Roll No. _____ [Total No. of Pages : 4

B. Tech. Ist Semester (Main) Examination Feb.- 2010

Engineering Mechanics

(Common to all Branches of Engineering)

1E1025

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **Five** questions selecting **one** question from each unit. All questions carry **equal** marks. Any missing data may be suitably assumed and stated.*

Unit - I

1. a) What is a free body diagram? Discuss various steps involved in drawing such diagram. **(6)**

   b) Determine the resultant of the co-planar system of concurrent forces as shown in Fig.1. **(10)**

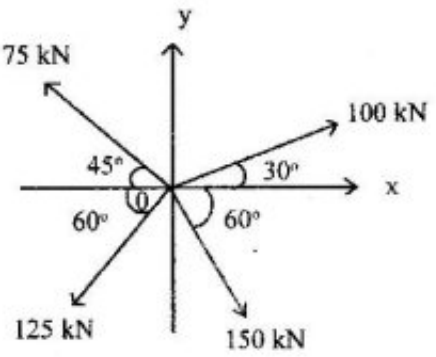


Fig. 1

OR

a) State and prove varigon's theorem. **(6)**

b) Determine the forces in all the members of a cantilever truss shown in Fig. 2. **(10)**

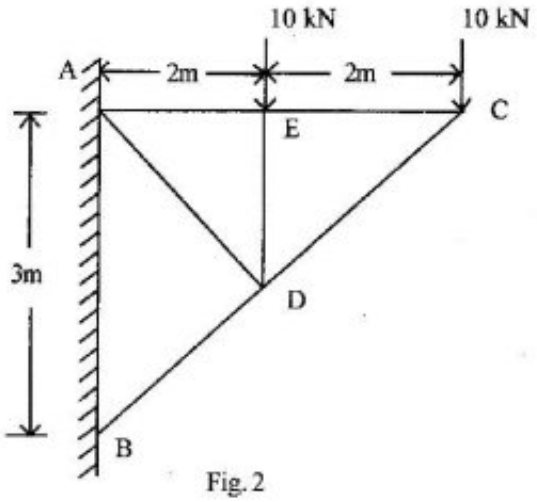


Fig. 2

Unit - II

2. a) Differentiate between angle of friction and angle of repose. **(6)**

b) A ladder of weight 390 N and 6m long is placed against a vertical wall at an angle of 30° with wall. The co-efficient of friction between the ladder and the wall is 0.25 and that between ladder and floor is 0.38. Find how high a man of weight 1170N can ascend, before the ladder begins to slip. **(10)**

OR

a) State the principle of virtual work. **(6)**

b) Two beams AC and CD are hinged at C and are supports by rollers at A and D. A hinge support is provided at B as shown in Fig. 3. Using principle of virtual work, determine the reactions at the hinge C and at support B, when a load of 600 N is acting at point E. **(10)**

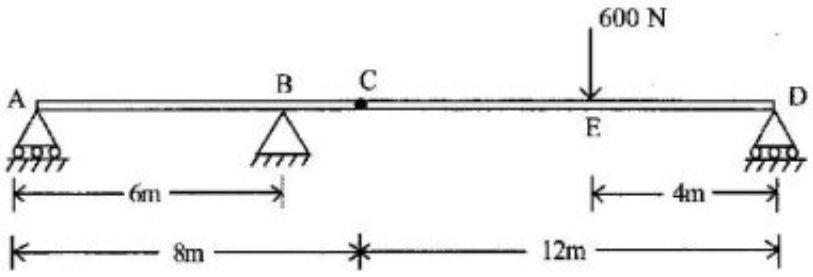


Fig. 3

Unit - III

3. Find the moment of inertia of the section shown in Fig. 4 about centroidal X-X and Y-Y axes. **(16)**

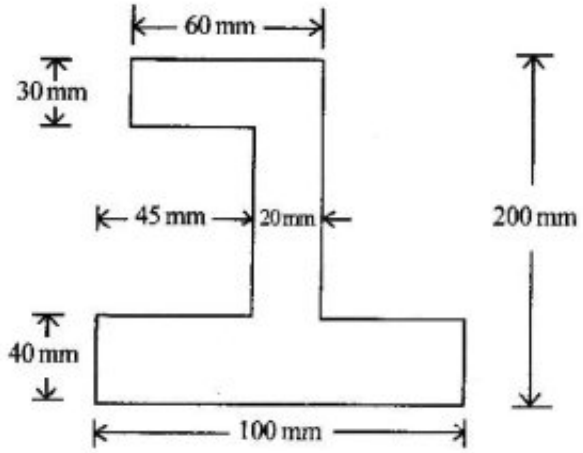


Fig. 4

OR

a) Differentiate between a reversible machine and a self locking machine. **(6)**

b) An open belt drive connects two pulleys 90 cm and 60 cm diameter mounted on two parallel shafts 3 m apart. The maximum belt tension is 2000 N. The co-efficient of friction is 0.3. The driving pulley of diameter 90cm runs at 300 rpm. Find the power transmitted, torque acting on each shaft, and initial tension in the drive. **(10)**

Unit - IV

4. a) A body falling freely under the action of gravity passes two points 20m apart vertically in 0.4 seconds. From what height, above the higher point, did the body start to fall? Take $g = 9.8 m/s^2$. **(8)**

b) A particle is projected from a point on an inclined plane with a velocity of 30 m/sec. The angle of projection and the angle of plane are 55° and 20° to the horizontal respectively. Show that the range up the plane is the maximum for the given plane. Find this range and the time of flight. **(8)**

OR

a) State D'Alembert's principle giving equations expressing the above principle for a rigid body in plane motion. **(6)**

b) Two blocks of weight 800N and 200N are connected by a string and move along a rough horizontal surface under the action of a force 400N applied to the first weight of 800N in horizontal direction. The co-efficient of friction between the sliding surfaces of the blocks and the plane is 0.3. Determine the acceleration of the system of blocks and the tension in the string using D'Alembert's principle. **(10)**

Unit - V

5. a) State and prove the law of conservation of energy. **(4)**

b) Find the work done in drawing a body of weight 500 N through a distance of 5 m along a horizontal surface by a force of 200 N, whose line of action makes an angle of 30° with the horizontal. **(4)**

c) A block of weight 12 N falls at a distance of 0.75m on top of the spring. Determine the spring constant if it is compressed by 150 mm to bring the weight momentarily to rest. **(8)**

OR

a) State the Impulse - Momentum relation. **(4)**

b) A ball of 2 kg is thrown straight up into the air with an initial velocity of 15m/sec. Calculate the time of flight of the ball using impulse momentum theorem. **(6)**

c) Define undamped vibrations. Write the equation for undamped free vibrations. **(6)**

1E1025

Roll No. : _____ Total Printed Pages : 4

1E1025

B. Tech. (Sem. I) (Main/Back) Examination, January/February - 2011
Engineering Mechanics
(Common to All Branches of Engg.)

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

Attempt overall five questions. All questions carry equal marks.
Any missing data may be suitably assumed and stated.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Nil 2. Nil

1 (a) State Varignon's theorem of moment. 4

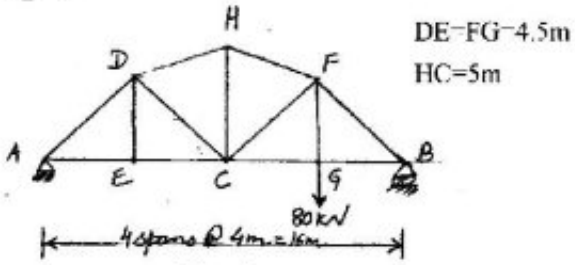
(b) Three forces, P, Q and R act along sides BC, AC and BA of an equilateral triangle ABC. If their resultant force is parallel to BC and passing through centroid of the triangle, prove that

$Q = R = P/2$ 12

OR

1 (a) Define equilibrium. State the conditions of equilibrium. 4

(b) Find the forces in the members EC, DC and DH of the truss shown in **Fig. 1**



12

Fig. 1

2 (a) Define angle of friction and angle of repose. 4

(b) Determine the horizontal force 'P' applied on wedge 'B' to raise block 'A' of weight 4500 N. The coefficient of friction may be taken as 0.2 on all surfaces. **(Fig. 2)**

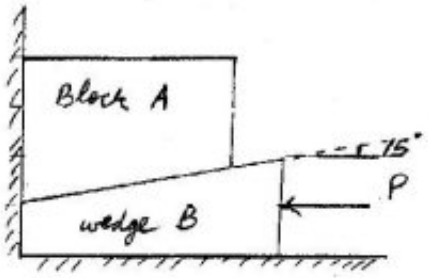


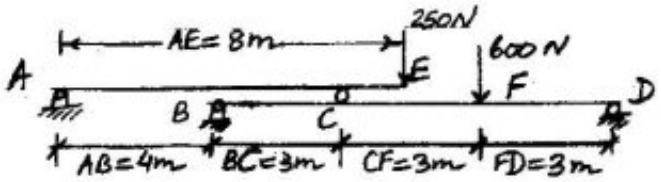
Fig. 2

12

OR

2 (a) Explain the principle of virtual work. 4

(b) Two beams AE and BD are supported by roller B and C as shown in figure 3. Determine the reactions at points B and D using the method of virtual work.



12

Fig. 3

3 (a) A differential wheel and axle system raised a load of 60 N by an effort of 6N. If the efficiency at this load is 80%, find the velocity ratio of the machine. If the diameter of effort wheel is 300 mm, determine the diameter of each axle. The sum of the diameters of axle is 280 mm. 8

(b) Two parallel shafts whose centre lines are 4.8 m apart are connected by an open belt drive. The diameter of larger pulley is 1.5 m and that of smaller pulley is 1 m. The initial tension in the belt is 3.0 kN when stationary. The coefficient of friction between the belt and pulley is 0.3. If the smaller pulley rotates at 400 rpm, determine the power transmitted. 8

OR

3 (a) A circular hole of diameter 15 cm is cut from a rectangular section of size 20 cm × 30 cm as shown in **Fig. 4.** Find the moment of inertia of this section about a horizontal x'-x' axis passing through its centroid.

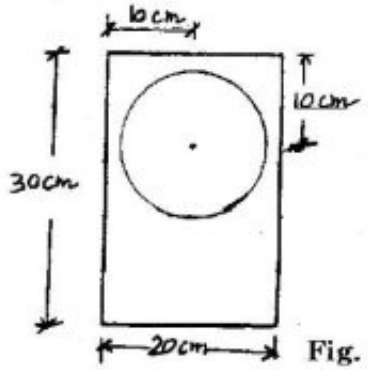


Fig. 4

8

(b) The boundary of an elliptical lamina is represented by

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

Determine the moment of inertia of this lamina about the minor axis.

8

4 (a) Explain the difference between rectilinear and plain curvilinear motion.
A particle moves with curvilinear motion has coordinates

$$x = 2t^2 - 4t$$

and $$y = 3t^2 - \frac{t^3}{3}$$

Determine the magnitudes of the velocity V and acceleration a at time t = 2 sec.

8

(b) A balloon weighing 'W' newton descends with an acceleration of 'α'. If weight w is removed from the balloon, the balloon has upward acceleration of 'α'. Show that

$$w = \frac{2\alpha W}{\alpha + g}$$

where g is acceleration due to gravity.

8

OR

4 (a) Define the terms 'Trajectory' and 'Range' for projectile motion. A particle during its projectile motion reaches height h in time t_1. Again it reaches this height 'h' in time t_2 meausred from start. Show that the height of point 'h' is $\frac{1}{2} g t_1 t_2$.

8

(b) Two blocks of mass 20 kg and 10 kg are connected by a light string as shown in **Fig 5.** The coefficient of friction between surface and both block is 0.2. Determine the acceleration of system.

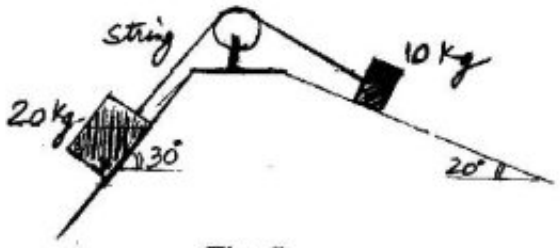


Fig 5

8

5 (a) Define undamped free vibration.
Determine the natural frequency of simple pendulum shown in **Fig 6.** Neglect the mass of the rod. The mass of pendulum is m and length of the rod is l.

Fig. 6

8

(b) Three perfectly elastic balls A, B and C of masses 1 kg, 2 kg and 4 kg move in the same direction with velocity 8 m/sec, 2 m/sec and 1.5 m/sec respectively. A impinges on B and B impinges on C. Prove that A and B will come to rest after the impacts. What will be the velocity of C after impact?

8

OR

5 (a) State Work-Energy Theorem.
A ball of mass 2 kg, is dropped from a height of 20 cm on a spring of stiffness k = 1225 N/m. Find the maximum deflection of the spring.

8

(b) A ball of mass 3 kg moving with a velocity of 3 m/s has an indirect collision with a ball of equal mass moving with a velocity of 4.5 m/s. The velocity of first ball and second ball make an angle of 30° and 60° with the line of impact respectively. If coefficient of restitution is 0.9, find the magnitudes and directions of final velocities of two balls.

8

1E1025

Roll No. _____ [Total No. of Pages : 4

1E1025

B.Tech. I - Sem.(Main/Back) Exam - Jan-Feb. 2012
105 – Engineering Mechanics

(Common to all Branches of Engg.)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt **any five questions** selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

UNIT - I

Q1. (a) Four forces of magnitude P, 2P, $3\sqrt{3}$P and 4P are acting at a point O. The angles made by these forces with x-axis are 0^o, 60^o, 150^o and 300^o respectively. Find the magnitude and direction of the resultant force. 6

(b) Determine the forces in all the members of a cantilever truss as shown in fig. 1. 10

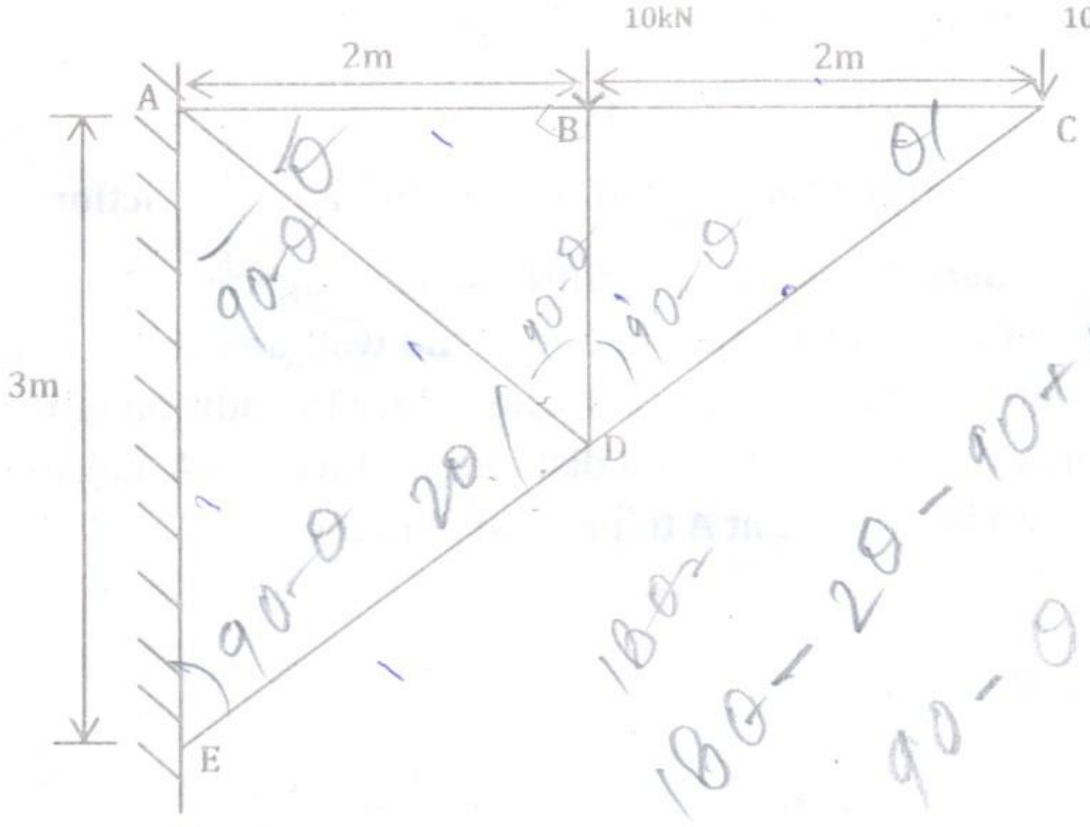


Fig. 1

1E1025

OR

Q1 (a) The resultant of two forces P and Q acting at a point is R, If Q is doubled, the force R also gets doubled and if Q is reversed, R is again doubled. Show that the ratio of P, Q and R is given by 8

$$P: Q: R = \sqrt{2}: \sqrt{3}: \sqrt{2}$$

(b) Four forces of magnitude 20 N, 30 N, 40 N and 50N are acting respectively along the four sides of a square taken in order. Determine the magnitude, direction and position of the resultant force. 8

UNIT - II

Q2. (a) Explain the principal of virtual work. 4

(b) A simply supported beam is loaded as shown in fig. 2. Using the method of virtual work determine the reactions at the supports A and B. 8

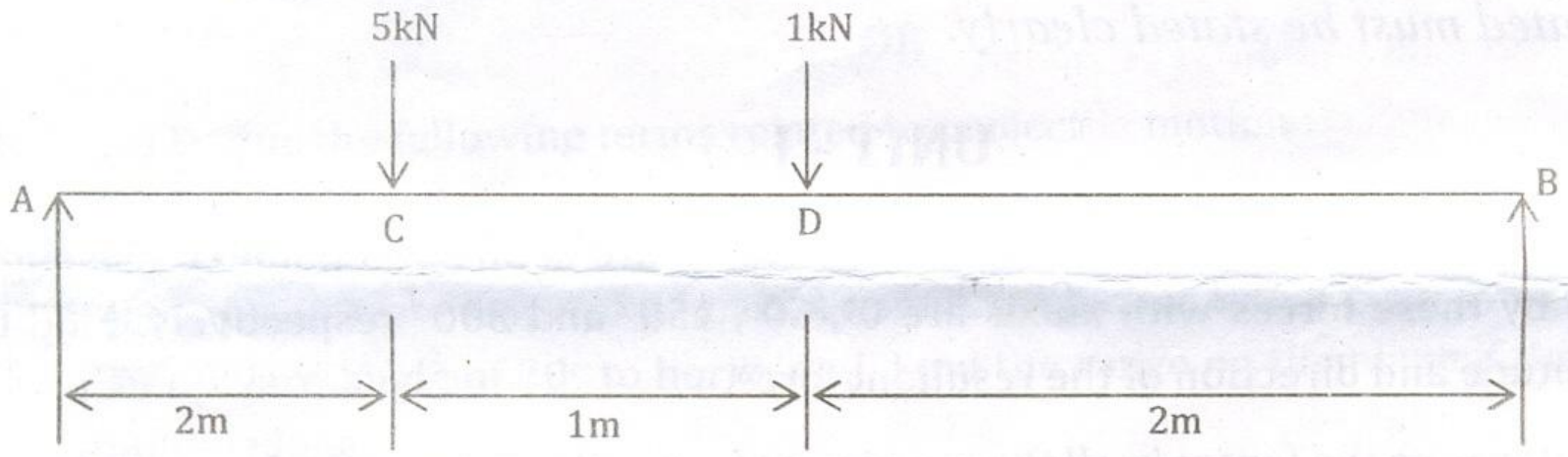


Fig – 2

(c) Define angle of repose and cone of friction. 4

OR

Q2. (A) Define the terms (i) co –efficient of friction (ii) angle of friction. 6

(b) A ladder of length 4m weighing 200N is placed against a vertical wall as shown in fig.3. The co-efficient of friction between the wall and the ladder is 0.2 and that between the floor and the ladder is 0.3. The ladder in addition to its own weight has to support a man weighing 600N at a distance of 3m from A. Calculate the minimum horizontal force to be applied at A to prevent slipping. 10

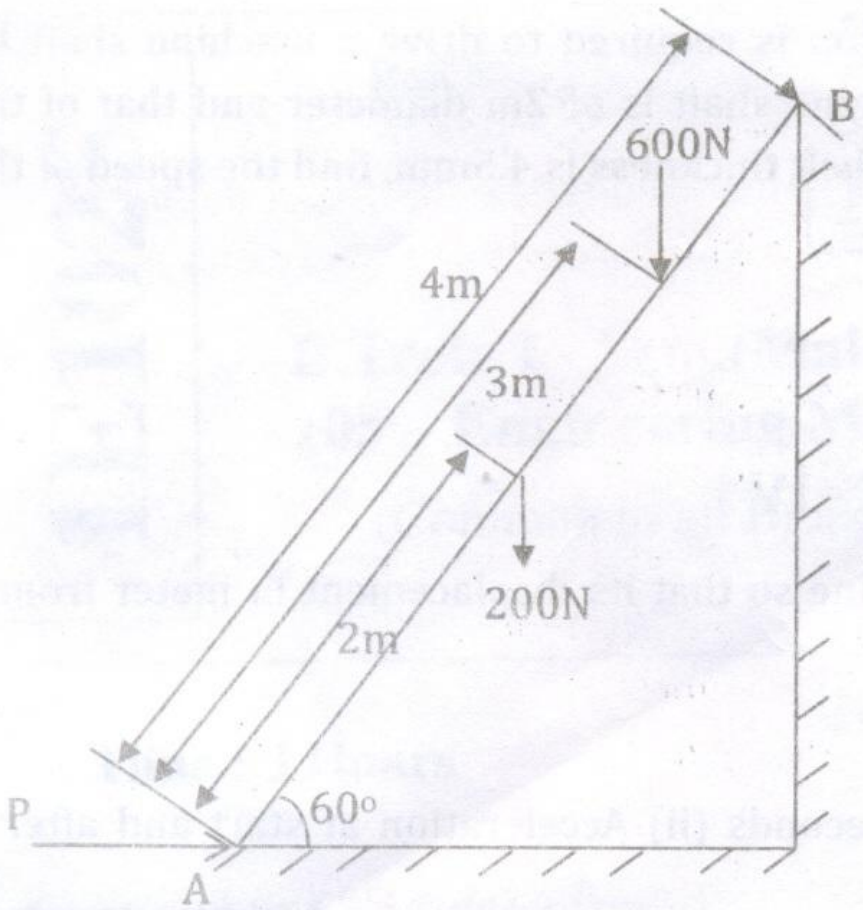


Fig. 3

UNIT - III

Q3. Determine the moment of inertia of a T- Section as shown in Fig.4 about the horizontal and vertical axes passing through the centroid of the section. 16

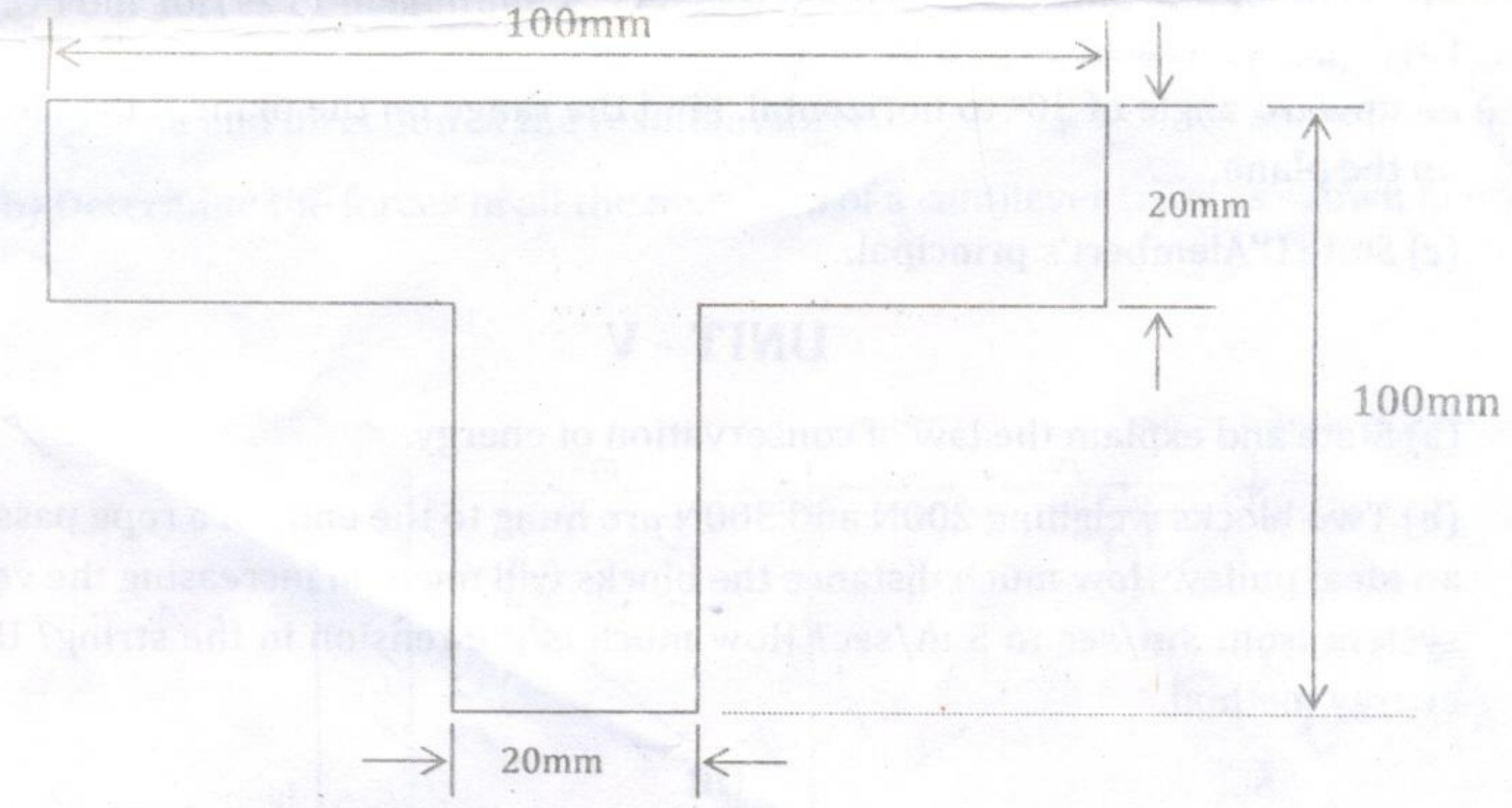


Fig. 4

OR

Q3. (a) Explain the difference between a reversible machine and a self locking machine. The efficiency of a machine is 80% when an effort of 15N is required to lift a load of 130N. Calculate the velocity ratio and the frictional force of the machine in terms of effort and load. 8

(b) An engine shaft running at 250 rpm is required to drive a machine shaft by means of a belt. The pulley on the engine shaft is of 2m diameter and that of the machine shaft is of 1m diameter. If the belt thickness is 4.5mm, find the speed of the belt when :

(i) there is no slip

(ii) there is a slip of 4 % 8

UNIT - IV

Q4 (a) A particle moves along a straight line so that its displacement in meter from a fixed point is given by

$$S = t^3+3t^2+4t+5$$

Find (i) velocity at start and after 4 seconds (ii) Acceleration at start and after 4 seconds . 8

(b) A ball is dropped from the top of a tower 30m high. At the same instant a second ball is thrown upward from the ground with an initial velocity of 15m/sec. When and where do they cross and with what relative velocity? 8

OR

Q4. (a) Define the following terms related to projectile motion :

(i) Range (ii) Height and (iii) Time of flight 6

(b) A plane has a slope of 5 in 12. A shot is projected with a velocity of 200 m/sec at an upward angle of 30° to horizontal. Find the range on the plane if the shot is fired up the plane. 8

(c) State D'Alembert's principal. 2

UNIT - V

Q5. (a) State and explain the law of conservation of energy. 8

(b) Two blocks weighing 200N and 300N are hung to the ends of a rope passing over an ideal pulley. How much distance the blocks will move in increasing the velocity of system from 3m/sec to 5 m/sec? How much is the tension in the string? Use work energy method. 8

OR

Q5. (a) Define undamped free vibrations. Drive the expression for this vibration of a single degree freedom system. 8

(b) A steel ball of 0.5N falls from a height of 8m and rebounds to a height of 6m. Find the impulse and the average force between the ball and the floor if the contact between the ball and the floor lasts for $1/10^{th}$ of a second. 8

2E2005

Roll No. _____ [Total No. of Pages : 4

2E2005

B.Tech. I Year II Semester (Main) Examination-2013

205 Engineering Mechanics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from each unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

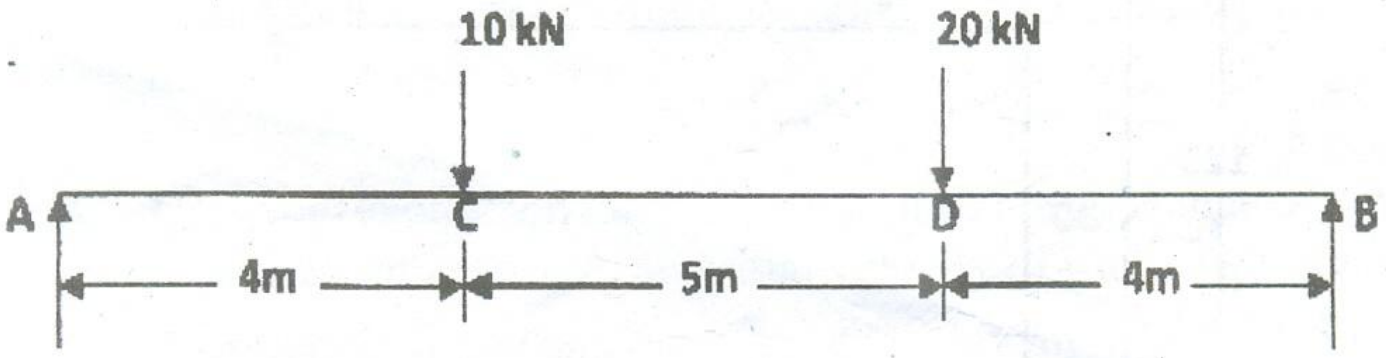
UNIT - I

1. a) State and prove parallelogram of forces. **(6)**

   b) Find the magnitude of two forces such that if they act at right angles, their resultant is $\sqrt{10}$ kN and when they act at an angle of 60°, their resultant is $\sqrt{13}$ kN. **(10)**

OR

1. a) By the principle of virtual work, find the values of reactions at A and B. **(6)**



b) The following forces act at a point: **(10)**

i) 20 N inclined at 30° towards North of East.

ii) 25N towards North.

iii) 30 N towards north west

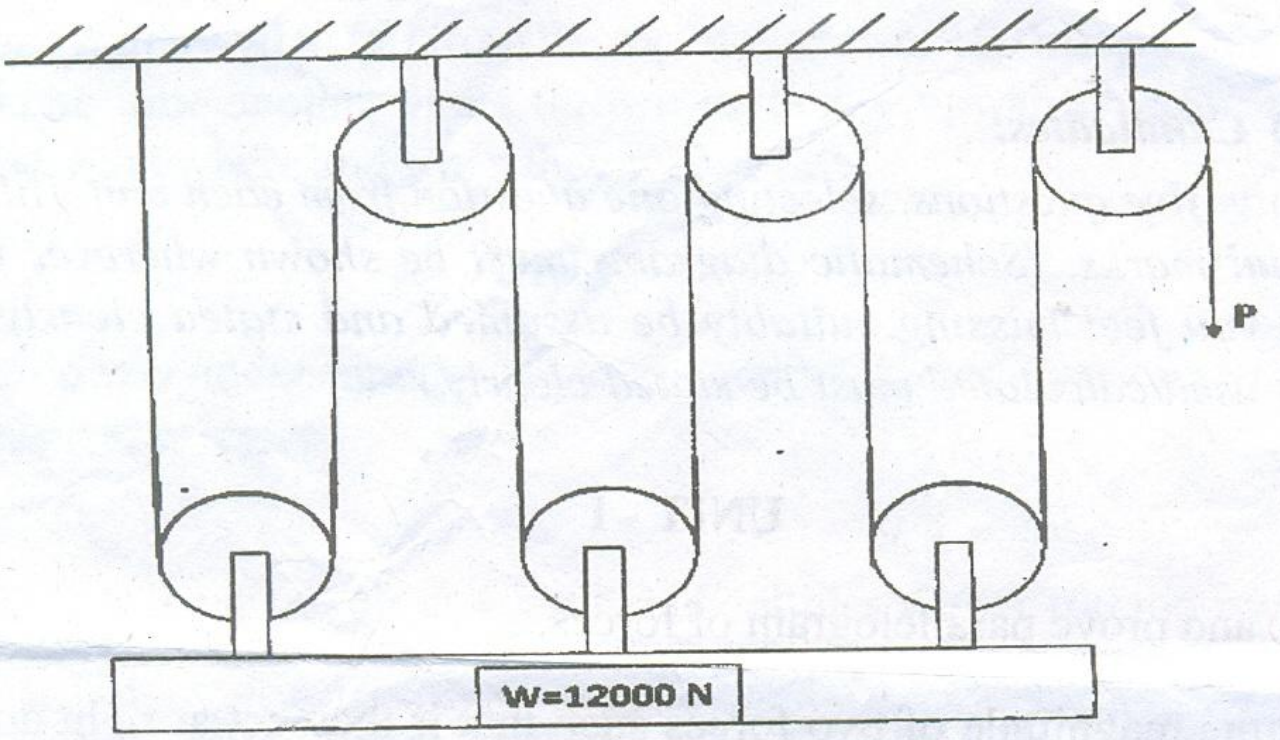
iv) 35 N inclined at 45° towards south of west.

Find the magnitude and direction of the resultant force

UNIT - II

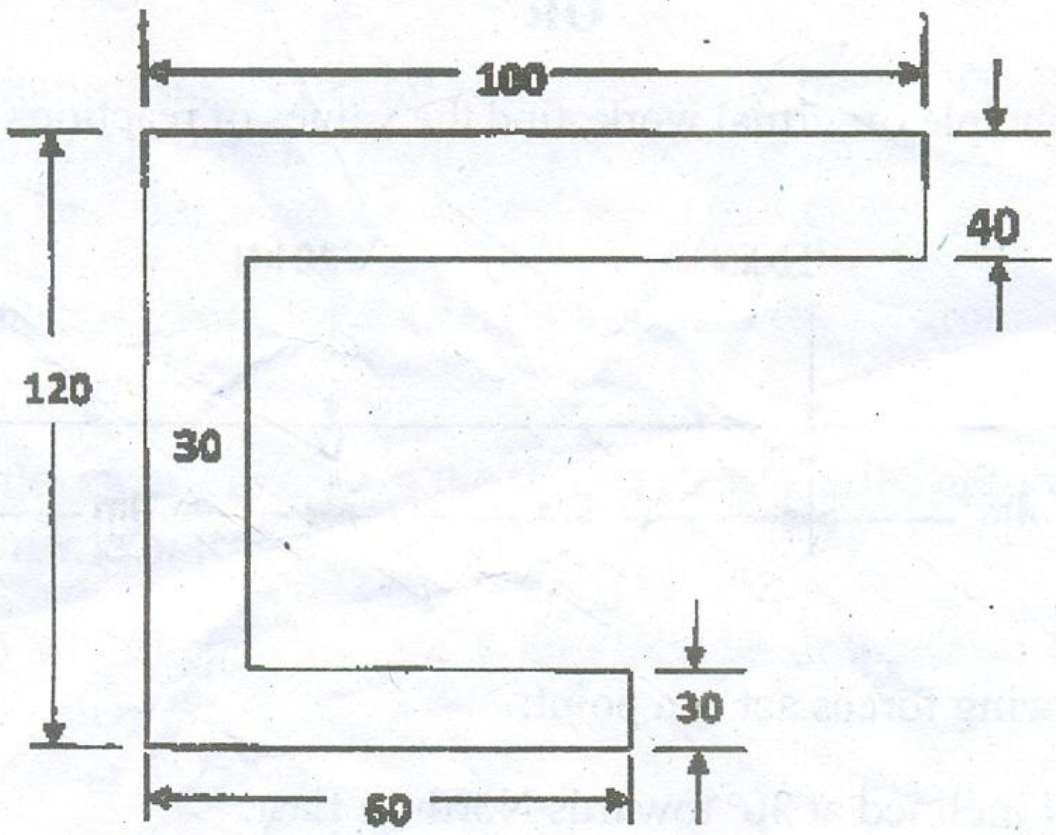
2. a) Draw neat sketch of first system of pulleys and obtain expression of mechanical advantage, velocity ratio and efficiency. **(6)**

b) What force is required to raise the load W shown in figure? Assume efficiency of the system to be 85%. **(10)**



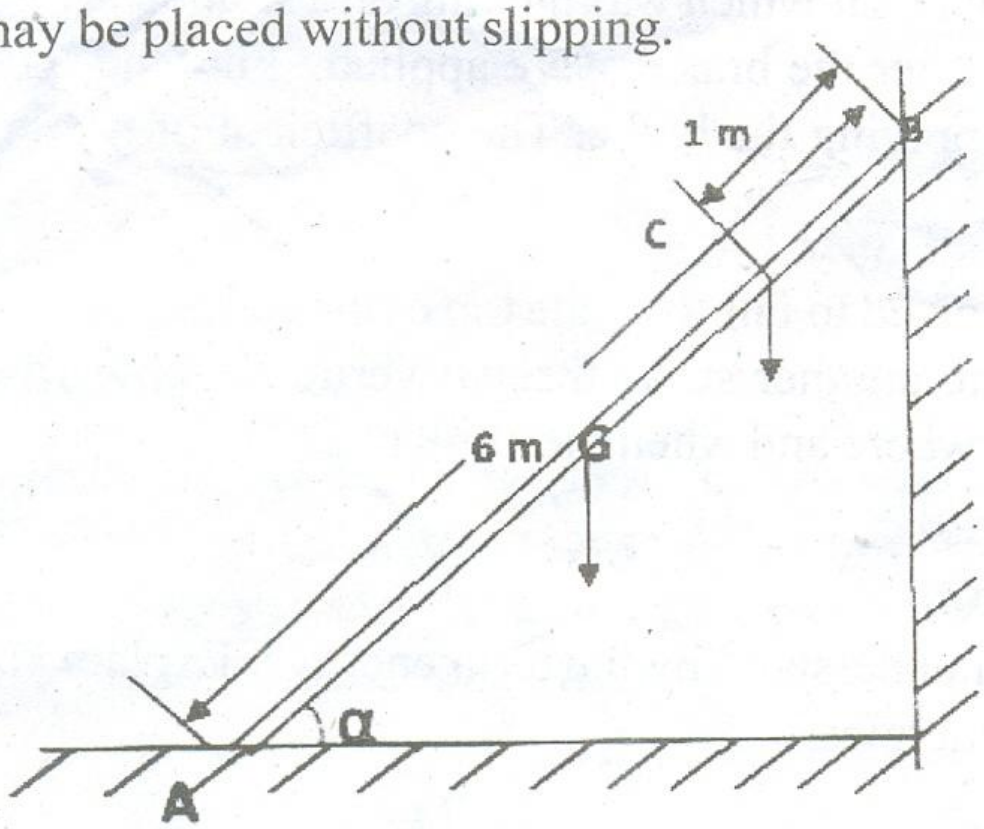
OR

2. Find the moment of inertia of the following fig. about XX and YY axis. **(16)**



UNIT - III

3. a) The ladder shown in fig. is 6m long and is supported by a horizontal floor and vertical wall. The coefficient of friction between the floor and the ladder is 0.25 and between wall and ladder is 0.4. The weight of the ladder is 200 N and act at about CG. The ladder also supports a vertical load of 900 N at C which is at a distance of 1m from B. Determine the least value of α at which the ladder may be placed without slipping. **(10)**



b) Explain different types of friction. State different laws of static and dynamic friction **(6)**

OR

3. a) Derive the expression for belt length for open belt drive. **(6)**

b) In an open belt drive the sum of the diameters of two pulleys is 60 cm. They are running at 1500 and 3000 rpm. Determine the diameter of each pulley assuming the total slip of the system is 5%. The pulley running at 1500 rpm is the driver pulley. **(10)**

UNIT - IV

4. a) Derive an expression for the maximum height and range of a projectile traversed by a stone thrown with an initial velocity of u and an inclination of θ. **(6)**

b) A projectile fired from the edge of a 150m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find:

i) The greatest elevation above the ground reached by the projectile:

ii) Horizontal distance from the gun to the point, where the projectile strikes the ground. **(10)**

OR

4. a) In an accident of car which was moving on a straight level road, it had skidded in 50 meters after the brakes were applied. Find the speed of the car just at the time of applying the brake. The coefficient of friction between tyre and road is 0.5. **(6)**

b) A stone is allowed to fall from the top of the tower 100 meters in height and at the same time another stone thrown vertically upwards with a velocity of 25 m/s. Find where and when they will meet? **(10)**

UNIT - V

5. a) What do you understand by the term energy? Explain various forms of mechanical energies. **(6)**

b) A 40 ton rail car travels at 4 km/h and collides with a 100 ton wagon on the same track, moving in the opposite direction at 1.2 km/h. Find their velocities immediately after impact assuming no loss of energy. What is the impulse between them? **(10)**

OR

5. a) A body weighing 600 N lies on a smooth incline plane. The plane is inclined at an angle of 45° with horizontal. The body is pulled up the plane and the distance of 5m. Calculate the work done in pulling the body. **(6)**

b) A 4 kg stone is dropped from a height *h* and strikes the ground with a velocity of 25 m/s.

i) Find the kinetic energy of the stone as it strikes the ground and the height *h* from which it was dropped.

ii) From what height must a 1 kg stone be dropped so it has the same kinetic energy? **(10)**

2E2005

2E2005 paper

B.Tech. (Sem.II) (Main/Back) Examination - 2014

205 Engineering Mechanics

[Total Marks : 80]

[Min. Passing Marks : 24]

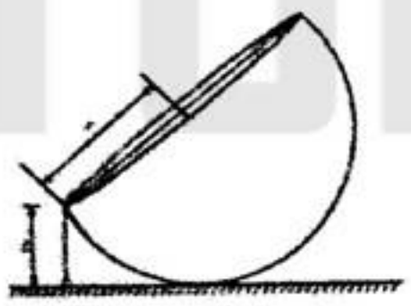
[Time : 3 Hours]

Instructions to Candidates :
Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Unit - I

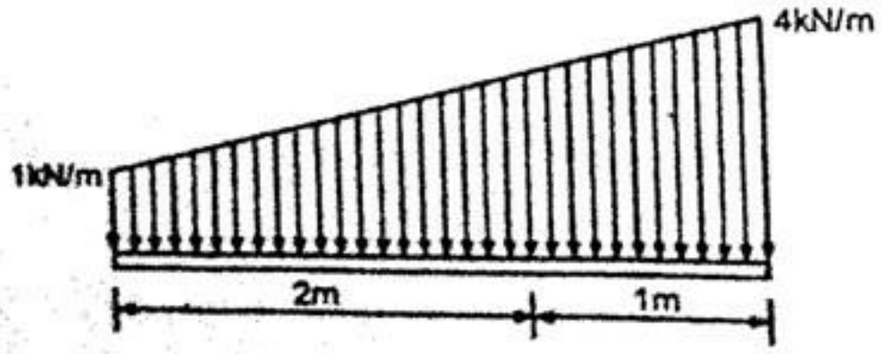
1. (a) State and prove Lami's theorem. What are the limitations of Lami's theorem to find out resultant of forces. (4+2)

(b) A hemisphere of radius 'r' and weight 'W' is placed with its curved surface on smooth table and a string of length $l(<r)$ is attached to a point on its rim and to a point on table as shown in figure. Prove that tension in string $T = \frac{3W}{8} \times \frac{r-l}{\sqrt{2rl-l^2}}$. (10)

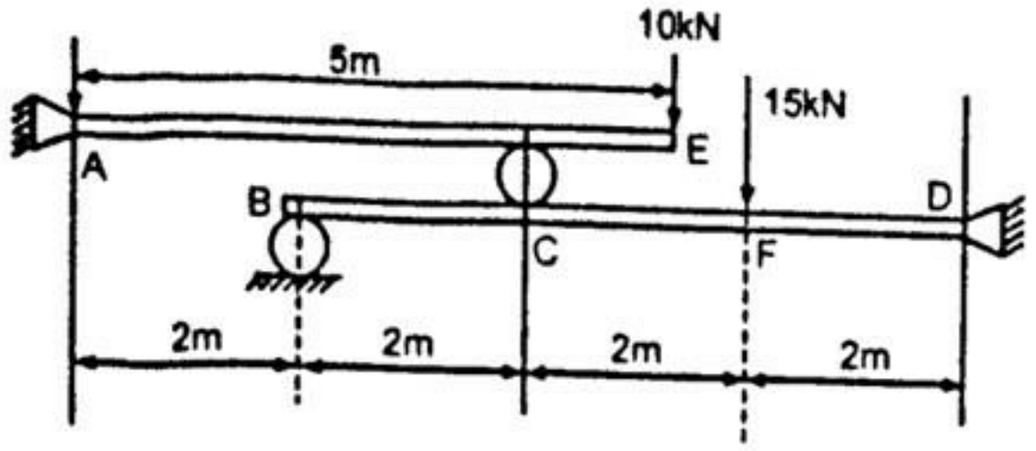


OR

1. (a) Determine reaction at beam support for given leading conditions.



(b) Determine reaction value at the roller support B and C using virtual work method.

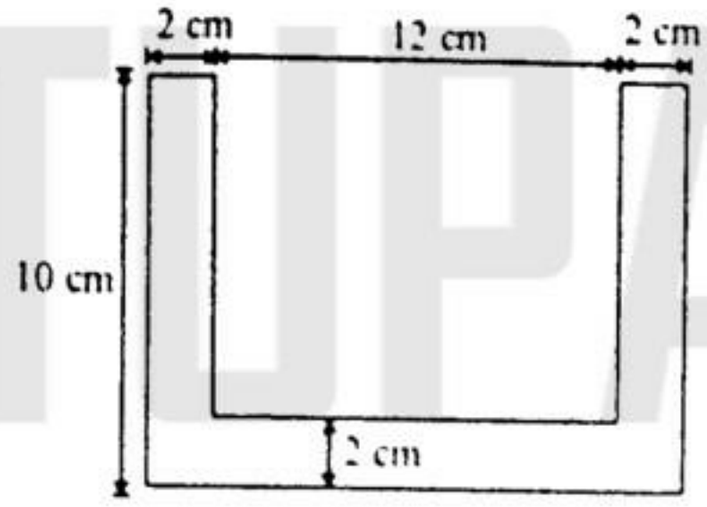


(8)

Unit - II

2. (a) State following theorems concerning moment of inertia for a plane area:
   (i) Parallel axes theorem
   (ii) Perpendicular axes theorem (2+2)

   (b) Find area moment of inertia of section shown in figure, about x-axis and y-axis passing through centroid of the section.



(12)

OR

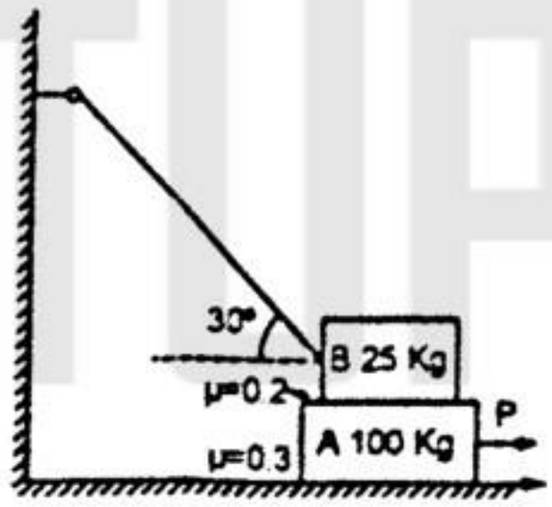
2. (a) How does the mechanical advantage and efficiency varies with load? (6)

   (b) A single purchase winch crab has the following particulars :
   Number of teeth on pinion = 16
   Number of teeth on spur wheel = 96
   Length of lever arm = 70 cm
   Diameter of load drum = 20 cm
   It is observed that an effort of 60 N lifts a load of 1800 N and an effort of 120N lifts load of 3960N.
   (i) Find efficiency in two cases (5)
   (ii) Determine loss of load and loss of effort in two cases. (5)

Unit - III

3. (a) A ladder of mass 35 Kg and length 10 m rest against a vertical wall and it is inclined at 60° to horizontal. The coefficient of friction for all surfaces is 0.25. How far up the ladder can a 72 kg person climb before the ladder begins to slip. (8)

   (b) Block A of mass 100 kg rests on horizontal surface and supports another Block B of mass 25 kg on top of it. Block B is attached to a vertical wall by on inclined string as shown in figure. Determine force P applied to lower block that will necessary to cause slipping to impend.



(8)

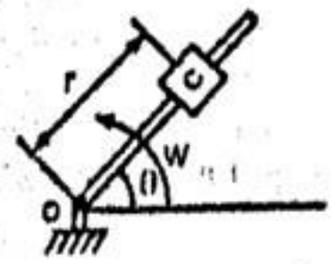
OR

3. (a) Drive expression for length of belt of a cross belt drive. (8)

   (b) Two pulleys of diameter 0.6 m and 0.3 m connected by cross belt drive are 3.5 m apart. Power transmitted is 5 KW. The permissible load on belt is 2.5 N/mm width of belt, larger pulleys make 220 rpm, thickness of belt is 5 mm, and coefficient of friction between belt and pulley is 0.35. Determine.
   (i) Length of belt (2)
   (ii) Width of belt (4)
   (iii) Initial tension in belt (2)

Unit - IV

4. (a) The motion of slider c is defined by the relation $r = 3t - t^2$ and $\theta = 2t$, where r is in meters and t is in seconds and θ in radians. Determine radial and transverse component of acceleration at t = 2 sec. (8)

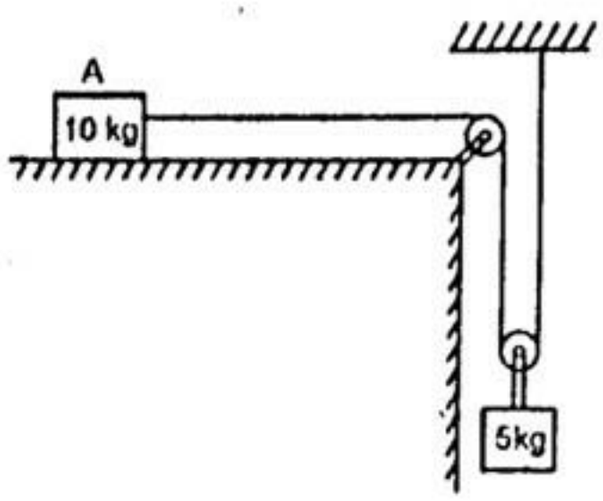


(b) Two vehicles are moving towards each other with velocities 20 m/sec and 15 m/sec. when distance between them is 150 m. Drivers of both vehicles apply their brake. In this condition they were able to just avoid accident. Assuming constant retardation in each case, find out :
(i) Retardation of each vehicle. (3)
(ii) Time required to stopvehicles (3)
(iii) Distance travelled by each vehicle while slowing down. (2)

OR

4. (a) A bird is sitting on tree of 9.57 m height. A hunter throws a stone towards bird but just before being hit by stone bird flies horizontally with 7.35 m/sec velocity. But stone hit the bird during downward motion after rising 4.9 m higher that level. Determine projection velocity. (8)

(b) A pulley, string and mass arrangement is shown in figure. When 10 kg block is released it moves with an acceleration of g/9. Find out coefficient of friction between block and table surface. (8)



Unit - V

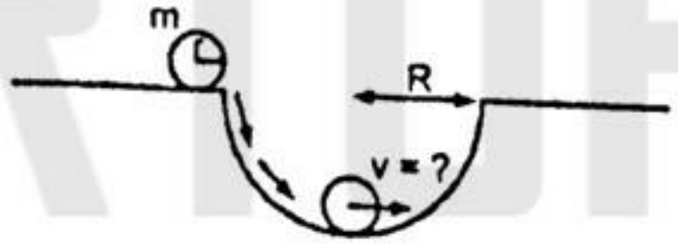
5. (a) A wagon of 60 kN weight starts from rest and moves 30 m down on surface with 1% gradients. If selling resistance of track is 5N/kN, determine velocity of wagon at 30 m distance. If wagon impact is absorbed by a spring which compress 1 cm by 25 kN weight. Determine how much this spring will be compressed. (8)

(b) A ball of mass 3 kg moving with velocity of 3 m/s has an indirect collision with a ball of equal mass moving with a velocity of 4.5 m/s. The velocity of first ball and second ball makes an angle of 30° and 60° with line of impact respectively. If coefficient of restitution is 0.9, find magnitudes and directions of final velocities of two balls. (8)

OR

5. (a) State the impulse-momentum relation. A ball of 2 kg is thrown straight up into the air with an initial velocity of 15 m/sec. Calculate the time of flight of the ball using impulse momentum theorem. (4+4)

(b) A solid sphere of mass 'm' and radius 'r' is rolled down in a semi cylinderical cavity. Sphere rolls in cavity without slipping what is linear velocity of sphere at bottom of cavity? (8)



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Roll. No.: 14EGTCS025

Total No. of Pages: 4

2E2005

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B.Tech. I Year II Sem. Main/ Back June-July Examination, 2015

205 Engg. Mechanics

Time: 3 hours

Maximum Marks: 80
Min. Passing Marks: 26

Note: Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. (Schematic diagrams must be shown wherever necessary). Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.
Use of following supporting material is permitted during examination.

1. NIL 2. NIL

UNIT-I

Q. 1 (a) Determine the magnitude and direction of the resultant a system of four coplanar concurrent forces as shown in figure-1. 8

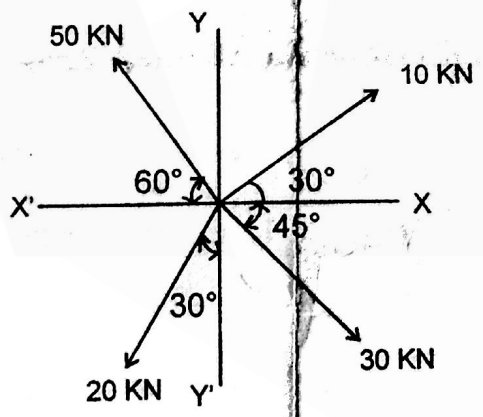

Figure-1

(b) Determine the support reactions for the beam loaded as shown in figure-2. 8

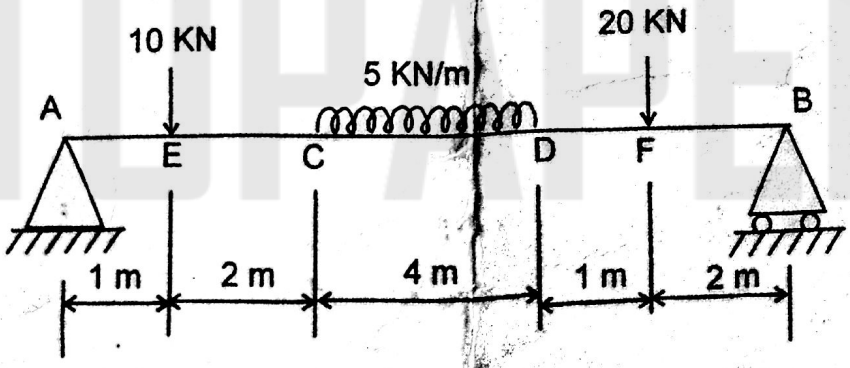

Figure-2

OR

Q. 1 (a) Use the principle of virtual work to determine the support reactions for the beam loaded as shown in figure-3. 8

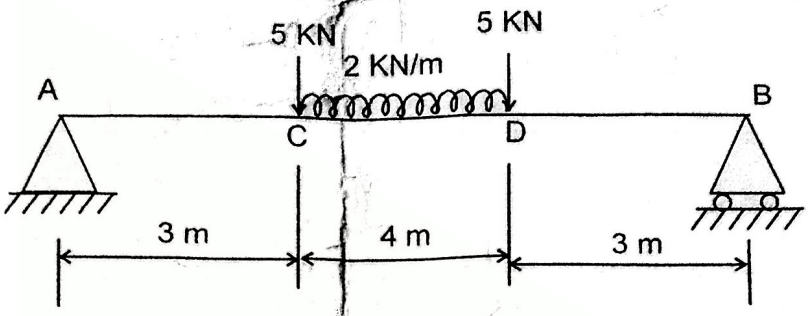

Figure-3

(b) Write short notes on the following:

(i) Lami's theorem

(ii) Varignon's theorem 4×2 = 8

UNIT-II

Q. 2 Determine the polar moment of inertia of the I-section given in figure-4, about X-X axis and Y-Y axis both. (All dimensions are in mm.) 16

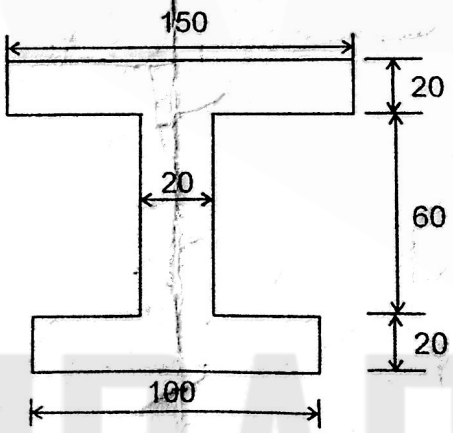

Figure-4

OR

Q. 2 (a) An effort of 200 N is applied through a distance of 6 m to lifting machine to raise a load through a distance of 60 cm. If the efficiency of the lifting machine is 80%, determine:

(i) Load lifted by the machine

(ii) Mechanical advantage

(iii) Velocity ratio $(2^n - 1)$ 8

(b) There are four pulleys in a third system of pulleys. An effort of 200 N is required to lift an unlock weight. If the efficiency of this machine is 70%, find the weight lifted. 8

UNIT-III

Q. 3 (a) A ladder of 5 m length and 50 N weight rest on a horizontal ground and against a smooth vertical wall at an angle of 60° with the vertical, when a man of 100 N stands on a ring 2 m from the foot of the ladder, it is on the point of slipping. Determine the coefficient of friction between the ladder and ground. 8

(b) A flat belt transmits 20 kW power from a pulley of 100 cm diameter running at 300 rpm. The angle of lap on the pulley is 160°. Find the width of the belt if the maximum tension is limited to 200 N/cm. Take $\mu = 0.3$. 8

OR

Q. 3 (a) Derive an expression the total length of the belt required for open belt drive. 8

(b) Write short notes on the following:

(i) Angle of Repose

(ii) Effect of Slip on Belt Drive

UNIT-IV

Q. 4 (a) A stone is projected with such an angle with horizontal, the range is 4 times the greatest height attained by the body. (Range is 200 m) Find:

(i) Angle of projection

(ii) Velocity of projection

(iii) Time of flight 8

(b) A parachute of 300 N weight falling with uniform acceleration from rest descends 5 m in first 3 second. Determine the resultant air force on the parachute. 8

OR

Q. 4 (a) A ball is dropped from a building of great height. Another ball is dropped from the same point exactly one second later. Find the separation between the balls after three seconds of the drop second ball. 8

(b) Find the acceleration and tension in the string of the system shown in figure-5. Coefficient of the friction $\mu = 0.2$ for all planes of the contact. Pulley is smooth. Also determine the velocity of the system in 5 seconds after starting from rest. 8

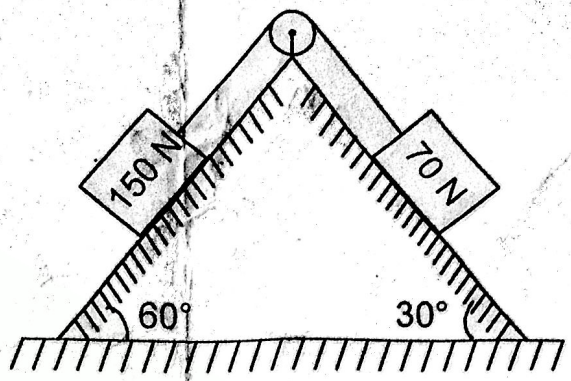

Figure-5

UNIT-V

Q. 5 (a) A block of weight 100 N slides along an inclined plane making an angle 30° with horizontal having initial velocity of 2 m/s. The distance travelled by the body along the plane is 2 m and after that it strikes the spring whose stiffness is 50 N/mm. Taking $\mu = 0.2$. Find the compression of the spring. 8

(b) Write short notes on the following:

(i) Principle of work and energy

(ii) Principle of linear impulse and momentum 4×2 = 8

OR

Q. 5 (a) Two balls A and B of mass 200 gm each, moving in opposite direction with their velocities 3 m/sec. and 2 m/sec. respectively, collide elastically. If no energy is lost during the collision, determine their velocities after collision. 8

(b) Write short notes on the following:

(i) Law of Conservation of Energy

(ii) Principle of angular momentum 4×2 = 8

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2E2005

B.Tech. II Semester (Main/ Back) Examination, June/July - 2016
205 Engineering Mechanics

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Describe force and State its application. Give a detailed classification of system of force. **(6)**

   b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in the Fig. (i) If in the equilibrium position, BC is horizontal and AB and CD make 150^0 and 120^0 with BC, find : (i) Tensions in the portions AB, BC and CD of the string and (ii) Magnitudes of weights W_1 and W_2. **(6+4)**

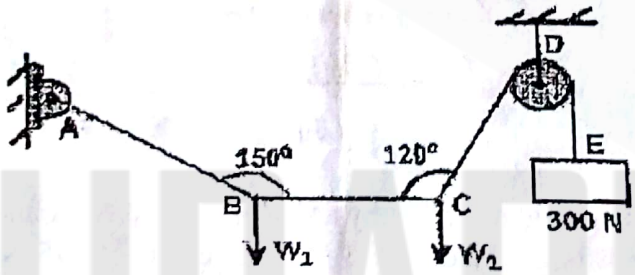

Fig. (i)

OR

1. a) State and Prove Lami's Theorem. **(8)**

b) Two beams AC and CD are hinged at C and are supported by rollers at A and D and a hinge support is provided at B as shown in Fig. (ii). Using principle of virtual work, determine the reactions at the hinge C and at support B, when a load of 600 N is acting at point E. **(8)**

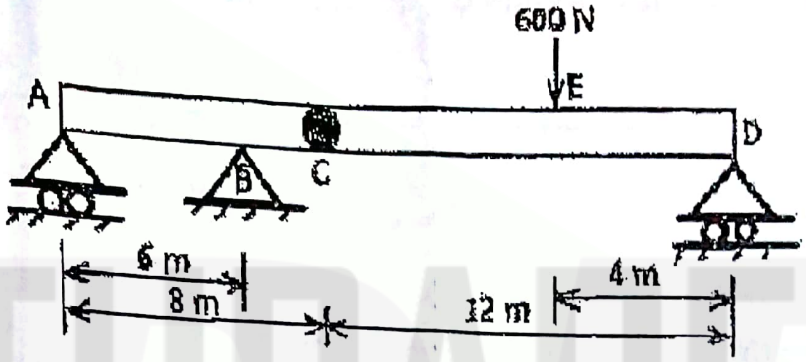

Fig. (ii)

Unit - II

2. a) State the law of machine. Derive an expression for the efficiency of a machine. **(6)**

b) Find the moment of inertia about the horizontal and vertical axis (X-X and Y-Y) passing through the centroid of the section shown in Fig. (iii). **(6+4)**

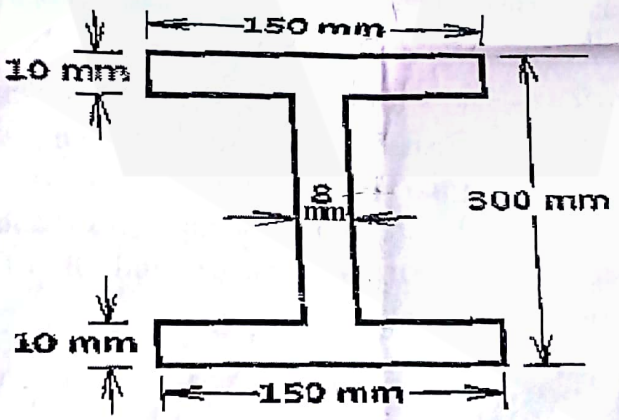

Fig. (iii)

OR

2. a) A machine lifts a load of 250 N by an effort of 160 N, at another instant the same machine lifts the load of 375 N by an effort of 175 N. If the velocity ratio of the machine is 20, determine :

i) Law of machine,

ii) Efficiency of the machine at 375 N &

iii) Efforts lost in friction at 250 N load. **(2+2+2)**

b) A uniform lamina as shown in fig. (iv) consists of a rectangle, a semicircle and a triangle. Determine the centroid of the lamina. All dimensions are in mm. **(10)**

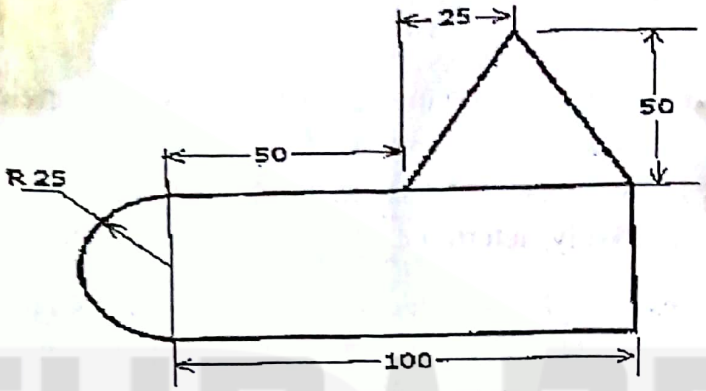

Fig. (iv)

Unit - III

3. a) Define angle of repose. Show that the angle of repose is equal to angle of static friction. **(6)**

b) A uniform ladder 3 m long weighs 200 N. It is placed against a wall making an angle of 60^0 with the floor. The co-efficient of friction between the wall and the ladder is 0.25 and that between the ladder and the floor is 0.35. The ladder in addition to its own weight has to support a man of 1000 N at its top. Calculate :

i) The horizontal force P to be applied to the ladder at the floor level to prevent slipping.

ii) If the force P is not applied, what should be the minimum inclination of ladder with the horizontal, so that there is no slipping of it? **(5+5)**

OR

3. a) Derive an expression for the ratio of belt tensions on the tight side and slack side for a flat belt passing over a fixed pulley in terms of co - efficient of friction and angle of contact of belt over pulley. **(8)**

b) A ladder of weight 390 N and 6 m long is placed against a vertical wall at an angle of 30^0 with wall. The co-efficient of friction between the ladder and the wall is 0.25 and that between ladder and floor is 0.38. Find how high a man of weight 1170 N can ascend, before the ladder begins to slip. **(8)**

Unit - IV

4. a) A stone is thrown vertically upwards with a velocity 20 m/s from the top of the tower of 25m height. Make calculations for the following parameters :

i) The maximum height to which the stone will rise in its flight. **(2+2+2)**

ii) Velocity of the stone during its downward travel at a point in the same level as the point of projection.

iii) Time required for the stone to reach the ground.

b) What is Projectile motion? Derive the expression for the horizontal range, maximum height and time of flight. **(4+3+3)**

OR

4. a) Two guns are pointed at each other, one upwards at an angle of 30^0 and the other at the same angle of depression. The muzzles of the guns are 40 m apart. If the guns are shot with velocities of 350 m/s upwards and 300 m/s downwards respectively, determine when and where the shots will meet. **(8)**

b) A particle moves along horizontal direction and its position at any instant is prescribed by the relation $X = 3t^3 - 5t^2$, where X is in m and t is in seconds, determine : **(2+2+2+2)**

i) Displacement during t = 2 sec. to 5 sec.

ii) Average velocity during t = 2 sec. to 5 sec. and instantaneous velocity at t = 2sec.

iii) Average acceleration during t = 2 sec. to 5 sec. and instantaneous acceleration at t = 5 sec.

iv) Distance travelled in first 5 sec.

Unit - V

5. a) Explain the principle of work and energy and derive an expression for the same. **(8)**

b) A pile hammer of 250 kg mass is made to fall freely on a pile from a height of 6 m. If the hammer comes to rest in 0.012 sec, determine (i) the change in momentum, (ii) impulse and (iii) average force. **(3+2+3)**

OR

5. a) State impulse momentum relation. A shell of mass 60 kg is fired horizontally with a velocity of 250 m/s by a gun of 3000 kg mass. Make calculations for : **(2+2+2+2)**

i) The velocity with which the gun recoils,

ii) The uniform force required to stop the gun in 0.5 m distance, and

iii) The time required to stop the gun. It may be presumed that momentum of the system comprising the gun and the shell is conserved.

b) From what height, must a heavy elastic ball be dropped on a floor, so that after rebounding thrice it will reach a height of 9 meters? Take $e = (0.5)^{1/3}$. **(8)**

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Roll No. _____ Total No of Pages: 4

2E2005

B. Tech. II Sem. (Main / Back) Exam., May - 2017

Common to all Branch

205 Engineering Mechanics

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

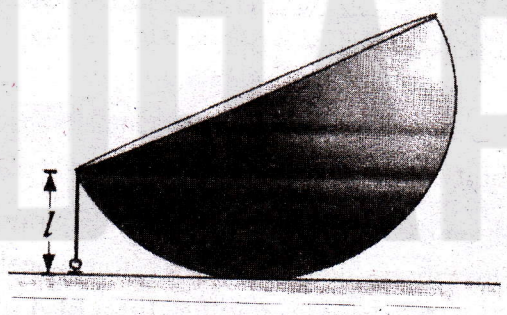
Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) State and explain the Varignon's theorem. [8]

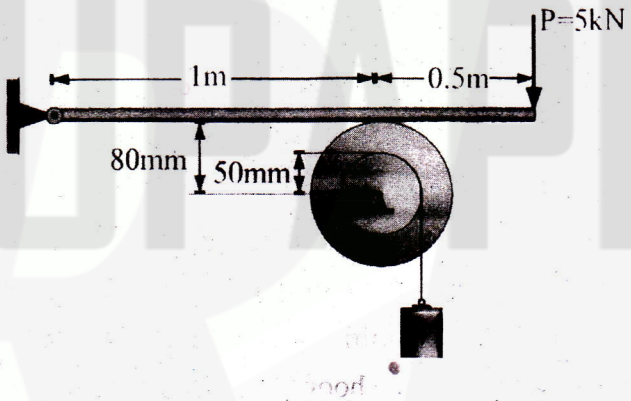
(b) A hemisphere of radius *r* and weight W is placed with its curved surface on a smooth table and a string of length l (< r) is attached to a point on its rim and to a point on the table as shown in Figure. Find the tension of the string. [8]



OR

Q.1 (a) Explain the principal of virtual work? [8]

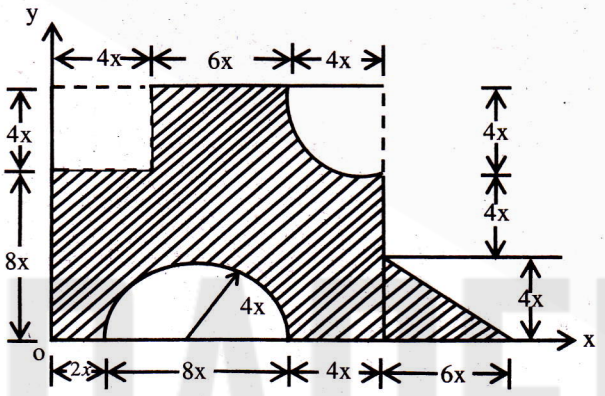
(b) What is the maximum load W that a force will hold up, if the coefficient of friction between lever and pulley is 0.2 in the arrangement shown in Figure? Neglect the weight of lever. [8]



UNIT – II

Q.2 (a) Determine the moment of inertia of a thin elliptical disk of mass m, having axial radius of a and b. [8]

(b) Determine the centroid of the composite figure about x-y coordinate. Take x = 40 mm. [8]



OR

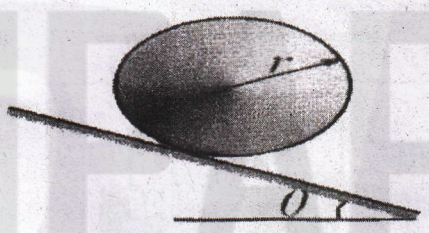
Q.2 (a) Explain the reversibility and law of machine. [8]

(b) The number of teeth on the worm wheel of a single worm and worm wheel is 60. Calculate the velocity ratio if the diameter of effort wheel is 25 cm and that of load drum is 12.5 cm. The effort required to lift a load of 600 N by this machine is 20 N. Find the efficiency of the machine. [8]

UNIT – III

Q.3 (a) Define the angle of friction and angle of repose. [8]

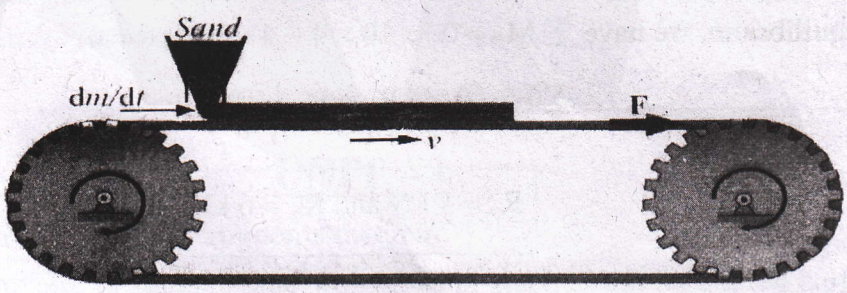
(b) Find the minimum value of the coefficient of friction between a body and a plane, so that the body may roll without slipping. The radius of gyration and radius of body are k and r, respectively [Fig.] [8]



OR

Q.3 (a) Derive can expression for the limiting ratio of tension in a V-belt over pulley. [8]

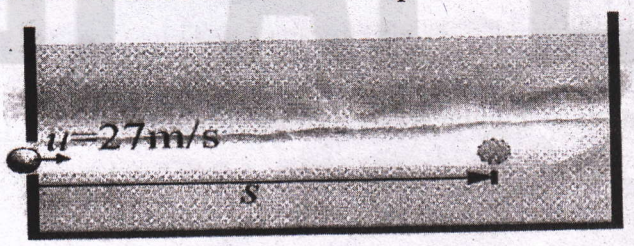
(b) Sand drops continuously from a hooper on to a moving belt as show in Figure. What force and power are required to keep the belt moving at a constant speed? [8]



UNIT – IV

Q.4 (a) Find Range, time of flight and maximum height for a projectile motion. [8]

(b) A sphere is fired horizontally into a viscous liquid with an initial velocity of 27 m/s [Fig.] If it experiences a deceleration a = -6 t m/s_2, where *t* is in seconds, determine the distance traveled before it stops. [8]



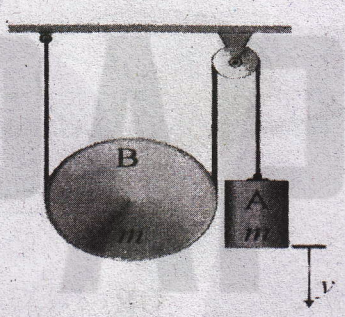
OR

Q.4 (a) Define and explain Newton's law of motion for rotational motion. [8]

(b) If the system shown in figure is released from rest, find

(i) velocity v of the falling block A as a function of y, and [4]

(ii) tensions of the string. [4]



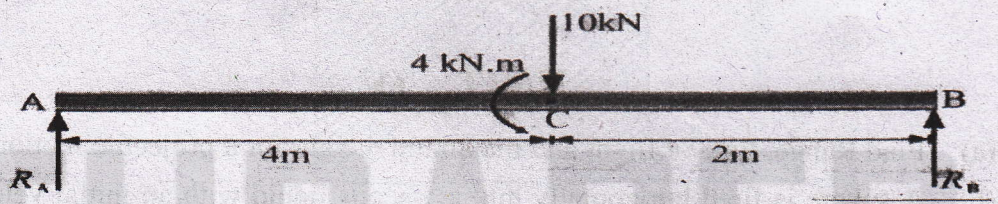
UNIT – V

Q.5 (a) Explain the principal of work and energy. [8]

(b) By transferring a load 10 kN at C by a force 10 kN and a moment 4 kNm, we draw free body diagram of the beam [Fig.] and applying equations of equilibrium, we have $\sum M_A = 0 \Rightarrow 10 \times 4 - 4 - R_B \times 6 = 0$ [8]

$$\sum F_y = 0 \Rightarrow R_A + R_B - 10 = 0$$

$R_A = 4$ kN and $R_B = 6$ kN



OR

Q.5 Write short note on:

(a) Conservation of Energy [8]

(b) Conservation of angular momentum [8]
