Code.No: 07A1EC09 | R07 | SET-1

I B.TECH – EXAMINATIONS, JUNE - 2011
ENGINEERING MECHANICS
(COMMON TO AE & MMT)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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l.a) State and explain the Law of Transmissibility of forces.

b) A beam AB 8.5 m long is hinged at A and is supported on a roller at B. The roller support is inclined at 45^0 to the horizontal. Find the reactions at A and B, if the loads applied on the beam are as given hereunder:
A concentrated load of 60 kN acting vertically downwards at a distance of 2 m from A.
A concentrated load of 50 kN acting vertically downwards at a distance of 1.5 m from B.
A load of 40 kN acting at an angle of 60^0 to the horizontal and at a distance of 4 m from A. [16]

2.a) From the expression for the efficiency of a screw jack, $\eta = \frac{\tan\alpha}{\tan(\alpha+\varphi)}$ where α is the equivalent inclination and φ is the friction angle, obtain the expression for the maximum efficiency and also the efficiency for it to be self-locking.

b) A homogeneous ladder 6 m long and weighing 400N rests against a smooth wall. The angle between the ladder and the floor is 70^0. The coefficient of friction between the floor and the ladder is 0.25. How far up the ladder can a man weighing 80 kg walk before the ladder slips? [16]

3.a) Distinguish between initial tension and centrifugal tension in a belt.

b) The maximum permissible stress in a belt is 1.4 N/mm^2, and the ratio of belt tensions is 2.0. Find the maximum power transmitted by a belt of 150 mm × 10 mm, if the density of belt material is $1\ gm/cm^3$. [16]

4.a) Distinguish between centre of gravity and centroid.

b) A steel ball of diameter 150 mm rests centrally over a concrete cube of size 150 mm. Determine the *C.G.* of the system, taking the weight of concrete as equal to 25000 N per m^3 and that of steel as 80000 N/m^3. [16]

5.a) Prove that the moment of inertia of a circular section about a horizontal axis (in the plane of the circular section) and passing through the C.G. of the section is given by $\frac{\pi D^4}{64}$.

b) You are given two spheres of the same mass, size and appearance, but one of them is hollow at the centre and the other is solid throughout. How will you find out which is hollow and which is solid? [16]

6.a) Under what conditions do the instantaneous centers of rotation and acceleration coincide for the motion of a rigid body?

b) A ball is thrown vertically upwards with an initial velocity of 36 m/s. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses the first balk at a height of 30 m? [16]

7.a) Imagine a triangular frame ABC with AC as the base of the triangle. A weight of 200 N is resting on the arm AB and another weight of 300 N is resting on the arm BC. The weights are connected together by an inextensible string passing over a smooth frictionless pulley fixed at the vertex B. In what distance will the weight A attain a velocity of 3 m/s starting from rest? Take the coefficient of friction between the blocks and the plane as 0.2.

b) Derive the kinetic energy of a body in fixed axis rotation. [16]

8.a) Prove that the time period (T) of oscillation of a vertical elastic string with upper end Fixed is given by: $T = 2\pi\sqrt{}$ {Static extension/Acceleration due to gravity}.

b) Determine the stiffness in N/cm of a vertical spring to which a weight of 100 N is attached and is set vibrating vertically. The weight makes 5 oscillations per second. [16]

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Code.No: 07A1EC09 | R07 | SET-2

I B.TECH – EXAMINATIONS, JUNE - 2011
ENGINEERING MECHANICS
(COMMON TO AE & MMT)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Distinguish between initial tension and centrifugal tension in a belt.
b) The maximum permissible stress in a belt is 1.4 N/mm^2, and the ratio of belt tensions is 2.0. Find the maximum power transmitted by a belt of 150 mm $\times$ 10 mm, if the density of belt material is 1 gm/cm^3. [16]

2.a) Distinguish between centre of gravity and centroid.
b) A steel ball of diameter 150 mm rests centrally over a concrete cube of size 150 mm. Determine the *C.G.* of the system, taking the weight of concrete as equal to 25000 N per m^3 and that of steel as 80000 N/m^3. [16]

3.a) Prove that the moment of inertia of a circular section about a horizontal axis (in the plane of the circular section) and passing through the C.G. of the section is given by $\frac{\pi D^4}{64}$.
b) You are given two spheres of the same mass, size and appearance, but one of them is hollow at the centre and the other is solid throughout. How will you find out which is hollow and which is solid? [16]

4.a) Under what conditions do the instantaneous centers of rotation and acceleration coincide for the motion of a rigid body?
b) A ball is thrown vertically upwards with an initial velocity of 36 m/s. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses the first balk at a height of 30 m? [16]

5.a) Imagine a triangular frame ABC with AC as the base of the triangle. A weight of 200 N is resting on the arm AB and another weight of 300 N is resting on the arm BC. The weights are connected together by an inextensible string passing over a smooth frictionless pulley fixed at the vertex B. In what distance will the weight A attain a velocity of 3 m/s starting from rest? Take the coefficient of friction between the blocks and the plane as 0.2.
b) Derive the kinetic energy of a body in fixed axis rotation. [16]

6.a) Prove that the time period (T) of oscillation of a vertical elastic string with upper end Fixed is given by: $T = 2\pi\sqrt{}$ {Static extension/Acceleration due to gravity}.
b) Determine the stiffness in N/cm of a vertical spring to which a weight of 100 N is attached and is set vibrating vertically. The weight makes 5 oscillations per second. [16]

7.a) State and explain the Law of Transmissibility of forces.
b) A beam AB 8.5 m long is hinged at A and is supported on a roller at B. The roller support is inclined at 45^0 to the horizontal. Find the reactions at A and B, if the loads applied on the beam are as given hereunder:
A concentrated load of 60 kN acting vertically downwards at a distance of 2 m from A.
A concentrated load of 50 kN acting vertically downwards at a distance of 1.5 m from B.
A load of 40 kN acting at an angle of 60^0 to the horizontal and at a distance of 4 m from A. [16]

8.a) From the expression for the efficiency of a screw jack, $\eta = \frac{\tan\alpha}{\tan(\alpha+\varphi)}$ where α is the equivalent inclination and φ is the friction angle, obtain the expression for the maximum efficiency and also the efficiency for it to be self-locking.
b) A homogeneous ladder 6 m long and weighing 400N rests against a smooth wall. The angle between the ladder and the floor is 70^0. The coefficient of friction between the floor and the ladder is 0.25. How far up the ladder can a man weighing 80 kg walk before the ladder slips? [16]

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Code.No: 07A1EC09 | R07 | SET-3

I B.TECH – EXAMINATIONS, JUNE - 2011
ENGINEERING MECHANICS
(COMMON TO AE & MMT)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Prove that the moment of inertia of a circular section about a horizontal axis (in the plane of the circular section) and passing through the C.G. of the section is given by $\frac{\pi D^4}{64}$.

b) You are given two spheres of the same mass, size and appearance, but one of them is hollow at the centre and the other is solid throughout. How will you find out which is hollow and which is solid? [16]

2.a) Under what conditions do the instantaneous centers of rotation and acceleration coincide for the motion of a rigid body?

b) A ball is thrown vertically upwards with an initial velocity of 36 m/s. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses the first balk at a height of 30 m? [16]

3.a) Imagine a triangular frame ABC with AC as the base of the triangle. A weight of 200 N is resting on the arm AB and another weight of 300 N is resting on the arm BC. The weights are connected together by an inextensible string passing over a smooth frictionless pulley fixed at the vertex B. In what distance will the weight A attain a velocity of 3 m/s starting from rest? Take the coefficient of friction between the blocks and the plane as 0.2.

b) Derive the kinetic energy of a body in fixed axis rotation. [16]

4.a) Prove that the time period (T) of oscillation of a vertical elastic string with upper end Fixed is given by: $T = 2\pi\sqrt{}$ {Static extension/Acceleration due to gravity}.

b) Determine the stiffness in N/cm of a vertical spring to which a weight of 100 N is attached and is set vibrating vertically. The weight makes 5 oscillations per second. [16]

5.a) State and explain the Law of Transmissibility of forces.

b) A beam AB 8.5 m long is hinged at A and is supported on a roller at B. The roller support is inclined at 45^0 to the horizontal. Find the reactions at A and B, if the loads applied on the beam are as given hereunder:
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A load of 40 kN acting at an angle of 60^0 to the horizontal and at a distance of 4 m from A. [16]

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Code.No: 07A1EC09 | R07 | SET-4

I B.TECH – EXAMINATIONS, JUNE - 2011
ENGINEERING MECHANICS
(COMMON TO AE & MMT)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Imagine a triangular frame ABC with AC as the base of the triangle. A weight of 200 N is resting on the arm AB and another weight of 300 N is resting on the arm BC. The weights are connected together by an inextensible string passing over a smooth frictionless pulley fixed at the vertex B. In what distance will the weight A attain a velocity of 3 m/s starting from rest? Take the coefficient of friction between the blocks and the plane as 0.2.

b) Derive the kinetic energy of a body in fixed axis rotation. [16]

2.a) Prove that the time period (T) of oscillation of a vertical elastic string with upper end Fixed is given by: $T = 2\pi\sqrt{}$ {Static extension/Acceleration due to gravity}.

b) Determine the stiffness in N/cm of a vertical spring to which a weight of 100 N is attached and is set vibrating vertically. The weight makes 5 oscillations per second. [16]

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