WBSCTE DIPLOMA QUESTION PAPER
FIRST YEAR COMMON FOR ALL BRANCHES
ENGINEERING MECHANICS DEC 2017

1. A. Fill in the blanks (any ten):

i) ……. is equal and opposite to the resultant of several forces acting on the body.

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

iii) The process of finding out the resultant force of two or more given forces is called …….

iv) The turning or rotational tendency of a force is called …….

v) A ……. has no resultant force but has resultant moment.

vi) Principle of moment is based on …….

vii) Dynamic or kinetic friction is always ……. than the static friction.

viii) Frictional force is directly proportional to …….

ix) Velocity ratio of first system of pulley is …….

x) The C.G. of a solid circular cone divides the height in the ratio ………..

xi) The maximum mechanical advantage of a lifting machine is ………

xii) The diagram which shows all forces including reactions at the contact surface after removing supports is known as ……… diagram.

B. State True or False (any ten):

i) If the arm of a couple is doubled, it's moment will be same.   [   ]

ii) Moment of a force is a scalar quantity.   [   ]

iii) The components of a force along two mutually perpendicular lines are called rectangular components.   [   ]

iv) The resultant of two like parallel forces acts at a point between their points of application. [   ]

v) The distance of C.G. from its base of a right circular cone of height 'h' is $\frac{h}{4}$.   [   ]

vi) Equivalent couple is one where moment and direction are different.   [   ]

vii) At the point of reversing the efficiency of a simple lifting machine is 60%.   [   ]

viii) Velocity ratio of a simple machine is constant.   [   ]

ix) In actual machine MA> VR .   [   ]

x) Load vs Effort graph is a curve.   [   ]

xi) A machine is said to be self-locking when its efficiency is less than 50%.   [   ]

xii) Semi-central angle in cone of friction is equal to angle of friction.   [   ]

Group -A

2. a) Give geometrical representation of moment of a force.

b) Two men carry a concrete bloCk weighing 400 N using a light wooden plank on their shoulders. The stronger man carries 225 N. How should the block be supported so that the stronger man gets his share if the length of the plunk between the shoulders is 3.5 meter?

3. a) Write short notes on equivalent couple.

b) A horizontal bridge AB of 18 meter long weighing 18 kN and rest on two supports at its end. What will be the pressure on each support when a car of weight 5 kN starting from A is two third of the way across the bridge.

4. a) State, explain and prove Lami's theorem.

b) A string AC of length 24 cm is attached to a point on a smooth vertical wall and to a point on the surface of a sphere of radius CO is 12 cm. The sphere whose weight is 100 kN hangs in equilibrium against the wall. Find the tension in the string and the reaction of the wall. (Fig. 1)
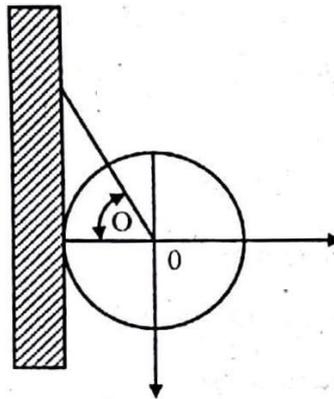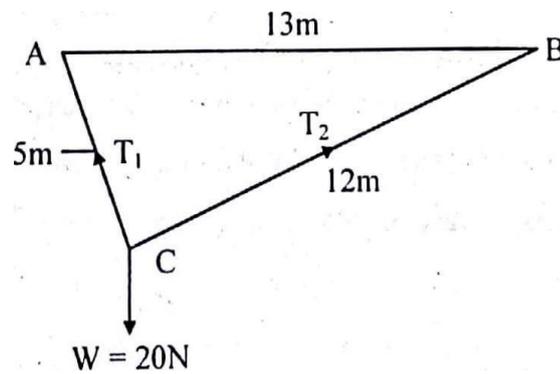

Fig: 1

5. a) State and explain triangular law of equilibrium.

b) A body of weight 20 N is suspended by two strings 5 meter and 12 meter long and other ends being fastened to the extremities of a rod of length 13 meter. If the rod is to remain horizontal, determine the tensions in the strings. (Figure below)

Group-B

6. a) Define limiting friction and normal reaction.

b) A body resting on a horizontal plane required a pull of' 80 N inclined to 30° to horizontal jus to move it. It was also found that a push of 100 N inclined at 300 to the horizontal just moved the

7. a) Prove that angle of repose is equal to the angle of friction.

b) A load W acts on an inclined plane of inclination e to the horizontal. If the co-efficient of friction is μ, show that the horizontal force necessary to move the load up the plane is $\dfrac{\mu + \tan\theta}{1 - \mu\tan\theta} \times W$.

8. a) Define the terms 'Coefficient of friction' and 'Angle of friction'.

b) A uniform ladder of weight 1000 N, inclined 45° to the horizontal, rests with upper extremity against a rough vertical wall and its lower extremity on the ground. Find the least horizontal force which will move the lower end towards the wall. Given 0.25 and 0.20 are the co-efficient of friction at the lower and upper ends respectively.

9. a) Find out the centroid of the uniform triangular lamina by method of integration.

b) Find out the centroid of an I-section has bottom flange 20 cm × 2 cm, top flange 10 cm × 2 cm and web 15 cm × 2 cm.

Group - C

10. a) Define mechanical advantage, velocity ratio, efficiency and effort of a simple machine.

b) For a differential wheel and axle, the diameter of the wheel is 240 mm. The larger and the smaller diameter of the differential axle are 80 mm and 70 mm respectively. An effort of 320N is applied to lift a load of 8000 N. Determine (i) V.R. (ii) M.A. (iii) Efficiency of the machine, and (iv) Effort lost in friction.

11. a) Derive the conditions maximum efficiency of a lifting machine.

b) in a lifting machine, the effort required to lift a load of 250 N and 375 N are 60 N and 70 N respectively. If the velocity ratio of the machine is 20. Determine - (i) law of machine, (ii) efficiencies corresponding to load of 250N and 375N, (iii) effort lost in friction in both cases.

12. a) A simple screw jack has a thread of pitch of 10 mm, find the mechanical advantage and efficiency, if an effort of 20N is applied at the end of an arm 500 mm long to lift a load 2.6kN.

b) The number of teeth on the worm wheel of a double threaded worm and worm wheel is 25. The effort handle is 25 cm long and load drum is of 15 cm diameter. Find the efficiency of the machine, if an effort of 300 N can lift load of 3.25KN.