Total No. of printed pages = 8

ME 181104

Roll No. of candidate | | | | | | | | | | |

2019

B.Tech. 1st Semester End-Term Examination

ENGINEERING MECHANICS

New Regulation (w.e.f. 2017 – 18) &
New Syllabus (Group B) (w.e.f. 2018 – 19)

Full Marks – 70 Time – Three hours

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

Answer question No. 1 and any *four* questions from the rest.

1. Answer the following MCQ : (10 × 1 = 10)

   (i) When resolving a force into its components
   - (a) only one component is possible
   - (b) only two components are possible
   - (c) only three components are possible
   - (d) infinite number of components are possible

   (ii) Method of Sections of truss analysis is generally found useful to determine
   - (a) forces in all members
   - (b) forces in selective members
   - (c) weights of the members
   - (d) bending of members

[Turn over

(iii) The maximum frictional force which comes into play, when a body just begins to slide over the surface of the other body, is known as

(a) static friction

(b) dynamic friction

(c) limiting friction

(d) coefficient of friction

(iv) The point, through which the whole weight of the body acts, irrespective of its position is known as

(a) moment of inertia

(b) centre of gravity

(c) centre of percussion

(d) centre of mass

(v) The second moment of area about the centroidal y axis of a rectangle having width b and height h will be

(a) $bh^3/12$

(b) $bh^3/3$

(c) $hb^3/12$

(d) $hb^3/3$

(vi) A machine having an efficiency less than 50%, is known as

(a) reversible machine

(b) non-reversible machine

(c) neither reversible nor non-reversible machine

(d) ideal machine

(vii) The velocity of a body on reaching the ground from a height h is

(a) $\sqrt{gh}$

(b) $2\sqrt{gh}$

(c) $2g\sqrt{h}$

(d) $\sqrt{2gh}$

(viii) Work done is zero when

(a) the motion is at right angles to the direction of force

(b) the body is in equilibrium

(c) the displacement is zero

(d) all of these

(ix) The free fall of a body is an example for

(a) uniform motion

(b) uniformly accelerated motion

(c) non-uniformly accelerated motion

(d) curvilinear motion

(x) When a body is suspended about a horizontal axis, its centre of gravity lies

(a) above the point of suspension

(b) anywhere on the body

(c) vertically below the point of suspension

(d) at the point of suspension

2. (a) Calculate the magnitude and direction of the resultant shown in Fig. 1

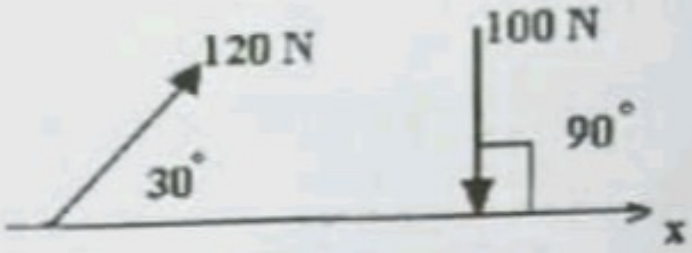

Fig. 1

(b) A roller of radius r = 120 mm and weight Q = 500 N is to be pulled over a curb of height h = 60 mm by a horizontal force P applied to the end of a string wound around the circumference of the roller. Find the magnitude of P required to start the roller over the curb (Fig. 2).

(5 + 10 = 15)

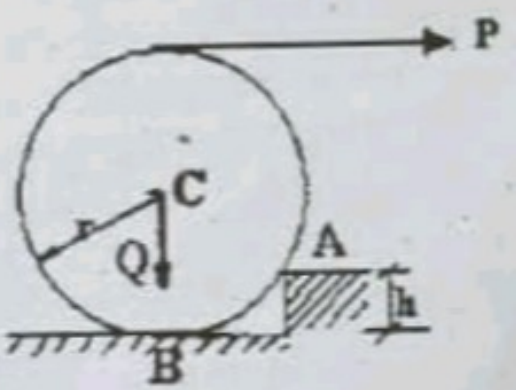

Fig. 2

3. (a) 'Method of joints is a special case of method of sections'. Explain. When do you think 'Method of sections' is preferable over 'Method of joints'?

(b) Cantilever truss is loaded as shown in fig 3. Find the forces in the members of the truss using method of Joints. (5 + 10 = 15)

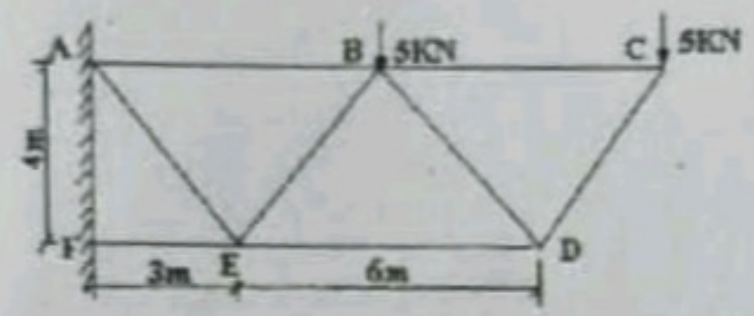

Fig. 3

4. (a) What is cone of friction? Show that the angle of repose is equal to angle of static friction.

(b) Two blocks connected by a horizontal link AB are supported on two rough planes as shown in fig.4. 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 $\phi = 15°$. What is the smallest weight W of block A for which equilibrium of the system can exist? (5 + 10 = 15)

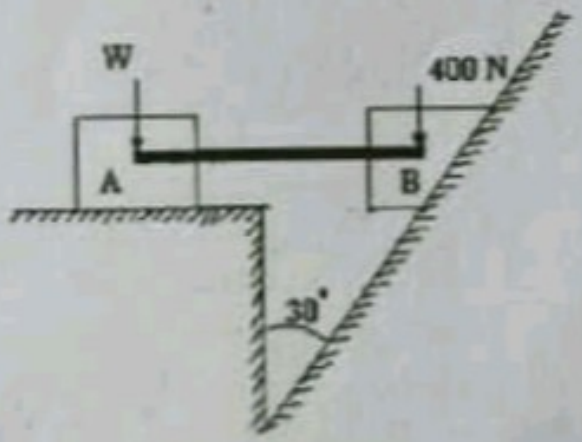

Fig. 4

5. (a) Determine the coordinates X_c and Y_c of the shaded area AB of radius r and central angle α as shown in Fig. 5

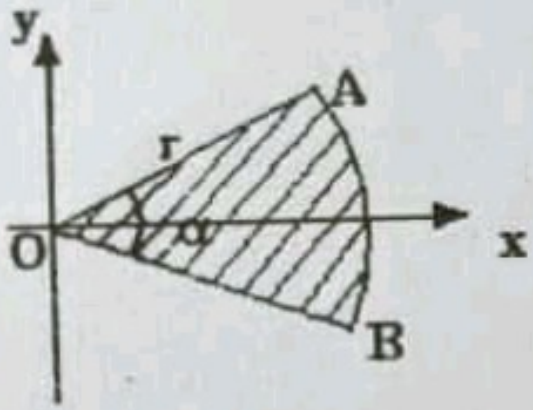

Fig. 5

(b) Find the Moment of inertia of the section about its CG as shown in Fig. 6. (5 + 10 = 15)

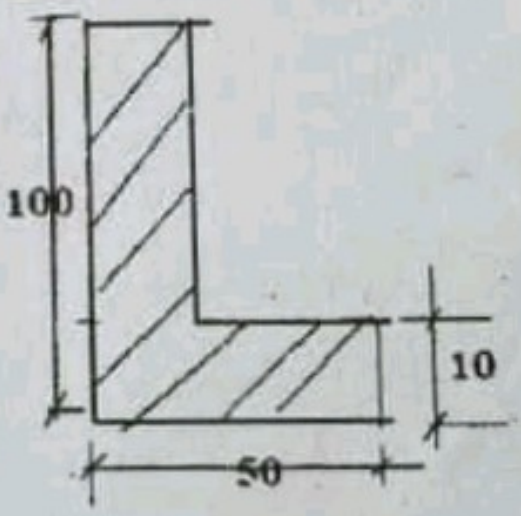

Fig. 6

6. (a) State D'Alembert's principle. What is the advantage of D'Alembert's principle compared to Newton's second law of motion?

(b) Two blocks of weighs P and Q are connected by a flexible but inextensible cord and supported as shown in fig.7. If μ is the coefficient of friction between block P and the surface, find

(i) the acceleration of the system and

(ii) the tensile force S in the cord. Take the following numerical data $P = 12N$, $Q = 6N$, $\mu = 1/3$. (5 + 10 = 15)

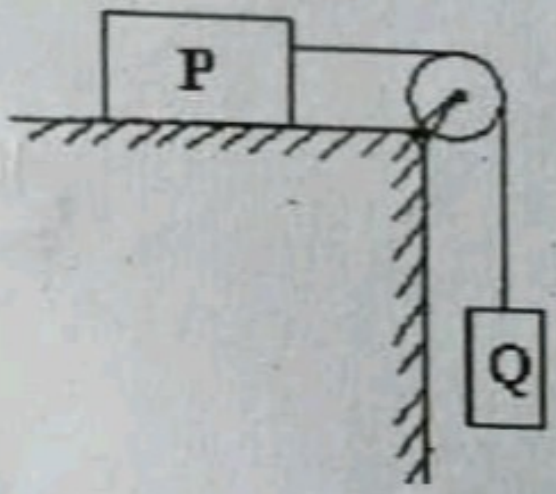

Fig. 7

7. (a) An effort of 50 N is required by a machine to lift a load of 500 N. The distance moved by the effort is 63 cm and the corresponding load movement is 6 cm. Make calculations for the mechanical advantage, velocity ratio and efficiency of the machine.

(b) Four bars AB, BC, CD, DA each of length L are hinged together at their ends so as to form a rhombus as shown in figure 8. Find the relation between the forces P and Q for equilibrium of any configuration defined by the angle θ. Neglect the weight of the bars and friction. Use Virtual work concept. (5 + 10 = 15)

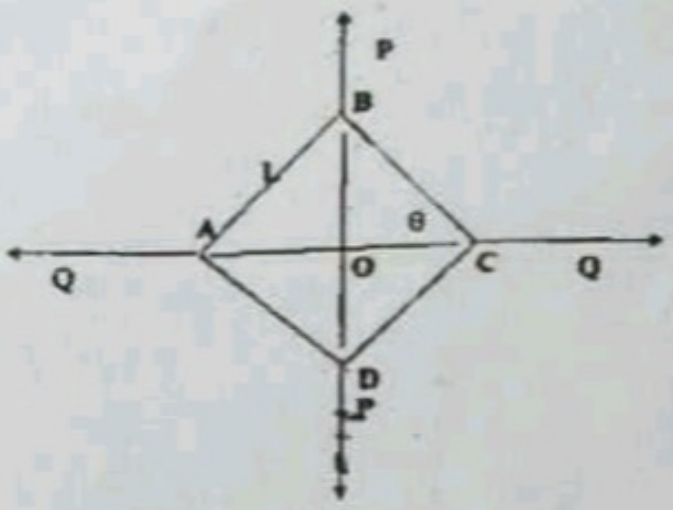

Fig. 8