Total No. of printed pages = 8

END SEMESTER EXAMINATION – 2019

Semester : 3rd

Subject Code : BES-304

APPLIED MECHANICS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. Questions on PART – A are compulsory.
2. Answer any *five* questions from PART – B.

PART – A

Marks – 25

1. Fill in the blanks : 1×10=10

   (a) The _____ of a body is due to gravitational force of attraction towards the centre of earth.

   (b) _____ is equal and opposite to the resultant of several forces acting on a body.

   (c) The splitting of force into two mutually perpendicular directions is called _____.

[Turn over

(d) The product of either force of a couple with the arm of the couple is called _____.

(e) Coulomb friction is friction between _____ surfaces.

(f) Maximum value of static friction is known as _____ friction.

(g) The force of friction acting on a moving body is called the _____.

(h) The unit of work done in SI system of units is _____.

(i) The vertical component of force 10N is 8.66N. Its horizontal component will be _____ N.

(j) Two forces 4N and 6N are acting along the same line, then the magnitude of resultant of the forces will be _____ N.

2. Write true or false : 1×10=10

(a) The forces, which lies on the same plane, are known as collinear forces.

(b) A force which combines with two or more forces to produce equilibrium is called resultant.

(c) Force causes linear displacement while moment causes angular displacement.

(d) Lami's theorem cannot be applied in case of concurrent forces.

(e) A body isolated from all other members which are connected to it is called free body.

(f) A redundant frame is also known as imperfect frame.

(g) A car starting from rest is accelerated at the rate of 0.4 m/s^2, then the distance covered by the car in 20 seconds is 70m.

(h) The frictional force is dependent of area of the contact surface.

(i) The method of determination of the resultant of forces acting on a particle is called resolution of forces.

(j) The SI unit of moment of a force is N.

3. Choose the correct answer : 1×5=5

(a) Which of the following physical quantities is not a vector ?

(i) Mass (ii) Momentum

(iii) Impulse (iv) Acceleration

(b) If the sum of all the forces acting on a body is zero, then the body may be in equilibrium provided the forces are

(i) concurrent (ii) parallel

(iii) like parallel (iv) unlike parallel

(c) Four forces P, 2P, 3P and 4P act along the sides, taken in order, of a square. The resultant force is

(i) Zero (ii) $2\sqrt{2}$ P

(iii) 2P (iv) $\sqrt{5}$ P

(d) The centre of gravity of a triangle lies at the point of intersection of

(i) Diagonals

(ii) Altitudes

(iii) Bisector of angles

(iv) Medians

(e) The moment of inertia of a circular body of diameter 1 mm is equal to

(i) 1 mm^4 (ii) 0.049 mm^4

(iii) 0.5 mm^4 (iv) None of these

PART – B

Marks – 45

4. (a) What is the effect of force and moment on a body? 2

(b) State the specifications required to define a force. 2

(c) State the principles of equilibrium. 3

(d) What is a free body diagram? Illustrate it with the help of a figure. 2

5. (a) The five forces F_1, F_2, F_3, F_4 and F_5 are acting at a point on a body as shown in Figure-1 and the body is in equilibrium. If F_1=18N, F_2=22.5N, F_3=15N and F_4=30N, find the force F_5 in magnitude and direction. 5

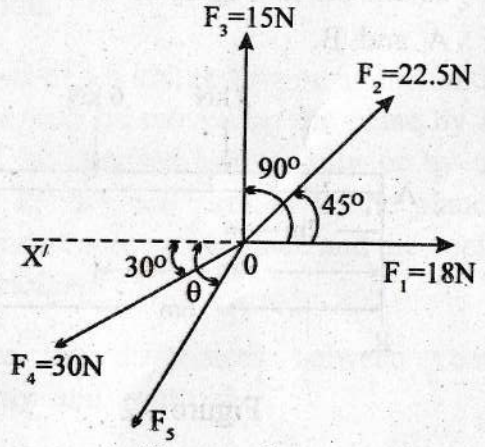

Figure – 1

(b) A lamp weighing 10N is suspended from the ceiling by a chain. It is pulled aside by a horizontal cord until the chain makes an angle of 60° with the ceiling. Find the tensions in the chain and the cord by applying Lami's theorem. 4

6. (a) Three forces of 2P, 3P and 4P act along the three sides of an equilateral triangle of side 100 mm taken in order. Find the magnitude and position of the resultant force. 5

(b) A simply supported beam AB of span 6m carries point loads of 3 kN and 6 kN at a distance of 2m and 4m from the left end A as shown in Figure-2. Find the reactions at A and B. 4

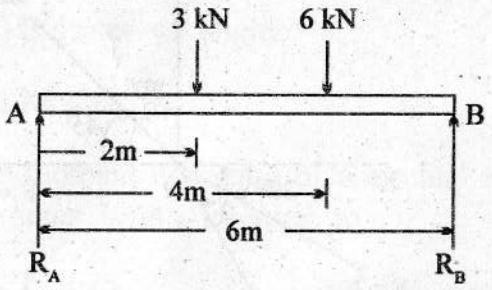

Figure – 2

7. Two identical rollers, each weighing Q=445N, are supported by an inclined plane and a vertical wall as shown in Figure-3. Assuming smooth surfaces, find the reactions induced at the points of support A, B and C. 9

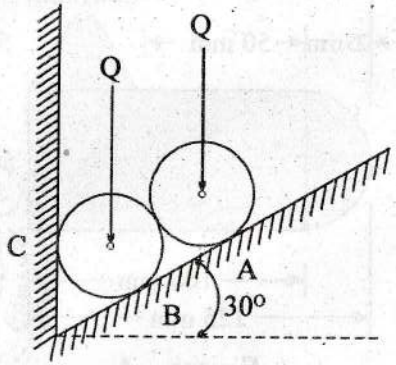

Figure – 3

8. (a) Define coefficient of friction and limiting friction. 2

(b) A load of 1.5 kN, resting on an inclined rough plane, can be moved up the plane by a force of 2 kN applied horizontally or by a force 1.25 kN applied parallel to the plane. Find the inclination of the plane and the coefficient of friction. 7

9. (a) Write the differences between centre of gravity and centroid. 2

(b) A uniform lamina shown in Fig.4 consists of a rectangle, a circle and a triangle. Determine the centre of gravity of the lamina. All dimensions are in mm. 7

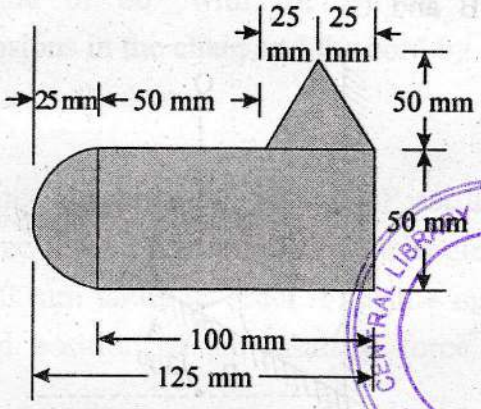

Figure – 4

10. Figure 5, shows a warren girder consisting of seven members each of 3m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in the members AE, AB, BE and BC of the girder, indicating whether the force is compressive or tensile and also find the reaction at point A and D. 9

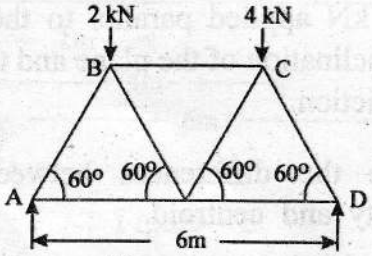

Figure – 5