Total No. of printed pages = 7

Me 201/EM/2nd Sem/2017/N

ENGINEERING MECHANICS

Full Marks – 70

Time – Three hours

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

Answer PART – A and any *five* questions from PART – B

PART – A

1. (a) Fill in the blanks 1×10=10

(i) Forces whose lines of action pass through a common point are called ——— forces.

(ii) A ——— is a single force which can replace two or more forces and produce the same effect on the body as the forces.

(iii) Centriod of a triangle lies at ——— from the base, where h is the height of triangle.

[Turn over

(iv) Moment of inertia of a rectangle about its centroidal horizontal axis is ———.

(v) The frictional force is independent of ——— of the contact surface.

(vi) Mechanical advantage is the ratio of effort applied to ———.

(vii) The unit of Power in SI unit is ———.

(viii) The resultant of two forces P and Q acting at an angle θ is ———.

(ix) ——— is the maximum frictional force which comes into play when a body just begins to slide over another surface.

(x) An irreversible machine is also called ——— machine.

(b) Write true or false : $1 \times 10 = 10$

(i) Velocity is a scalar quantity.

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

(iii) Center of gravity is the point where the whole weight of the body is assumed to be concentrated.

(iv) The SI unit of moment of inertia is Nm.

(v) Dynamic friction is a also known as kinetic friction.

(vi) The efficiency of an idle machine is less than 100%.

(vii) Power is defined as the rate of doing work .

(viii) The law of machine is given by the relation $P = m W + c$.

(ix) The rate of change of angular displacement is called angular velocity.

(x) The rotational tendency of a force is called moment.

(c) Choose the correct answer : $1 \times 5 = 5$

(i) Moment of a force

(a) varies directly with its distance from the pivot

(b) varies inversely with its distance form the pivot

(c) is independent of its distance from the pivot

(d) None of the above.

(ii) What are the units of moment of inertia of an area ?

(a) Kg m (b) Nm

(c) m^4 (d) N

(iii) A machine will be reversible, it its efficiency is

(a) more than 50%

(b) less than 50%

(c) 100%

(d) None of the above.

(iv) _____ is the branch of mechanics which deals with bodies in motion.

(a) Statics

(b) Dynamics

(c) Both (a) and (b) above

(d) None of the above.

(v) For ideal machine

(a) mechanical advantage > velocity ratio

(b) mechanical advantage = velocity ratio

(c) mechanical advantage < velocity ratio

(d) mechanical advantage independent of velocity ratio.

PART – B

Answer any *five* questions.

2. State parallelogram law of forces. A particle is acted upon by the following forces

(i) 20N inclined 30 degree north of east

(ii) 25N towards north

(iii) 30N towards north west

(iv) 35N inclined 40 degree south of west. Find the magnitude and direction of the resultant force.

2+7=9

3. State equilibrium conditions for bodies under coplanar non concurrent forces. Find the magnitude of two like parallel forces acting at a distance of 1m apart whose resultant force is 300 N acting at a distance of 200 mm from one of the forces.

3+6=9

4. Write the differences, between center of gravity and centroid. Find the moment of inertia about the horizontal centroidal axis of an I section of following dimension :

Top flange = 60 mm × 10 mm, Web = 10 mm × 100 mm, Bottom flange = 120 mm × 10 mm.

2+7=9

5. What are laws of static friction ?

A body resting on a rough horizontal plane required a pull of 82 N inclined at 30 degree of the plane just to move it. It was found that a push of 100 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. 2+7=9

6. Establish the relation between mechanical advantage, velocity and efficiency of a lifting machine. In a lifting machine the effort required to lift loads of 200N and 300N were 50N and 60N respectively. If the velocity ratio of the machine is 20, determine –

   (i) law of the machine

   (ii) the maximum efficiency which can be expected from this machine. 2+4+3=9

7. State D' Alembert's principle. A stone is thrown from the ground vertically upwards with a velocity of 40m/s. After 3 seconds another stone is thrown in the same direction and from the same place if both the stone strike the ground at the same time, calculate the velocity with which the second stone was thrown. 2+7=9