Code: 9A01101

R09

B.Tech I Year (R09) Supplementary Examinations June 2017

ENGINEERING MECHANICS

(Common to AE, BT, CE, ME & MCTE)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) State and prove Lami's theorem.
(b) State and prove theorem of varignon.

2 (a) Explain just rigid frame and over rigid frame.
(b) Explain the types of frames with neat sketches.

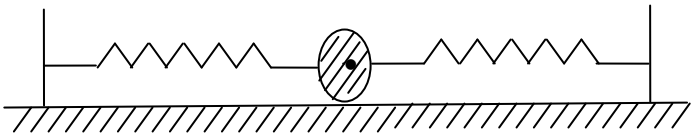
3 A screw jack raises a load of 40 kN. The screw is square threaded having 3 threads per 20 mm length and 40 mm in diameter. Calculate the force required at the end of a lever 400 mm long measured from axis of screw, if coefficient of friction between screw and nut is 0.12.

4 A steel cylinder of diameter 200 mm and height of 300 mm rests centrally over a concrete rectangle of 1000 x 800 x 600 mm size. Determine the center of gravity of the system, taking weight of concrete = 28500 N/m² and that of steel 81000 N/m².

5 A square prism of cross section 200 mm × 200 mm and height 400 mm stands vertically and centrally over a cylinder of diameter 300 mm and height 500 mm. Calculate the mass moment of inertia of the composite solid about the vertical axis of symmetry, if the mass density of the material is 2000 kg/m^3.

6 (a) The velocity of a particle is $v = v_o [1-\text{Sin}(\pi t/T)]$.The particle starts from the origin with an initial velocity v_o, Determine: (i) Its position and acceleration at t = 4T.
(ii) Its average velocity during the interval t = 0 to t = T.
(b) The motion of a rotor is defined by the relation $\theta = 8t^3-6(t-2)^2$, where θ and t are expressed in radians and seconds respectively. Determine: (i) When the angular acceleration is zero. (ii) The angular coordinate and angular velocity at that time.

7 Two identical springs of spring constant K = 0.2 N/mm is attached with a ball of mass m = 0.75 kg as shown in figure below. If the ball is initially displaced from its middle position by an amount 1 mm to the right, determine the period of oscillation of the ball and the velocity with which the ball passes its middle position. Assume the contact surfaces are frictionless.



8 A small ball of weight 'w' is attached to the middle of a tightly stretched perfectly flexible wire AB of length '$2l$'connected between two horizontal rigid surfaces (arrangement is vertical) Prove that for small lateral displacements and high initial tension in the wire, the ball will have a SHM, and calculate the period of oscillation.

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