Reg. No.										

प्रज्ञानं ब्रह्म

Manipal
INSPIRED BY LIFE

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

I SEMESTER B.S. DEGREE EXAMINATION – JUNE 2016

SUBJECT: ENGINEERING STATICS AND DYNAMICS (CE 111)

(COMMON TO ALL BRANCHES)

SATURDAY, 11th JUNE, 2016

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer FIVE full questions.**
- ✓ **Assume missing data, if any, suitably and indicate them clearly**

1.A. Explain Triangle Law and Polygonal Law of forces with neat sketches highlighting the conditions for equilibrium graphically.

1.B. . A body of negligible weight, subjected to two forces F_1= 900N, and F_2=100N acting along the vertical, and the horizontal directions respectively, as shown in Fig Q. No. 1B. Find the component of each force parallel, and perpendicular to the plane AB.

1.C. A ladder of length 6m weighing 600 N is placed at 45˚ against a vertical wall. The coefficient of friction between the ladder and wall is 0.2 and ladder and ground is 0.5. If a man weighing 800 N ascends the ladder, how high will he be when the ladder slips. If a boy now stands on the bottom of the rung of the ladder what must be his least weight so that the man can go up to the top of the ladder. **(5+5+10=20 Marks)**

2.A. Derive an expression for Moment of a Couple with respect to a Moment Center with a neat Figure. Also, Resolve a Force into Force-couple system illustrating with a neat sketch.

2.B. Two cylinders P and Q of diameters 120mm and 60mm, weighing 180N and 45N respectively, are placed in a trench as shown in Fig Q. No. 2B. Assuming all contact surfaces as smooth, determine reactions at all contact points. **(5+15=20 Marks)**

3.A. Find forces in members of a truss shown in Fig Q. No. 3A by the method of joints.

3.B. What horizontal force P is required on the wedges B and C just to raise the weight 1500N resting on A? Angle of limiting friction between all contact surfaces is 15^o. Refer Fig Q. No. 3B. **(12+8=20 Marks)**

4.A. Locate the centroid of an area (Fig Q. No. 4A) with respect to axis Y-Y. Also, determine the second moment of area and radius of gyration with respect to the vertical centroidal axis.

4.B. State Parallel Axis Theorem. With a neat figure, derive the expression for the second moment of area for an axis parallel to horizontal centroidal axis.

(14+6=20 Marks)

5.A. Define: i) Rigid Body ii) Equilibrium iii) Polar Moment of Inertia

5.B. Locate the centroid of quarter Circular Area with respect to any boundary radial line from first principle.

5.C. Determine the resultant of a coplanar force system shown in Fig Q. No. 5C. Locate the resultant with respect to A. **(3+5+12=20 Marks)**

6.A. The blocks A and B having weights 150 N and 400 N start from rest. The horizontal plane and the pulleys are frictionless. Determine the acceleration and the tension in the string. Refer (Fig Q. No. 6A).

6.B. A ball of mass 30grams moving with a velocity of 4m/s impinges on a ball of mass 40grams moving with a velocity of 2m/s. The velocity of the two balls are parallel and inclined at 30^0 to the line joining the centre at the instant of impact. If e = ½ , find the magnitude and direction of velocity after impact. **(8+12=20 Marks)**

7.A. A man weighing 700N moves horizontally with a velocity of 2m/s and jumps on to a boat which is at rest and at the same level. If the boat weighs 3000N, what is the velocity of both? What is the distance traveled before coming to rest if they are subjected to an opposing force of 40N?

7.B. Explain i) Impulse of a Force ii) Energy iii) D'Alembert's Principle iv) Momentum

7.C. A bullet of weight 0.25N is fired horizontally into a body of weight 100N which is suspended by a string 0.75m long. Due to this impact the body swings through an angle of 35^o. Find the velocity of the bullet. **(8+4+8=20 Marks)**

8.A. A motorist traveling at a speed of 68kmph suddenly applies his brakes and comes to a stop after skidding 40m. Determine

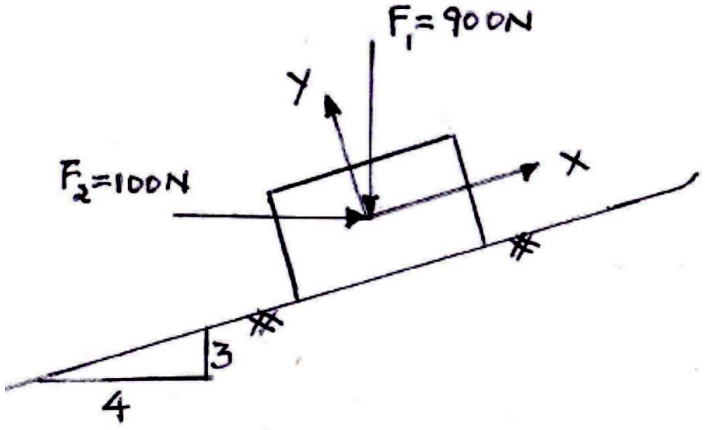
a. Time required for the car to stop
b. The coefficient of friction between the tyres and the pavement.

8.B. A road curve has radius of 240m. It is banked to have no side thrust for a vehicle speed of 52 Kmph. Find the safe velocity for avoiding skidding if $\mu = 0.25$.

8.C. A ball is thrown against a wall with a velocity of 12m/s making an angle 40^0 with the wall. If e=0.5, find the magnitude and direction of velocity after impact.

(10+5+5=20 Marks)

A



B

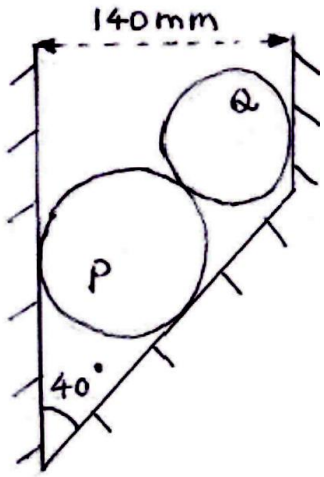
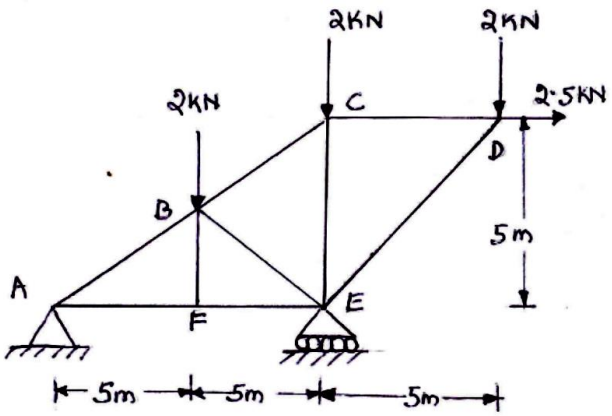


Fig Q. No. 1B

Fig Q. No. 2B



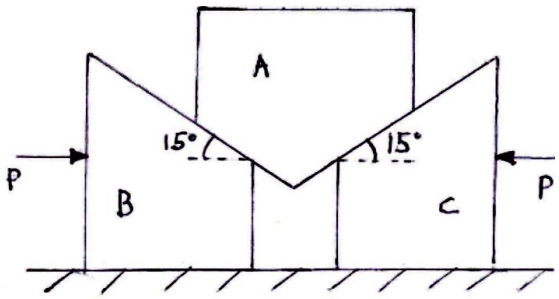
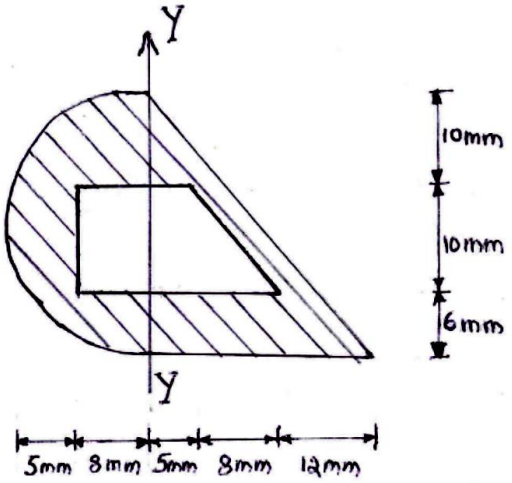


Fig Q. No. 3A

Fig Q. No. 3B



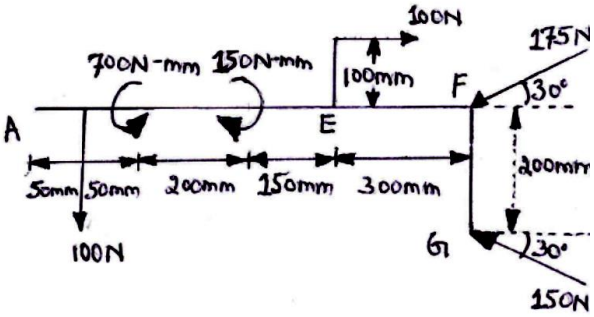


Fig Q. No. 4A

Fig Q. No. 5C

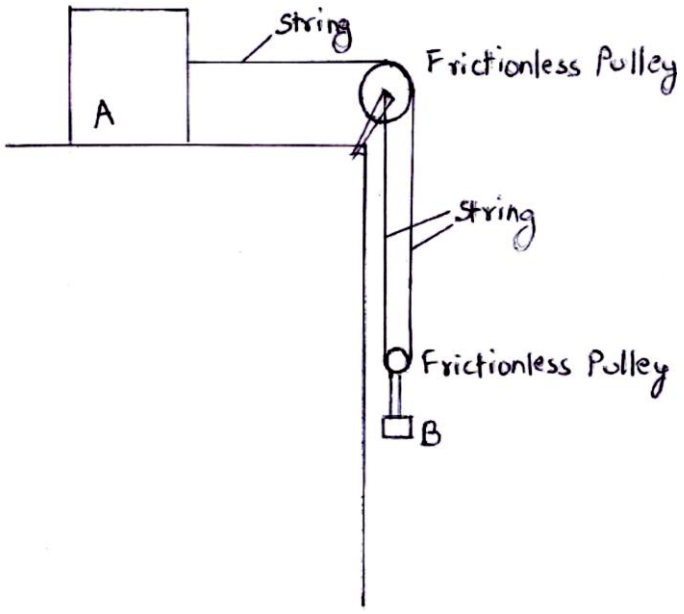

String
Frictionless Pulley
A
String
Frictionless Pulley
B

Fig Q. No 6A