

Code: 13ME1003

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)

I B.Tech II Semester Supplementary Examinations, October 2014

ENGINEERING MECHANICS

(Common to CE, CSE &amp; IT)

Time : 3 hours

Max Marks : 70

PART – A

## 1. Answer all Questions

[10 X 1 = 10M]

- State the law of transmissibility of forces
- Define free body diagram
- State varignon theorem
- State D- Alembert's Principle
- What is angle of friction?
- State pappus theorem
- Define mass moment of inertia
- Define rectilinear motion
- What is rigid body?
- Define centroids?

PART-B

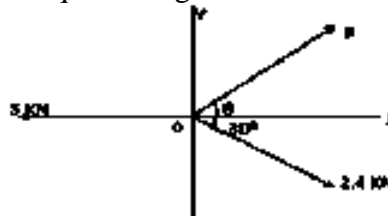
Answer one question from each unit

[5X 12 = 60M]

UNIT-I

2. The force system in figure has a resultant of 2 KN pointing up along the y-axis.  
Compute the values of F and required to give this resultant.

(12M)

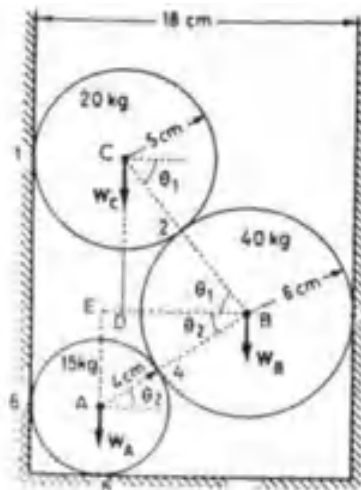


(OR)

- State and prove parallelogram Law
- Discuss graphical and analytical methods for finding resultant of several coplanar concurrent forces?

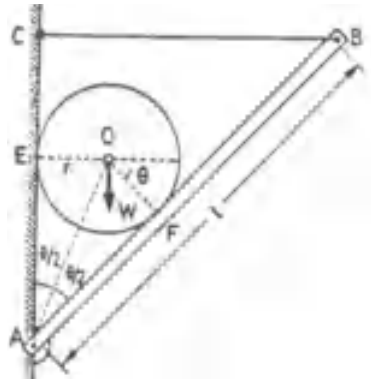
UNIT-II

4. Three cylinders are piled up in a rectangular channel as shown. Determine the reaction  $R_6$  between the cylinder A and the vertical wall of the channel.

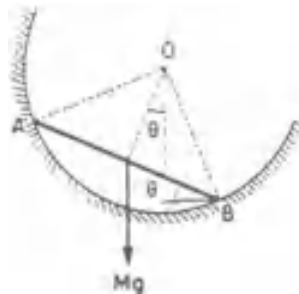


(OR)

5. A cylinder of weight  $W$  and radius  $r$  is supported horizontal position against a vertical wall by a bar  $AB$  of negligible weight. The bar is hinged to the wall at  $A$  and supported at  $B$  by a horizontal rope  $BC$ . Find the value of the angle  $\theta$  that the bar should make with the wall so that the tension in the rope is minimum. Assume frictionless conditions.

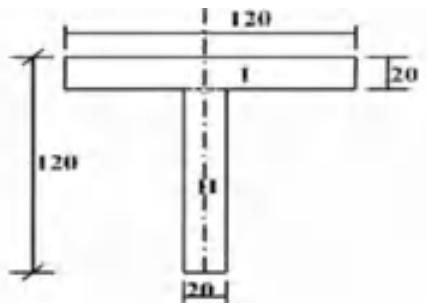
**UNIT-III**

6. The two ends of a circular rod  $AB$  of mass  $M$  are supported by a circular ring in vertical plane as shown in Fig... The length of the rod is such so as to subtend an angle of  $90^\circ$  at the center of the ring. The coefficient of friction at the point of contact  $A$  and  $B$  are  $\mu$  each. What is the greatest angle of inclination  $\theta$  that the rod can make with the horizontal in the condition of equilibrium?



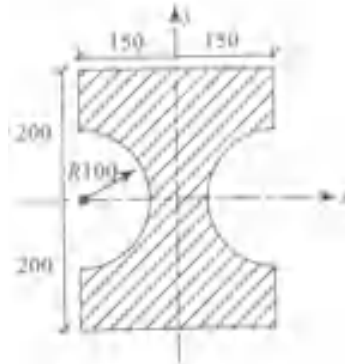
(OR)

7. a) Determine the centroid of rectangle of base ' $b$ ' and height ' $h$ ' from the basic principle (6M)  
b) Determine the centroid for the following figure. (6M)



UNIT-IV

8. Find the Moment of Inertia about X and Y axes

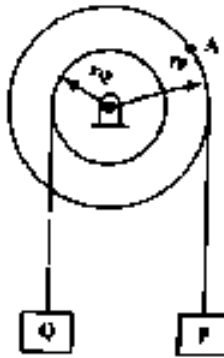


(OR)

9. Find the moment of inertia of circular plate of radius  $R$  and thickness  $t$  about its centroidal axis.

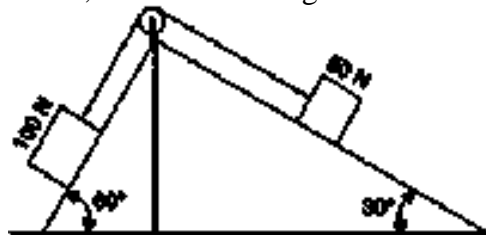
UNIT-V

10. A pulley system attached with loads  $P$  and  $Q$  as shown in Figure. If  $P$  has uniform acceleration of  $4.2 \text{ m/sec}^2$  with initial velocity  $3 \text{ m/sec}$  downward, determine the number of revolutions executed by the pulley in  $5 \text{ sec}$ , velocity and position of the load  $Q$  after  $5 \text{ sec}$  and acceleration of the point  $A$  at  $t = 0$ . Take  $r_p = 2 \text{ m}$ ,  $r_q = 1.5 \text{ m}$ .



(OR)

11. Two rough planes inclined at  $30^\circ$  and  $60^\circ$  to horizontal are placed as shown. The blocks of weights  $50 \text{ n}$  and  $100 \text{ n}$  are placed on the faces and are connected by a string running parallel to planes and passing over a frictionless pulley. If the coefficient of friction between planes and blocks is  $1/3$ , find the resulting acceleration and tension in the string.



**13BS1004****ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)****I B.Tech II Semester Supplementary Examinations, October 2014****ENGINEERING PHYSICS  
(Common to EEE & ECE)****Time: 3 hours****Max. Marks: 70****PART-A****Answer all questions****[10X1=10M]**

1. a) What is superposition principle?  
b) What are coherent sources?  
c) What are different types of diffraction?  
d) What is population inversion?  
e) Define acceptance angle of an optical fiber.  
f) What are Miller indices?  
g) Define Co-ordination number of a crystal.  
h) What is a Bohr Magneton?  
i) Define piezoelectric effect.  
j) What is De-Broglie hypothesis?

**PART-B****Answer one question from each unit****[5X12=60M]****Unit-I**

2. a) Derive the conditions for maxima and minima for interference in plane parallel film due to reflected light.  
b) In a Newton's rings experiment the diameter of 15<sup>th</sup> ring was found to be 0.59 cm and that of 5<sup>th</sup> ring is 0.336 cm. If the radius of curvature of the lens is 100 cm, find the wavelength of the light.

**[8M+4M]****(OR)**

3. a) Explain Fraunhofer diffraction due to single slit.  
b) Distinguish between interference and diffraction.

**[8M+4M]****Unit-II**

4. a) Explain the principle, construction and working of a ruby laser with neat diagrams.  
b) Distinguish between spontaneous emission and stimulated emission of light.  
c) What is meant by optical resonator.

**[6M+4M +2M]****(OR)**

5. a) Derive an expression for the numerical aperture of step index fibers.  
b) Distinguish between step index and graded index fibers.  
c) The refractive indices of core and cladding of an optical fiber are 1.55 and 1.50. If the light is launched in air, calculate its numerical aperture.

**[6M+4M +2M]****Unit-III**

6. a) Show that FCC is the most closely packed of the three cubic structures by calculating the packing factors.  
b) What are unit cell and primitive cell?

**[10M+2M]****(OR)**

7. a) Define crystal planes and crystal directions.  
b) State Bragg's law and explain Bragg's law of x-ray diffraction. [2M+10M]

**Unit-IV**

8. a) What are the differences between hard and soft magnetic materials?  
b) Explain the domain theory of ferromagnetism. [6M+6M]

**(OR)**

9. a) Describe different types of polarization mechanisms in dielectric materials.  
b) What are ferroelectric materials? [10M+2M]

**Unit-V**

10. a) Define the terms drift velocity, relaxation time and mean free path of electrons.  
b) State the drawbacks of classical free electron theory.  
c) Calculate the mobility of electrons in Aluminium wire having electric field 0.18V/m and drift velocity of electrons  $0.230 \times 10^{-3}$  m/s. [3M+6M +3M]

**(OR)**

11. a) Derive time independent Schrodinger's wave equation.  
b) Write a note on particle in a one dimensional potential box. [6M+6M]

Code No: 13ME1002

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**I B.Tech. II Semester Supplementary Examinations, October – 2014**

**CLASSICAL MECHANICS**

**(Mechanical Engineering)**

Time: 3 Hours

Max Marks: 70

**PART-A**

Answer all questions

[10X1=10M]

1.
  - a) Distinguish clearly between resolution of force and composition of forces.
  - b) State Varignon's principle of moments.
  - c) A force 10 KN is acting at  $60^\circ$  with vertical. Determine the horizontal and vertical components of the force.
  - d) What are the basic assumptions for the perfect truss?
  - e) What are the applications of virtual work?
  - f) What do you mean by first moment of area?
  - g) Define mass moment of inertia.
  - h) Differentiate translation and rotation.
  - i) The displacement of a body from a point of time  $t$  is given by  $S = 5t^3 - 4t^2 - 7$ . Find the momentum at 10 sec, if the mass of the body is 10 kg.
  - j) State the principle of conservation of energy in a rigid body.

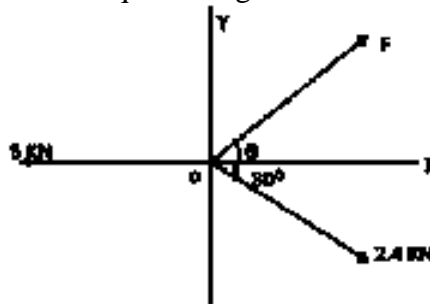
**PART – B**

Answer one question from each unit

[5X12=60M]

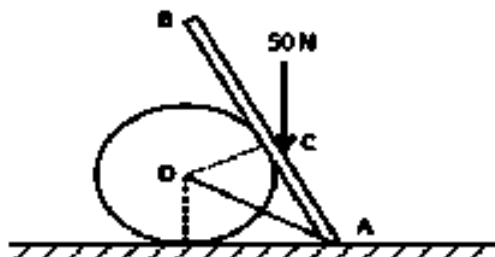
**UNIT – I**

2. a) State and prove Lami's theorem. (4M)
- b) The force system in figure has a resultant of 2 KN pointing up along the y-axis. Compute the values of  $F$  and required to give this resultant. (8M)



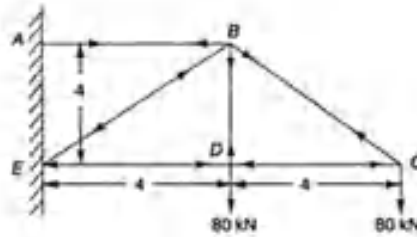
(OR)

3. a) What are the steps to be followed in drawing free body diagram? (4M)
- b) A smooth cylinder of radius 100 mm resting on a horizontal surface supports a bar AB of length 30 cm which is hinged at A. The weight of the bar is 50 N. The cylinder is kept from rolling away by a string AO of length 200 mm. Assuming all surfaces to be frictionless, find the tension in the string. (8M)



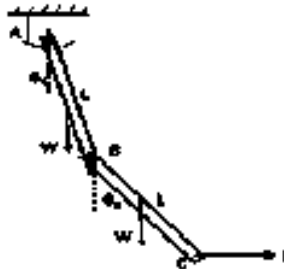
UNIT – II

4. A cantilever truss is loaded as shown below. Find the forces in each member. (12M)

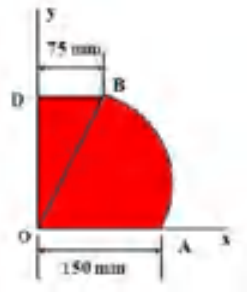


(OR)

5. Two uniform rods each of length  $L$  and weight  $W$  are connected as shown. Using the method of virtual work determine  $\theta_1$  and  $\theta_2$  corresponding to the equilibrium of the bars. (12M)

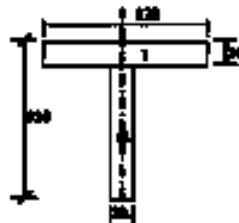
UNIT – III

6. Locate the centroid of the shaded area OABD shown in the figure. (12M)



(OR)

7. a) Find the second moments of area of a T – section 120 x 120 x 20 about its centroidal axes. (6M)

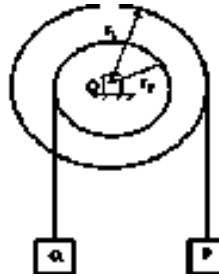


- b) Determine the mass moment of inertia of the homogeneous solid cylinder of radius  $r$  and length  $l$  with respect to the centroidal coordinate axes. (6M)

UNIT – IV

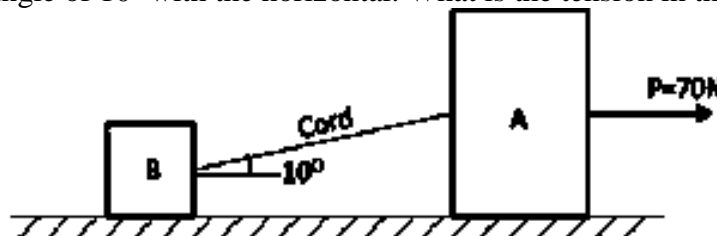
8. a) A stone was thrown vertically upward from the ground with a velocity of 64 m/sec. After 2 sec, another stone was projected from the same point vertically upward with a velocity of 58 m/sec. Find when and where they meet each other. (6M)

- b) A two step pulley supports two weights P and Q as shown in figure. Find the downward acceleration of P. Assume  $P = 40 \text{ N}$ ,  $Q = 60 \text{ N}$  and  $r_1 = 2r_2$ . Neglect friction and inertia of the pulleys. (6M)



(OR)

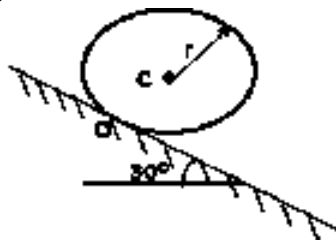
9. a) The x and y components of the displacement in meters of a point are given by the equation  $x = 4t^2 - 3t$ ,  $y = t^3 - 10$ . Determine the velocity and acceleration of the point when  $t = 2 \text{ sec}$ . (4M)
- b) A horizontal force  $P = 70 \text{ N}$  is applied on mass  $A = 16 \text{ kg}$  as shown in figure. The coefficient of friction between A and the horizontal plane is 0.25. B has a mass of  $4 \text{ kg}$  and coefficient of friction between it and the plane is 0.50. The cord between the A and B makes an angle of  $10^\circ$  with the horizontal. What is the tension in the cord? (8M)

UNIT - V

10. A projectile is aimed at a target along a horizontal plane through the point of projection. It falls 10 m short when the angle of projection is  $17^\circ$ , when it overshoots the target by 25 m when the angle of projection is  $44^\circ$ . Find the angle of projection to hit the target. (12M)

(OR)

11. a) A sphere of radius 0.5 m and mass 10 kg is released gently from rest on a  $30^\circ$  incline as shown in figure. If it rolls without slipping, determine the minimum coefficient of friction compatible with the rolling motion. What would be the velocity of its centre of mass after it rolled down 5 m. (6M)



- b) A solid cylindrical pulley of mass 800 kg, having 0.8 m radius of gyration and 2 m diameter, is rotated by an electric motor, which exerts a uniform torque of 60 KN-m. A body of mass 3000 kg is lifted by a wire wrapped round the pulley. Find (i) acceleration of the body; and (ii) tension in the rope. (6M)