2014
STRUCTURE-I

Paper : 1.5
Full Marks : 100
Time : 3 Hours

The figures in the margin indicate full marks for the questions.
Answer any five questions.

1. a) A triangular frame structure is- 2
   i) Perfect
   ii) Imperfect
   iii) Deficient

   b) The resultant of two forces P and Q, acting at an angle θ is equal to-
   i) $\sqrt{P^2+Q^2+2PQ\sin\theta}$ ii) $\sqrt{P^2+Q^2+2PQ\cos\theta}$
   ii) $\sqrt{P^2+Q^2-2PQ\sin\theta}$ iv) $\sqrt{P^2+Q^2-2PQ\cos\theta}$

   c) State true or false
   i) Moment of inertia forms the basic of rigid bodies and strength of materials.
   ii) A body is said to be in equilibrium if it has no linear motion.

   d) Which of the following is a fundamental quantity?
   i) Velocity
   ii) Area
   iii) Mass
   iv) Force

   e) The force of friction always acts in a direction opposite to that-
   i) In which the body tends to move
   ii) In which the body is moving.
   iii) Both (i) and (ii)
   iv) None of the above

   f) According to Lami's theorem, the three force-
   i) Must be at 120^0 to each other
   ii) Must be both of above
   iii) May not be any of the two

g) The Lami's theorem is applicable only for-
   i) Coplanar force
   ii) Concurrent forces
   iii) Coplanar and concurrent forces
   iv) Any type of forces.

h) The force of friction between two bodies in contact depends upon the-
   i) Area of the contacts
   ii) Relative velocity between them
   iii) Is always normal to both (i) and (ii)

i) The moment of inertia of a circular section of diameter 'd' is given by the relation –

   i) $\frac{\pi}{16}(d)^4$ ii) $\frac{\pi}{32}(d)^4$

   iii) $\frac{\pi}{64}(d)^4$ iv) $\frac{\pi}{96}(d)^4$

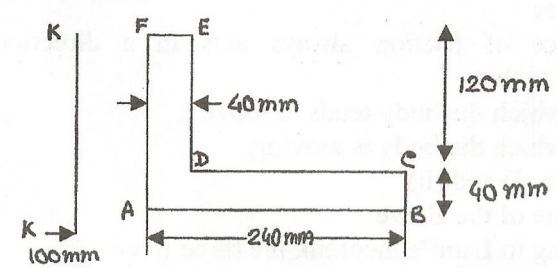
j) The contre of gravity of hemisphere lies at a distance of _____ from its base measured along the vertical radius

   i) $\frac{3r}{8}$ ii) $\frac{3}{8r}$ iii) $\frac{8r}{3}$ iv) $\frac{8}{3r}$

2. a) State Parallelogram Law of force 10
   b) The following forces act at a point- 10
      i) 20N inclined at 30^0 towards NE
      ii) 25N towards N
      iii) 30N towards NW and
      iv) 35N inclined at 40^0 towards SW

   Find the magnitude and direction of the resultant force.

3. a) Define moment of force 5
   b) Find the moment of Inertia of the area ABCDEF as shown below: 15

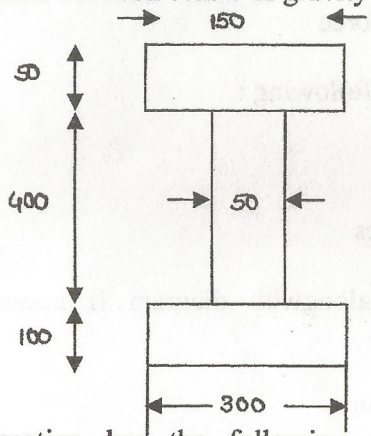


Compute the MI of the above area about pair K-K

4. a) Write down the effects of a force and characteristics of force. 5
   b) Find the magnitude of the two forces, such that they act right angles, their resultant is $\sqrt{10}N$. 15

   But if they act at 600, their resultant is $\sqrt{13}N$.

5. Differentiate between centre of gravity and centroid. 5+15



An I- section has the following dimentions Bottom flange=300mm×100mm
Top flange = 150mm×50mm
Web=400mm×50mm
Determine the position of centre of gravity.

6. a) State true or false : 1×10
   i) The SI units of luminous intensity is Candela
   ii) The C.G. of a body depends upon the shape of the body.
   iii) Co-efficient of friction has no units.
   iv) The CG of a body always lies inside the body
   v) Collinear forces mean the forces are having the same plane.
   vi) A body is said to be in equilibrium if it has no linear motion
   vii) Moment of inertia is also called second moment of area.
   viii) The moment of inertia of an area may be obtained by the method of integration.
   ix) Friction force can accelerate a body.
   x) If like parallel forces are acting on a body, the body remains in equilibrium.

P.T.O.

b) Define the following : 2×
   i) Kinematics
   ii) Fundamental units
   iii) Dynamic friction
   iv) Moment of a force
   v) Force

7. Write short notes on the following : 4×
   i) Limiting friction
   ii) Effects of force
   iii) Moment of Inertia
   iv) Equilibrium of forces
   v) Normal reaction

8. Define the following alongwith diagram if necessary (attempt any five) : 4×
   i) Angle of friction
   ii) Laws of static friction
   iii) Concurrent forces
   iv) Perfect frame
   v) Collinear forces
   vi) Parallel forces and couples.

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