'W' and radius 'r' each are in equilibrium in a horizontal channel of 'A' and 'B' vertical sides as shown in Fig. 4. Find the force exerted by each sphere on the other. Calculate these values, if r = 250 mm, b = 900 mm and W = 100 N. (16)

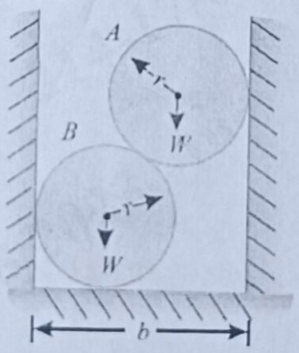

Fig. 4

Q4 Find the reactions and forces in the members of the truss as shown in Fig. 5. (16)

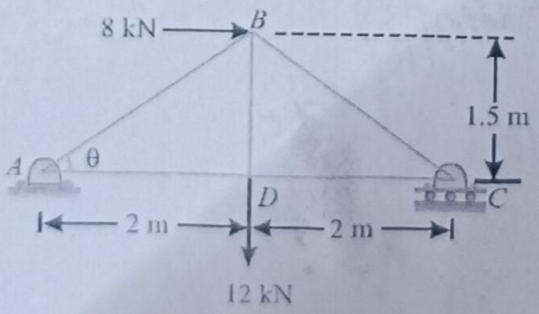

Fig. 5

Q5 Two smooth inclined planes whose inclinations with the horizontal are 30° and 20° are placed back to back. Two bodies of mass 10 kg and 6 kg are placed on them and are connected by a light inextensible string passing over a smooth pulley as shown in Fig 6. Find the tension in the string. Take g = 9.8 m/s². (16)

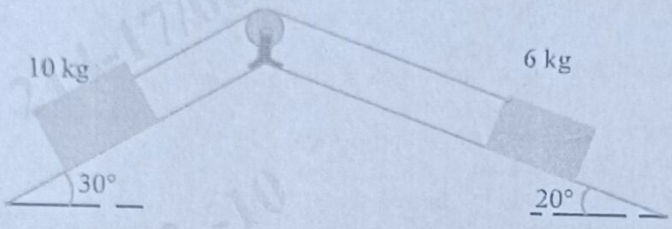

Fig. 6

Q6 A body weighing 196.2 N slides up a 30° inclined plane under the action of an applied force 300 N acting parallel to the inclined plane. The co-efficient of friction, μ is equal to 0.2. The body moves from rest. (16)

Determine:

(i) acceleration of the body,

(ii) work done on the body in four seconds,

(iii) momentum of the body after four seconds,

(iv) impulse applied in four seconds.