Total No. of printed pages = 8

BES-304/App.Mech./3rd Sem/2018/M

APPLIED MECHANICS

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer *all* the questions from Part (A) and any *five* from Part (B).

PART – A

1. Choose the correct answer : 1×10=10

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

   (i) Mass (ii) Momentum

   (iii. Impulse (iv) Acceleration.

   (b) Newton's first law of motion gives the concept of

   (i) Work (ii) Force

   (iii) Inertia (iv) Energy.

[Turn over

(c) According to equilibrium law, two forces can be in equilibrium only if they are

(i) Equal in magnitude

(ii) Opposite in direction

(iii) Collinear in action

(iv) All of the above.

(d) 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

(e) Resultant of two equal forces is equal to either of them. The angle between the forces is

(i) $0°$ (ii) $60°$

(iii) $90°$ (iv) $120°$

(f) The coefficient of friction depends upon

(i) Nature of the surface

(ii) Area of contact

(iii) Shape of the surface

(iv) All of the above.

(g) The maximum frictional force which comes into play when a body just begins to slide over another surface is called

(i) Sliding friction

(ii) Limiting friction

(iii) Rolling friction

(iv) Kinetic friction.

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

(i) Diagonals

(ii) Altitudes

(iii) Bisector of angles

(iv) Medians.

(i) A framed structure is perfect if it contains member equal to

(i) $2n-1$ (ii) $2n-2$

(iii) $2n-3$ (iv) $2n-4$

where n is number of joints in a frame.

(j) A zero angle of friction implies that

(i) Frictional force is infinite

(ii) Frictional force is zero

(iii) Frictional force acts normal to the plane

(iv) Frictional force acts along the direction of motion.

2. Fill up the blanks : $1 \times 10 = 10$

(a) ____ relates to bodies in motion without any reference to forces.

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

(c) The unit of energy in SI system of units is ____.

(d) The co-efficient of friction is independent of ____ of contact surface.

(e) The friction experienced by a body in motion is known as ____.

(f) The process of splitting up a force into components is called ____.

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

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

(i) The rate of change of velocity is called _____.

(j) The ratio of limiting force of friction to the normal reaction is known as _____.

3. Answer right or wrong : 1×5=5

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

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

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

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

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

PART – B

4. (a) What do you mean by scalar and vector quantities ? 2

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

   (c) The resultant of two concurrent forces is 1500 N and the angle between the forces is 90°.The resultant makes an angle of 36° with one of the force. Find the magnitude of each force. 5

5. (a) State the specifications required to define a force. 3

   (b) The resultant of the two forces, when they act an angle of 60° is 14 N. If the same forces are acting at right angles, their resultant is $\sqrt{136}$ N. Determine the magnitude of the two forces. 6

6. (a) State the laws of static friction. 3

   (b) Four forces of magnitudes 20 N, 30 N, 40 N and 50 N are acting respectively along the four sides of a square taken in order. Determine the magnitude, direction and position of the resultant force. 6

7. Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. i

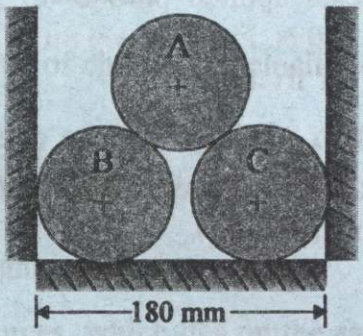

Fig. (i)

Determine the pressure exerted by :

(i) the cylinder A on B at the point of contact

(ii) the cylinder B on the base and

(iii) the cylinder B on the wall. 9

8. (a) Define moment of inertia. 1

(b) Find the moment of inertia of a T – section with flange as 100 mm × 50 mm and web as 100 mm × 50 mm about X – X and Y – Y axes through the centre of gravity of the section. 8

9. An effort of 180 N is required just to move a certain body up an inclined plane of angle 15°, the force being parallel to the plane. If the angle of inclination of the plane is made 20°, the effort required, again applied parallel to the plane, is found to be 210 N. Find the weight of the body and co-efficient of friction. 9

10. Find all the forces in the members of a cantilever truss shown in fig. (ii). 9

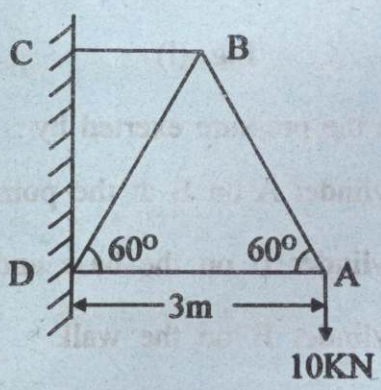

Fig. (ii)