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14CIV13/23

First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Elements of Civil Engineering and Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting ONE full question from each module.***

Module – 1

1 a. With a neat sketch, explain the components of i) Earth dam; ii) Gravity dam. **(10 Marks)**

b. Determine the X and Y components of the forces shown in Fig.Q.1(b). **(10 Marks)**

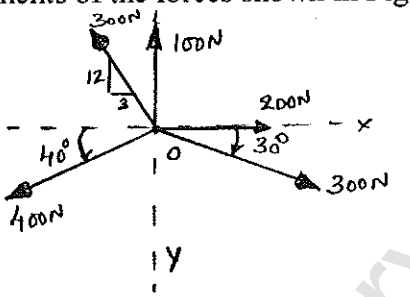


Fig.Q.1(b)

2 a. Define couple and state its characteristics. **(06 Marks)**

b. Draw a neat sketch of RCC-T beam bridge and name its components. **(04 Marks)**

c. Replace the system of forces acting on the frame shown in Fig.Q.2(c), by a resultant force 'R' through 'A' and a couple acting horizontally through 'B' and 'C'. **(10 Marks)**

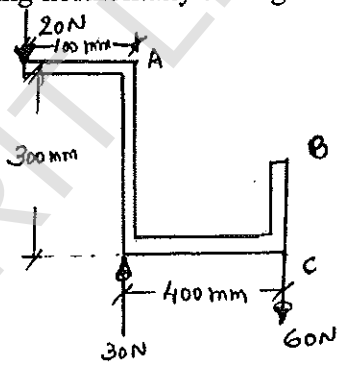


Fig.Q.2(c)

Module – 2

3 a. State and prove parallelogram law of forces. **(06 Marks)**

b. Check the stability of the dam carrying the forces as shown in Fig.Q.3(b). The dam is said to be stable if the resultant lies in the middle 1/3 of the base OT. **(10 Marks)**

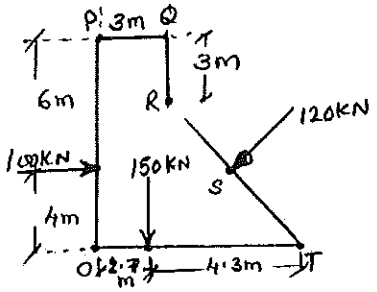


Fig.Q.3(b)

c. Define resultant and equilibrant of a force system. **(04 Marks)**

4 a. State and prove Varignon's theorem. **(06 Marks)**

b. Two locomotives on opposite banks of a canal pull a vessel moving parallel to the banks of a canal by means of ropes as shown in Fig.Q.4(b). The tension in the ropes are 20kN and 24kN while the angle between them is 60°. Find the resultant pull on the vessel along the centerline and the angle 'α' and 'β'. **(08 Marks)**

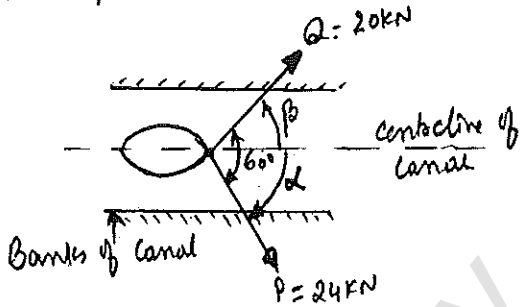


Fig.Q.4(b)

c. An electric transmission tower supports two cables carrying tensions of 80kN and 120kN as shown in Fig.Q.4(c). Determine the required tension in the guy wire AB, so that the resultant of the forces exerted by three cables will be vertical. Also find the magnitude of the resultant. **(06 Marks)**

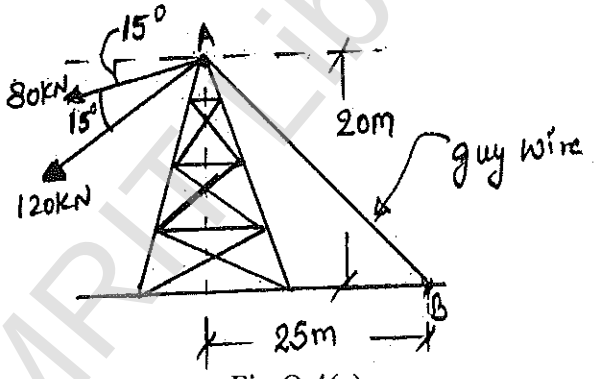


Fig.Q.4(c)

Module – 3

5 a. State conditions of equilibrium for coplanar concurrent and non concurrent force system. **(04 Marks)**

b. Draw a neat sketch showing the number of reactions at i) Roller support; ii) Hinged support; iii) Fixed support. **(06 Marks)**

c. Find the least value of 'P' required to cause the system of block shown in Fig.Q.5(c) to have impending motion to the left. The coefficient of friction for all contact surfaces are 0.2. **(10 Marks)**

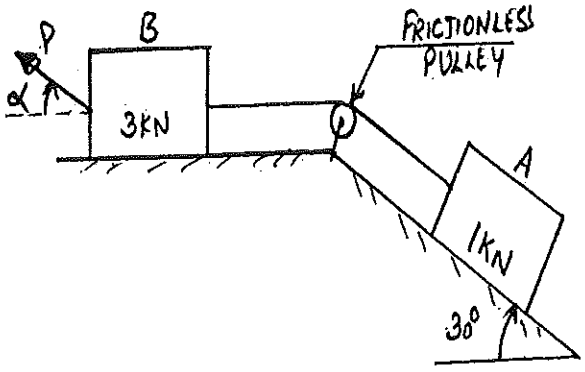


Fig.Q.5(c)

6 a. Define the terms: i) Coefficient of friction; ii) Angle of repose. **(06 Marks)**

b. Find the reactions for the beam loaded as shown in Fig.Q.6(b). **(06 Marks)**

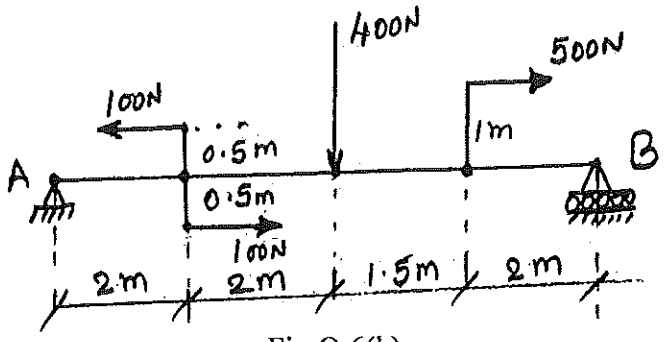


Fig.Q.6(b)

c. Cylinder 'A' of diameter 200mm and cylinder 'B' of diameter 300mm are placed in a trough shown in Fig.6(c). If cylinder 'A' weighs 800N and cylinder 'B' weighs 1200N, determine the reactions developed at contact surfaces P, Q, R and S. Assume that all contact surfaces are smooth. **(08 Marks)**

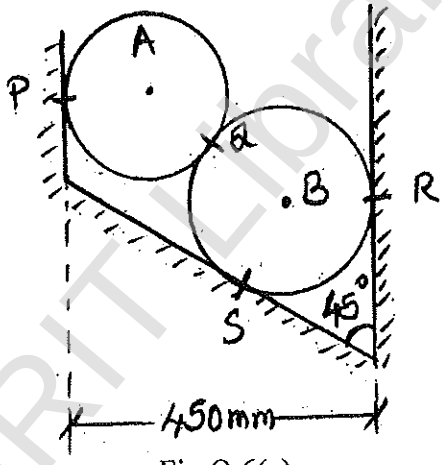
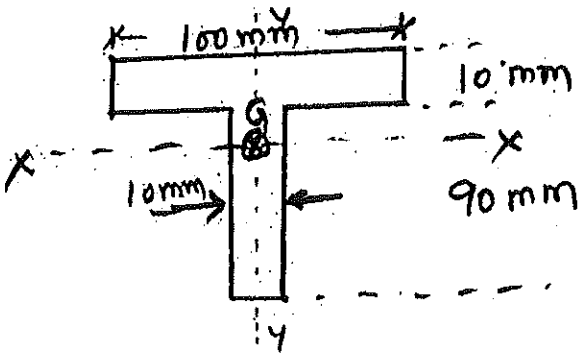


Fig.Q.6(c)

Module – 4

7 a. Derive an expression for the centroid of a semicircle of radius 'r' with respect to the base of the semicircle from the first principles. **(06 Marks)**

b. Determine the radius of gyration for the area shown in Fig.Q.7(b), along horizontal XX and vertical YY axis passing through the centroid of the area. **(14 Marks)**



8 a. State and prove parallel axis theorem. **(06 Marks)**

b. Locate the centroid of the lamina shown in Fig.Q.8(b) with respect to point 'O'. **(14 Marks)**

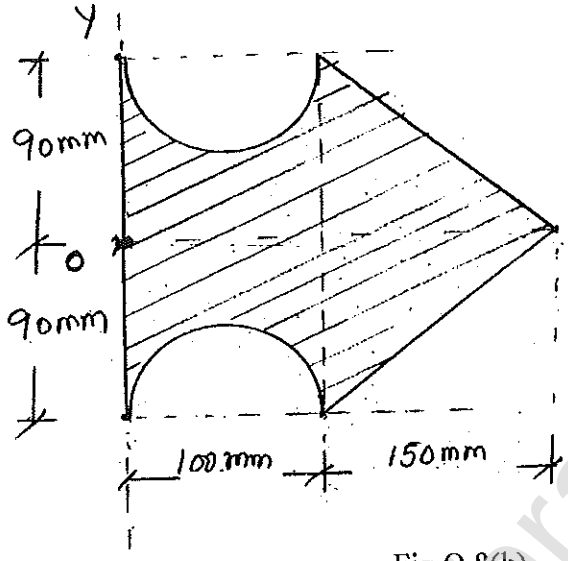


Fig.Q.8(b)

Module – 5

9 a. State Newton's Law's of motion. **(06 Marks)**

b. What is super elevation and list the benefits of providing the super elevation. **(06 Marks)**

c. A projectile is fired at certain angle with the horizontal and has a horizontal range of 3.5km. If the maximum height reached is 500m, what is the angle of elevation of the cannon? What was the muzzle velocity of the projectile? **(08 Marks)**

10 a. A small steel ball is shot up vertically with a velocity of 19.6 m/sec, from the top of a building 24.5m high. Calculate:

i) Time required for the ball to reach maximum height.

ii) How high the ball will rise above the building?

iii) Compute the velocity with which it will strike the ground.

iv) Total time for which the ball is in motion. **(10 Marks)**

b. The distance between two stations is 2500m. The locomotive starts from first station with an acceleration such that it reaches a speed of 36 kmph in 30 secs until its speed attained is 55 kmph. This speed is maintained until the brakes are applied and the locomotive is brought to rest at second station with a retardation of $1 m/sec^2$. Find the time taken to perform the journey and the distance covered during the acceleration, uniform and retarded motion. **(10 Marks)**

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