END SEMESTER EXAMINATION, 2019

1947

Semester: 2nd Sem
Subject code: ME - 201
Subject: Engineering Mechanics (New Course)
Full Marks: (Part A-25 + Part B-45) =70
Duration: 3 hours

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: 1x10=10

a) One kg force is equal to _____.
b) The process of finding out the resultant force is called _____ of forces.
c) The resultant of two forces P and Q (such that P > Q) acting along the same straight line, but in opposite direction is given by _____.
d) The forces which do not meet at one point and their lines of action do not lie on the same plane are known as _____.
e) The point through which the whole weight of the body acts, irrespective of its position is known as _____.
f) The S.I. unit of moment of inertia is _____.
g) The friction experienced by a body, when at rest is known as _____.
h) In actual machines, mechanical advantage is _____ velocity ratio.
i) The velocity ratio for the first system of pulleys is _____.
j) The rate of doing work is known as _____.

2. Write true or false : 1x10=10

a) Energy may be defined as the capacity of doing work.
b) The rate of displacement of a body is called momentum.
c) A non-reversible machine is also called a self-locking machine.

d) The angle of the inclined plane at which a body just begins to slide down the plane, is called helix angle.
e) Static friction is always less than dynamic friction.
f) Moment of inertia of a rectangular section 3 cm wide and 4 cm deep about x-x axis is 16 cm^4.
g) The centre of gravity of a triangle lies at a point where its medians intersect each other.
h) If the resultant of a number of forces acting on a body is zero, then the body will not be in equilibrium.
i) Vectors method for the resultant force is also called polygon law of forces.
j) The resultant of two forces each equal to P and acting at right angles is $\sqrt{2}$ P.

3. Choose the correct answer : 1x5=5

a) Two forces are acting at an angle of 120^0. The bigger force is 40 N and the resultant is perpendicular to the smaller one. The smaller force is
i) 20 N ii) 40 N iii) 80 N iv) None of these

b) The forces, whose line of action are parallel to each other and act in the same direction, are known as
i) Coplanar concurrent forces ii) Coplanar non-concurrent forces
iii) Like parallel forces iv) Unlike parallel forces

c) The centre of gravity of an equilateral triangle with each side a is, _____ from any of the three sides.

i) $\sqrt{3}\frac{a}{2}$ ii) $2\sqrt{3}\,a$ iii) $\frac{a}{2\sqrt{3}}$ iv) $3\sqrt{2}\,a$

d) The moment of inertia of a square of side 'a' about an axis through its centre of gravity is

i) $\frac{a^4}{4}$ ii) $\frac{a^4}{8}$ iii) $\frac{a^4}{12}$ iv) $\frac{a^4}{36}$

e) Co-efficient of friction depends upon
i) area of contact only ii) nature of surface only
iii) both (i) and (ii) iii) none of these

PART-B
MARKS-45

4.a) State the principle of transmissibility of a force. 2

b) Find the magnitude of two forces such that, if they act at right angles, their resultant is 5N while when they act at an angle of 60^0, their resultant is $\sqrt{37}$ N. 7

5. a) State Lami's theorem. 2

b) A machine weighing 1500 N is supported by two chains attached to some point on the machine. One of these ropes goes to the eye bolts in the wall and is inclined at 30^0 to the horizontal and other goes to the hook in ceiling and is inclined at 45^0 to the horizontal. Find the tensions in the two chains. 7

6. a) State parallel axis theorem. 2

b) Find the moment of inertia about the horizontal axis through the c.g. of the I section having the following dimensions. 7
Top flange : 60 mm x 10 mm
Web : 10 mm x 100 mm
Bottom flange : 120 mm x 10 mm

7. a) What are the laws of static friction. 2

b) An effort of 200 N is required just to move a certain body up an inclined plane of 15^0, the force acting parallel to the plane. If the angle of inclination of the plane is made 20^0, the effort required again applied parallel to the

plane, is found to be 230 N. Find the weight of the body and the co-efficient of friction. 7

8.a) Define mechanical advantage and velocity ratio. 3

b) In a lifting machine an effort of 120 N raises a load of 6.5 KN and the efficiency of the machine is 60%. If on the same machine an effort of 200 N raises a load of 11.5 KN, what is the maximum mechanical advantage and maximum efficiency. 6

9.a) A simple screw jack has a thread of pitch 12 mm. Find the load that can be lifted by an effort of 20 N applied at the end of the handle 500 mm long. Take efficiency of the machine as 50%. 5

b) In a simple wheel and axle, the radius of effort wheel is 240 mm and that of the axle is 40 mm. Determine the efficiency, if a load of 300 N can be lifted by an effort of 60 N. 4

10. a) A stone is thrown from the ground vertically upwards, with a velocity of 40 m/s. After 3 seconds another stone is thrown in the same direction and from the same place. If both the stones strike the ground at the same time, compute the velocity with which the second stone was thrown. 5

b) A burglar's car had a start with an acceleration of 2 m/s^2. A police vigilant party came after 5 seconds and continued to chase the Burglar's car with a uniform velocity of 20 m/s. Find the time taken, in which the police will overtake the car. 4

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