Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, JULY 2018

Course Code: BE100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1 Differentiate between the various types of supports for beams. (5)

2 Explain Free Body Diagram with sketches. (5)

3 What are the characteristics of dry friction? (5)

4 Differentiate between 'polar moment of inertia' and 'product of inertia'. (5)

5 Define the term instantaneous centre in plane motion and explain the methods to locate it. (5)

6 Differentiate between periodic motion and simple harmonic motion. (5)

7 A body of mass 'm' is undergoing rectilinear motion under a force of $F = F_0 Sin\omega t$, establish the equations for: (5)

i) Displacement –time relationship ii) Velocity-time relationship

iii) Acceleration-time relationship.

The initial displacement and velocity are zero.

8 State the difference between free and forced vibration. Derive the differential equation for free vibration system considering only spring mass model. (5)

PART B

Answer any 2 full questions from each set, each carries 10 marks

SET I

9 Three spheres A, B and C weighing 300N, 600N and 300N respectively and having diameters 800mm, 1200mm and 800mm respectively are placed in a trench as shown in Fig.1. Determine the reactions developed at contact points P, Q, R and S. The angle of inclination is 30^0. (10)

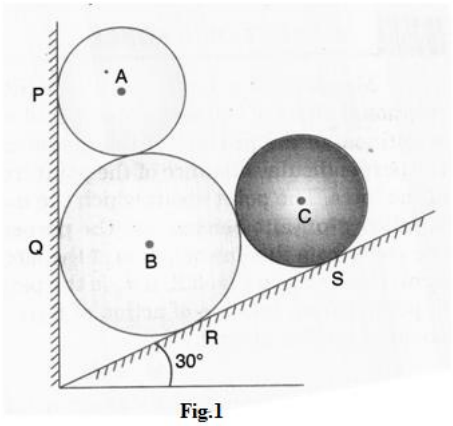

Fig.1

10 Determine the resultant of the three forces acting on the dam section shown in Fig.2and locate its intersection with the base AB. For a safe design this intersection should be within the middle third. Is it a safe design? (10)

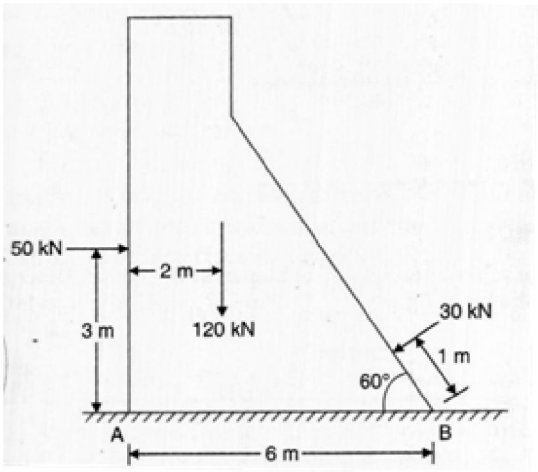

Fig.2

11 a) Determine the support reactions for the beam shown in Fig.3. (7)

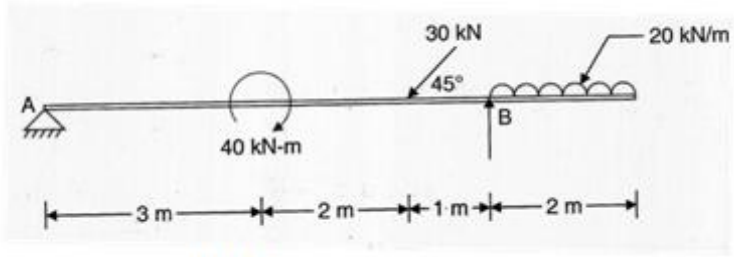

Fig.3

b) The stay wire of a tower is anchored by means of a bolt at A as shown in Fig.4. The force in the AB is 75kN. Determine the components of F_x, F_y and F_z of the force at A. (3)

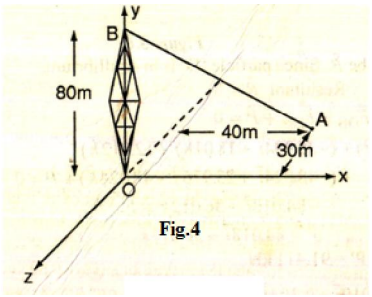

Fig.4

SET II

12 Determine the followings for the built-up section shown in Fig.5**,** all dimensions are in mm: (10)

i) Centroid ii) Moment of Inertia about the base

iii) Moment of inertia about horizontal centroidal axis

iv) Radius of gyration about the horizontal centroidal axis

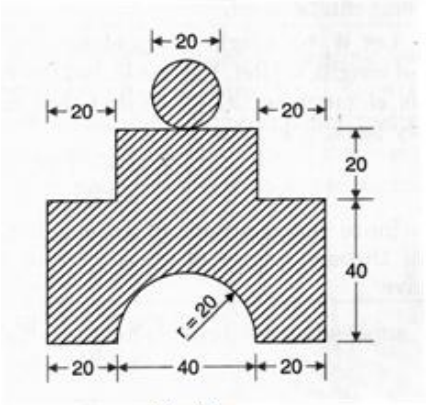

Fig.5

13 Determine the force P required to move the wedge downwards as shown in Fig.6. (10)
Angle of friction is 15^o for all the surfaces.

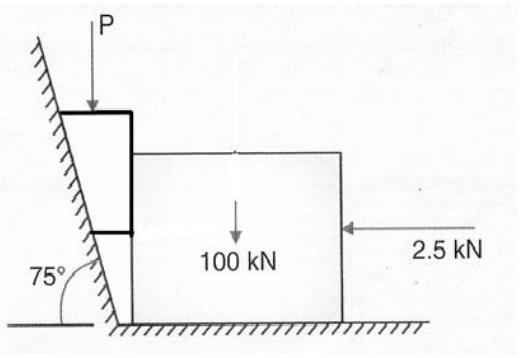

Fig.6

14 a) State thetheorems of Pappus and Guldinus. Illustrate it with the determination of (5)
(a) surface area of a cylinder (Radius R and Length L) (b) Volume of a sphere of radius R.

b) Determine the support reactions for the beam shown inFig.7by applying principle (5)
of virtual work.

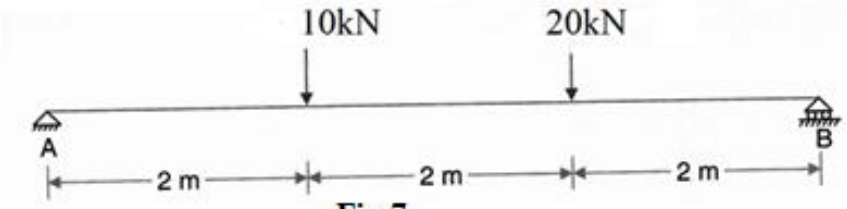

Fig.7

SET III

15 a) State D'Alembert principle giving the equation. (3)

b) In a crank and connecting rod mechanismshown in Fig.8, the radius of the crank is 300mm and the length of the rod is 1500mm. The crank is rotating at 300rpm. Determine the following, when the crank makes an angle 40^0 as shown in Fig.8: (7)

i) Velocity at point **A** ii) Angular velocity of the rod **AC**

iii) The velocity of the piston at **C.**

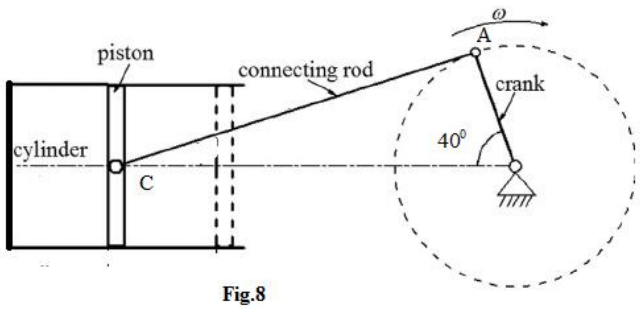

Fig.8

16 A lift has an upward acceleration of $1m/s^2$. Find the pressure exerted by the man of 62.5kg on the floor of the lift. If the lift had a downward acceleration of $1m/s^2$, find the pressure exerted by the man. Also find an upward acceleration of the lift, which would cause the man to exert a pressure of 700N. (10)

17 A body of mass 500kg is suspended by two springs in series, the stiffness of springs being 60kN/m and 40kN/m. The body is pulled down from its equilibrium position by 50mm and released. What will be the maximum acceleration and maximum velocity of the body? What would be the maximum acceleration, if the springs were in parallel? (10)

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