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.
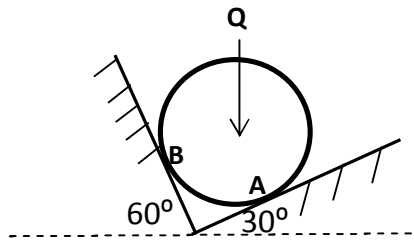
  c) State theorem of Transmissibility.
  d) Write the applications of 1st theorem of Pappus.
  e) What do you understand by Limiting equilibrium?
  f) Write Principle of Conservation of Momentum.
  g) What do you understand by an ideal system?
  h) Write the equation of work-energy for rectilinear motion 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)**
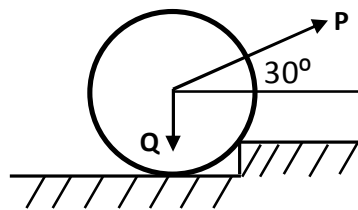
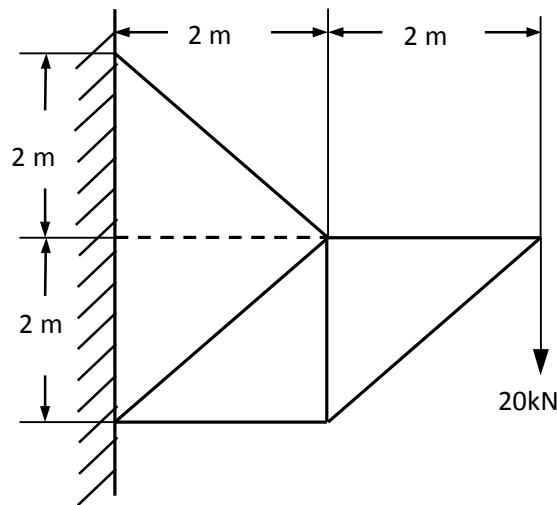 **b)** Two forces are acting at a point as shown in the figure. Find the resultant.   **(5)**
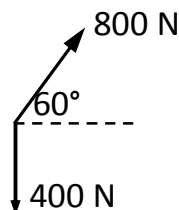
Q4 **a)** Find the centroid of the area between the parabola $y = x^2/a$ and straight line $y = x$ as shown in the figure below. **(10)**
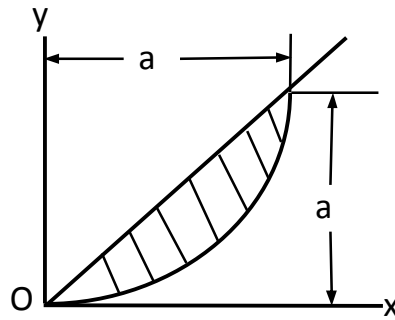

b) State and prove Parallel Axis theorem. **(5)**

**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 $\varphi = 15°$. What is the smallest weight W of the block A for which the equilibrium of the system exists. **(10)**
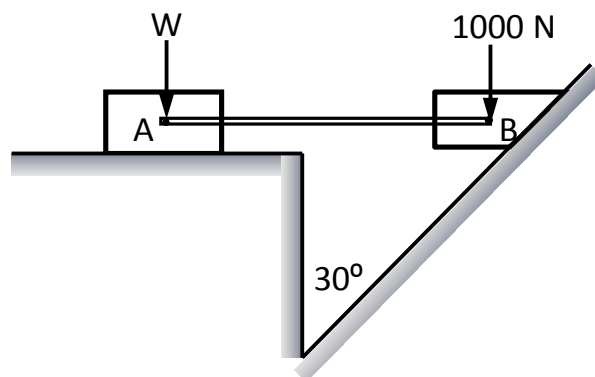
b) Explain virtual displacement, virtual work and Principle of Virtual Work with a neat sketch. **(5)**

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/s² to the weight W. **(10)**
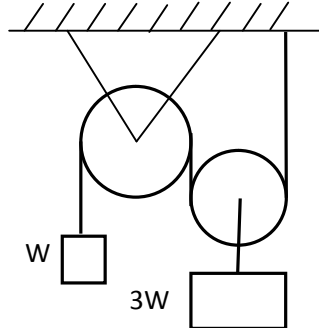
Q8 **a)** A block of weight 12N falls from a height of 0.75m on top of a spring. Determine the spring constant if it is compressed by 150mm to bring the weight momentarily to rest. **(7.5)**

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)**