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15CIV13/23

First/Second Semester B.E. Degree Examination, July/August 2021 Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Explain the scopes of i) Geo Technical Engineering ii) Water Resources Engineering. (04 Marks)
- b. Define couple. List the characteristics of a couple. (04 Marks)
- c. Convert the given force system shown in Fig.Q.1(c) into an equivalent force-couple system acting at A. (08 Marks)

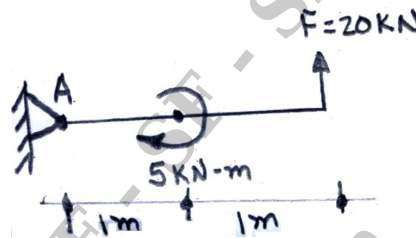


Fig.Q.1(c)

- 2 a. State principle of transmissibility of forces. What are its limitations? (04 Marks)
- b. Draw neat cross section of earthen dam. Indicate different components on it. (04 Marks)
- c. The moment of certain force 'F' is 200kN-m anticlockwise about 'K' and 100kN-m clockwise about 'L'. If the moment of 'F' about 'J' is zero, determine the force 'F', its inclination and position and show it on the diagram (Ref. Fig.Q.2(c)). (08 Marks)

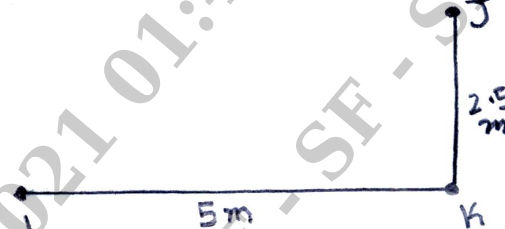


Fig.Q.2(c)

- 3 a. State and prove Varignon's theorem. (08 Marks)
- b. Calculate the resultant reaction at A and force in the cable BC (Ref. Fig.Q.3(b)). (08 Marks)

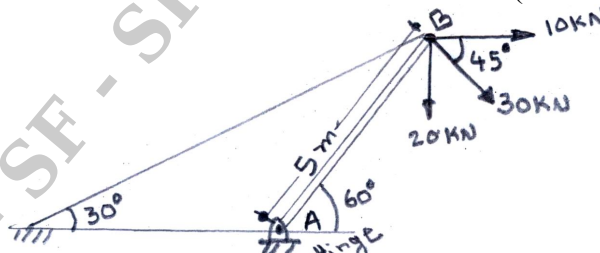


Fig.Q.3(b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 4 a. Explain with sketches the i) Hinged support ii) Roller support. (06 Marks)
 b. Find the magnitude, direction and position of the resultant for the system of forces shown in Fig.Q.4(b) with respect to 'P'. (10 Marks)

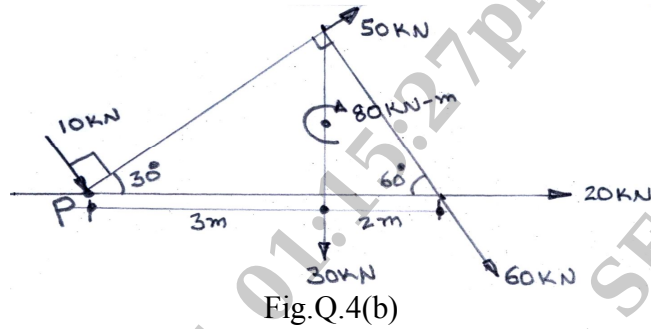


Fig.Q.4(b)

- 5 a. Define Equilibrant. (02 Marks)
 b. For the force system shown in Fig.Q.5(b), calculate 'h' for equilibrium. (06 Marks)

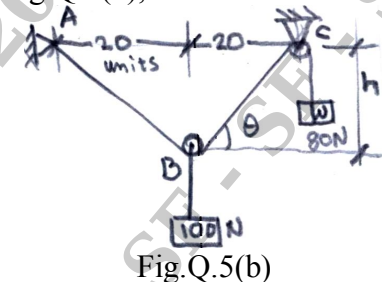


Fig.Q.5(b)

- c. Calculate the horizontal force 'P' required for limiting equilibrium. Take coefficient of friction on 0.3 (Ref.Fig.Q.5(c)). (08 Marks)

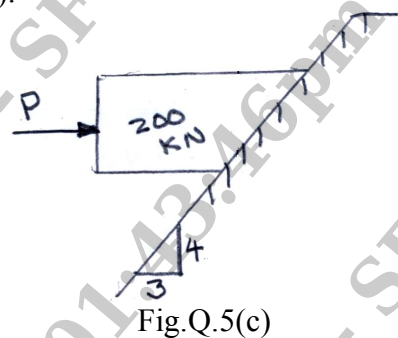


Fig.Q.5(c)

- 6 a. Define : i) Core of friction ii) Angle of friction. (02 Marks)
 b. Calculate the forces in the members AB, AD given force in AC is 100N and the force system is in equilibrium (Ref. Fig.Q.6(b)). (06 Marks)

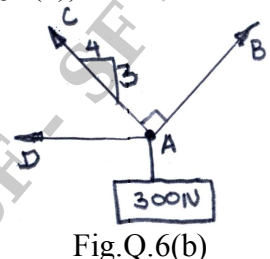


Fig.Q.6(b)

- c. Calculate the angles α and β , given that the force 1400N shown in Fig.Q.6(c) is the resultant of F_1 and F_2 . (08 Marks)

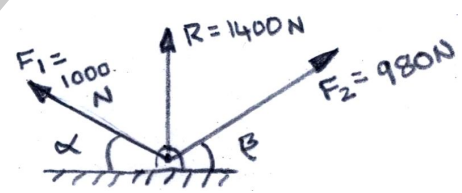


Fig.Q.6(c)

- 7 a. Establish the centroidal distance of a quarter circle from first principles. (06 Marks)
 b. Find the polar moment of inertia for the area shown in Fig.Q.7(b). (10 Marks)

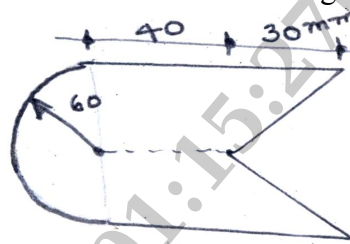


Fig.Q.7(b)

- 8 a. Explain: i) Radius of gyration ii) Parallel axes theorem. (06 Marks)
 b. Calculate the coordinates of centroid of the area shown in Fig.Q.8(b) with respect to "P". (10 Marks)

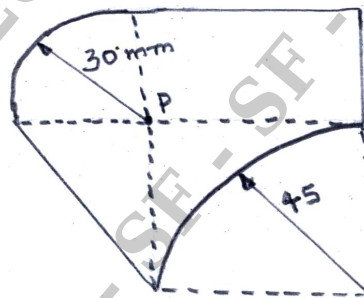


Fig.Q.8(b)

- 9 a. What is superelevation? (02 Marks)
 b. Derive the equation of super elevation $\tan \theta = \frac{v^2}{gr}$ with usual notations. (04 Marks)
 c. An aeroplane goes into a vertical power drive directly over its target at a constant velocity of 1000kmph. An anti-aircraft gun fires a shell vertically upwards with an initial velocity of 683m/sec when the plane is at 1920m elevation. Find the elevation and time at which the shell hit the plane.
 If the shell missed the plane and the plane released a bomb at 1500m elevation, how long thereafter would the bomb reach the target at zero elevation? With what velocity the bomb strikes the target? (10 Marks)
- 10 a. Show that the path traced by a projectile is a parabola. (04 Marks)
 b. A car starts from a station and moves with constant acceleration. It covers a distance of 19m during tenth second of its motion. Find the acceleration and velocity after 9th and 10th second from start. (06 Marks)
 c. A bird is sitting on a wall of 10m height. A shooter 25m away from the wall shoots at the bird with an initial velocity of 28m/sec. Calculate the angle at which he should shoot at the target. (06 Marks)

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