**Reg. No. :** | | | | | | | | | | |

# Question Paper Code: 51121

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Second Semester

Civil Engineering

15UCE206 - BASIC ENGINEERING MECHANICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A system of three forces acts on a body and keeps it in equilibrium. The forces need to be

   (a) three forces acting at a point are always in equilibrium
   (b) if three forces acting on a point can be represented in magnitude and direction by the sides of a triangle, the point will be in the state of equilibrium
   (c) three coplanar forces acting at a point will be in equilibrium, if each force is proportional to the sine of the angle between the other two
   (d) three coplanar forces acting at a point will be in equilibrium if each force is inversely proportional to the sine of the angle between the other two

2. The necessary condition of equilibrium of a body, is

   (a) algebraic sum of horizontal components of all the forces must be zero
   (b) algebraic sum of vertical components of all the forces must be zero
   (c) algebraic sum of the moments of the forces about a point must be zero
   (d) all the above

3. Reactions at the supports of a structure can be determined by equating the algebraic sum of

   (a) Horizontal forces to zero (b) vertical forces to zero
   (c) moments about any point to zero (d) all the above

4. A frame is said to be redundant if it satisfies

(a) $m = 2j-3$ (b) $m > 2j-3$ (c) $m = 2j+3$ (d) $m < 2j-3$

5. Which one of the following statements is true?

(a) The tangent of the angle of friction is equal to coefficient of friction
(b) The angle of repose is equal to angle of friction
(c) The tangent of the angle of repose is equal to coefficient of friction
(d) All the above

6. The angle which an inclined surface makes with the horizontal when a body placed on it is on the point of moving down, is called

(a) angle of repose (b) angle of friction
(c) angle of inclination (d) None of these

7. The centre of gravity of plane lamina will not be at its geometrical centre if it is a

(a) Circle (b) Square
(c) Rectangle (d) Right angled triangle

8. The centre of gravity of a homogeneous body is the point at which the whole

(a) volume of the body is assumed to be concentrate
(b) area of the surface of the body is assumed to be concentrated
(c) weight of the body is assumed to be concentrated
(d) all the above

9. The unit of Moment of Inertia of a body, is

(a) m (b) $m^2$ (c) $m^3$ (d) $m^4$

10. M.I. of a thin ring (external diameter D, internal diameter d) about an axis perpendicular to the plane of the ring, is

(a) $\frac{\pi}{64}(D^4 + d^4)$ (b) $\frac{\pi}{64}(D^4 - d^4)$ (c) $\frac{\pi}{64}(D^4 + d^4)$ (d) $\frac{\pi}{64}(D^4 \times d^4)$

PART - B (5 x 2 = 10 Marks)

11. Define Varignon's theorem.

12. What are the types of beams?

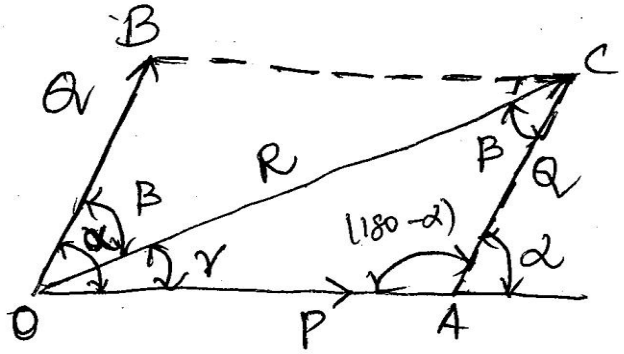
13. How can you classify the dynamic friction?.

14. Differentiate the centre of gravity and centroid.

15. State perpendicular axis theorem.

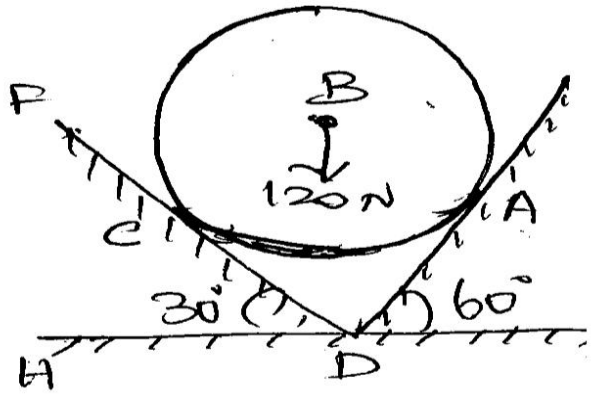
PART - C (5 x 16 = 80 Marks)

16. (a) Two forces P and Q are acting at a point O as shown in fig. The force P = 240 N and force Q = 200 N. If the resultant of the force is equal to 400 N, then find the values of angles β, α and g. (16)



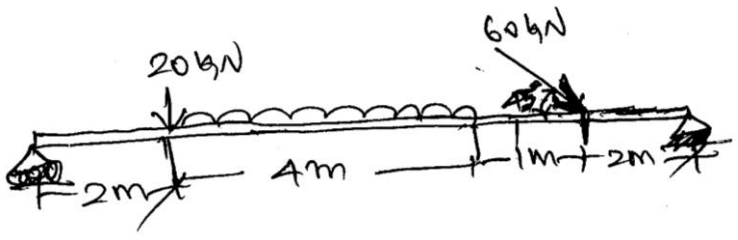

Or

(b) A ball weight 120 N rests in a right – angled groove, as shown in fig. The sides of the groove are inclined to an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then determine the reactions $R_A$ and $R_C$ at the point of contact. (16)



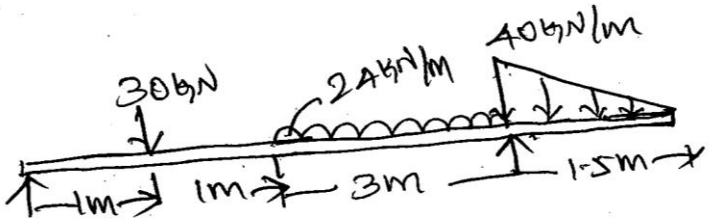

17. (a) Find the support reactions of the beam shown in fig.

(i)



(8)

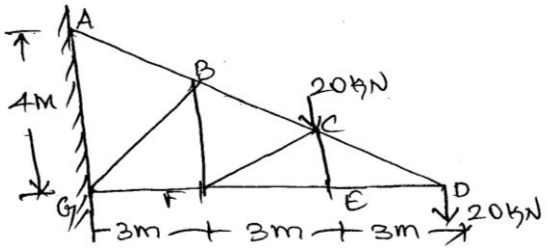
(ii)




(8)

Or

(b) Determine the member forces of the cantilever truss shown in fig, using method of joints. (16)

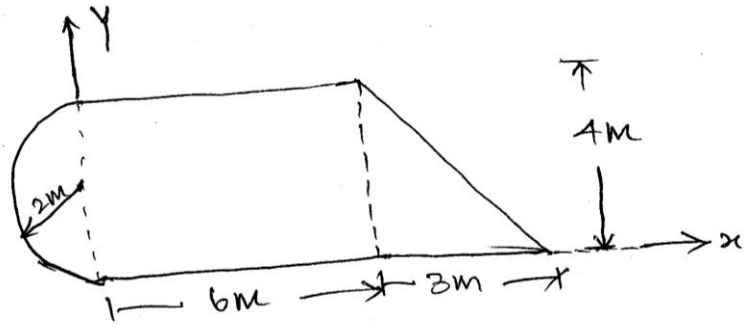



18. (a) A uniform ladder weight 200N of length 4.5 m rests on a horizontal ground and leans against a rough vertical wall. The co-efficient of friction between the ladder and floor is 0.4 and between ladder and vertical wall is 0.2. When a weight of 900 N is placed on the ladder at a distance of 1.2 m from the top of the ladder, the ladder is at the point of sliding. Find (i) the angle made by the ladder with horizontal (ii) Reaction at the foot of the ladder, and (iii) Reaction at the top of the ladder. (16)

Or

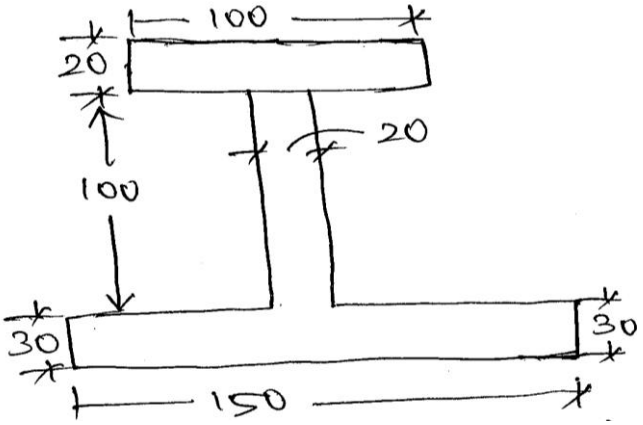
(b) An open – belt drive connects two pulleys 120 cm and 50 cm diameters, on parallel shafts 4 m apart. The maximum tension in the belt is 1853.3 N. The coefficient of friction is 0.3. The driver pulley of diameter 120 cm runs at 200 r.p.m. Calculate: (i) the power transmitted, and (ii) torque on each of the two shafts. (16)

19. (a) Determine the centroid of the area shown in fig. with respect to the axes shown. (16)

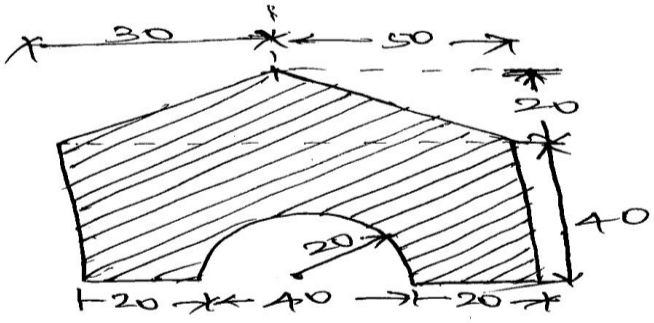



Or

(b) Loacate the centroid of the section shown in fig. all dimensions are in *mm*. (16)

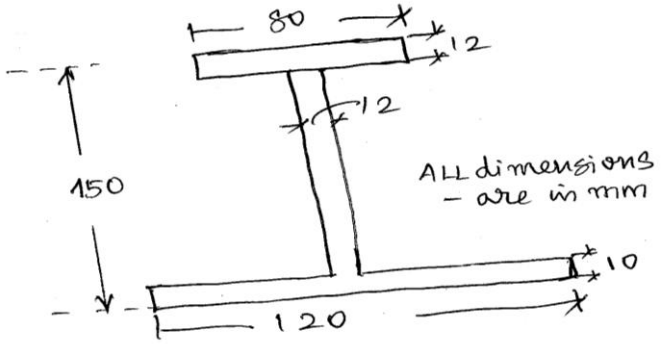



20. (a) Find the second moment of the shaded portion shown in the fig. about its centroidal axis. (16)




Or

(b) Determine the polar moment of inertia about centroidal axes of the I section shown in fig. Also determine the radii of gyration with respect to x-x and y-y axes. (16)



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