Registration No:

Total Number of Pages : 4                                     AR-19

B.TECH 1$^{ST}$ SEMESTER EXAMINATIONS (REGULAR), NOV/DEC 2019
BESBS1031-BASIC OF MECHANICS

Time : 3 Hours                                                             Maximum : 70 Marks

Answer ALL Questions
The figures in the right hand margin indicate marks.
PART – A: (Multiple Choice Questions) 10 × 1=10 Mark

Q.1. Answer *All* Questions.

a   If a body is in equilibrium, we may conclude that                                    [CO1] [PO1]
  a) No force is acting on the body
  b) The resultant of all the forces acting on it is zero
  c) The moments of the forces about any point is zero
  d) Both (b) and (c)

b   The resultant of two equal forces acting on a particle is equal to either of them. The angle   [CO1] [PO2]
 between the two forces will be
  a) 0°   b) 45°   c)60°   d) 120°

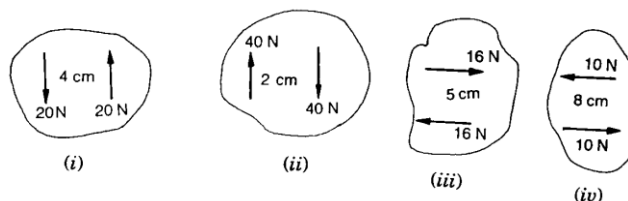c   In the Fig.1, the equivalent couples are                                              [CO1] [PO1]



Fig.1
  a) (i) and (ii)      b) (ii) and (iii)      c)(iii) and (iv)    d)(i) and (iv)

d   For a perfect truss, the relation between the number of joints and the number of members is   [CO2] [PO2]
 a) $m = 2j - 3$  b) $m = 2j + 3$  c) $m = 3j + 2$  d)$m = 3j - 2$

e   A redundant frame is also called as _____ frame                                   [CO2] [PO1]
  a) Perfect  b) Imperfect  c) Deficient  d) None of theses

f   The centroid of a semicircular area of radius 'R' from the base is                     [CO3] [PO1]
  a) $2\pi R/3$  b) $4R/3\pi$  c)$8R/3\pi$  d)$16R/3\pi$

g   For a solid cone of height 'h', the centre of gravity from the base is                 [CO3] [PO1]
  a) $2h/3$  b)$h/3$  c)$h/4$  d)$3h/8$

h   The ratio of the moment of inertia of a triangular area about its centroidal axis parallel to the   [CO3] [PO2]
 base to its moment of inertia about an axis passing through vertex and parallel to the base is
 a)6  b)12  c)1/9  d)4

i   A stone dropped in space will be subjected to                                          [CO4] [PO1]
 a)Uniform motion                  b)Uniformly accelerated motion
 c) Variable acceleration          d)None of the above

j   A man is standing on a weighing machine kept in a lift. The scale reading indicated by the   [CO4] [PO2]
 machine will be equal to the weight of the machine when the lift is
  a) Moving upwards with constant acceleration
  b) Moving downwards with constant acceleration
  c) At rest
  d) Moving with uniform velocity

PART – B: (Short Answer Questions) 10 × 2=20 Marks

Q.2. Answer *ALL* questions
a   State Lami's theorem                                                                   [CO1] [PO1]

| | | |
|---|---|---|
| b | Two forces of magnitude 10 N and 8 N are acting at a point. If the angle between the two forces is $60^0$, determine the magnitude of the resultant force. | [CO1] [PO2] |
| c | What do you understand by zero force members? Can they be removed from the structure? | [CO2] [PO2] |
| d | Define angle of repose. | [CO2] [PO2] |
| e | Distinguish between static friction and kinetic friction | [CO2] [PO2] |
| f | State parallel axis theorem. | [CO3] [PO1] |
| g | Define product of inertia. | [CO3] [PO1] |
| h | Find the moment of inertia of a rectangular section 30 mm wide and 40 mm deep about X-X axis and Y-Y axis | [CO3] [PO2] |
| i | Write the expression for the distance travelled by a body with nth second. | [CO4] [PO1] |
| j | Under what circumstances, you will apply the principle of | [CO4] [PO2] |

     i)       Newton's second law,

     ii)     work and energy and

     iii)    impulse and momentum

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PART – C: (Long Answer Questions) 4 x 10 =40 Marks

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Q.3

| | | | |
|---|---|---|---|
| a | A mass of 45 kg is suspended by a rope from a ceiling. The mass is pulled by a horizontal force until the rope makes an angle of 70° with the ceiling as shown in Fig.2. Find the horizontal force and tension in the rope. | | [CO1] [PO2] |



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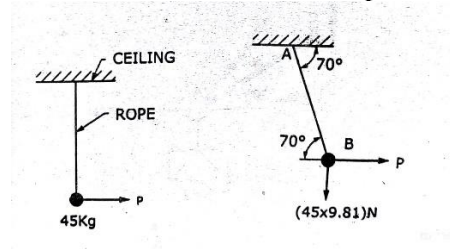
Fig.2

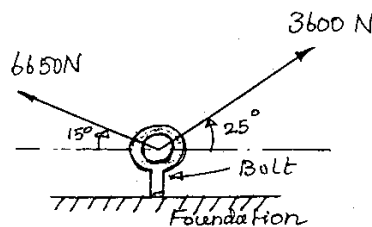| | | | |
|---|---|---|---|
| b | Two wires are attached to a bolt in a foundation as shown in Fig.3. Determine the pull exerted by the bolt on the foundation. | 5 | [CO1] [PO2] |



Fig.3

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OR

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| | | | |
|---|---|---|---|
| c | State the law of parallelogram of forces and show that the resultant $R= \sqrt{P^2 + Q^2}$ when the two forces P and Q are acting at right angles to each other. Find the value of R if the angle between the forces is zero. | 5 | [CO1] [PO2] |
| d | Reduce the given system of forces acting on the beam AB in Fig.4 below to | 5 | [CO1] [PO] |

     i)      an equivalent force-couple system at A

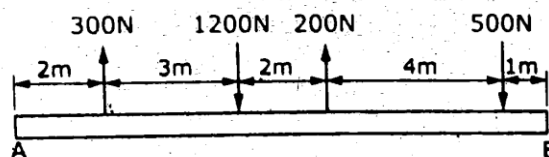     ii)     an equivalent force-couple system at B

Fig.4

## Q.4

a   Find the forces in the members AC and AB of a simple triangular truss with the loading and support system shown in the Fig. 5.   [CO2] [PO2]

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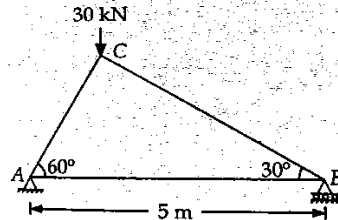


Fig.5

b   When do we use method of joints and method of sections?   3   [CO2] [PO2]

OR

c   A uniform ladder of weight 200 N of length 4.5 m rests on a horizontal ground and leans against a rough vertical wall. The co-efficient of friction between the ladder and floor is 0.4 and between ladder and vertical wall is 0.2. When a weight of 900 N is placed on the ladder at a distance of 1.2 m from the top of the ladder, the ladder is at the point of sliding. Find:   [CO2 [PO2]

7

    (i)     Sketch the diagram and indicate the forces on a free body diagram.
    (ii)    Reactions at the foot and top of the ladder.

d   State at least three laws of solid friction.   3   [CO2] [PO2]

## Q.5

a   Differentiate  center of gravity and centroid .   3   [CO3] [PO2]

b   Find the position of the centre of gravity of the L-section from AB and AC, as shown in Fig.7. Also determine the moment of inertia about XX passing through the CG. All dimensions are in cm.   7   [CO3] [PO2]
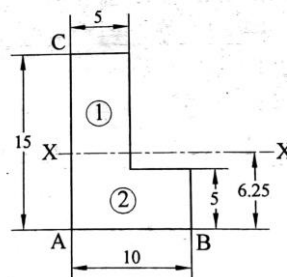


Fig.7

OR

c   Find the product of inertia of a rectangle as shown in Fig.8, about x and y axes passing through the origin.   [CO3] [PO2]
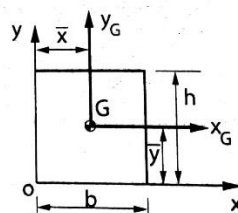
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Fig.8

d    A uniform lamina shown in Fig.9 consists of a rectangle, a circle and a triangle    7    [CO3]
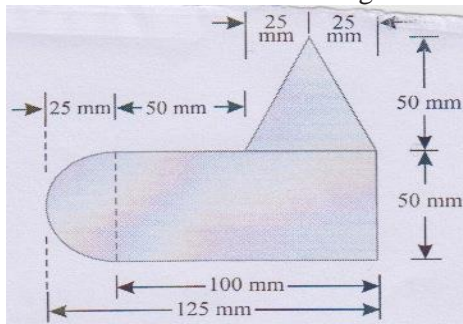[PO2]



Fig.9

Determine the centre of gravity of the lamina. All dimensions are in mm.

Q.6

a    Prove that the velocity of a particle moving along a curve described by the expressions $x = 3\cos 2t$; $y = 3\sin 2t$ is constant.    3    [CO4] [PO2]

b    Water drips from a tap fitted to a barrel at the rate of four drops per second. Find the vertical separation between two consecutive drops after the lower drop has attained a velocity of 3 m/s.    7    [CO4] [PO2]

OR

c    Find the horizontal force required to bring a body of mass 8 kg moving on a smooth surface with a velocity of 10 m/s to rest in 5 seconds.    3    [CO4] [PO2]

d    Block P of weight 100 N and block Q of weight 50 N are connected by a cord that passes over a smooth pulley as shown in Fig.10 Find the acceleration of the blocks and the tension in the cord when the system is released from rest. Neglect the mass of the pulley.    7    [CO4] [PO2]
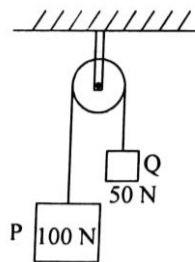


Fig.10