Question Paper Code : 21556

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Second Semester

Civil Engineering

ME 2151/ ME 25/ 10122 ME 205/ 080120002/ CE 1151 – ENGINEERING
MECHANICS

(Common to Aeronautical, Automobile, Marine, Mechanical, Production,
Chemical, Petroleum Engineering, Biotechnology, Polymer, Textile,
Textile (Fashion), Plastic Technology, Materials Science and Engineering,
Manufacturing Engineering Mechatronics Engineering, Industrial
Engineering, Industrial Engineering and Management, Environmental
Engineering Geoinformatics, Mechanical and Automation Engineering,
Petrochemical Engineering, Chemical and Electrochemical Engineering,
Petrochemical Technology, Pharmaceutical Technology, Textile Chemistry,
Mechanical Engineering (sand wich) and Robotics and Automation)

(Regulation 2008/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by force-couple system?

2. Find the unit vector of a force $\vec{F} = 4\vec{i} - 5\vec{j} + 8\vec{k}$.

3. State Varignon's theorem.

4. Write the equations of equilibrium of a rigid body in two dimensions.

5. When will the centroid and centre of mass coincides?

6. Find the radius of gyration of a rectangular area of MI about its base $9 \times 10^4 \ cm^4$ and cross-sectional area $300 \ cm^2$.

7. A car runs with an initial velocity of 30 m/s and uniform acceleration of $3 \ m/s^2$. Find its velocity after 5 seconds.

8. State D'Alembert's principle.

9. What is meant by general plane motion?

10. A flywheel has a mass moment of inertia of 11 $kg.m^2$ about the axis of rotation. It runs at a constant angular velocity of 94.25 rad/s. find the kinetic energy of the flywheel.

PART B — (5 × 16 = 80 marks)

11. (a) A system of four forces P,Q, R and S of magnitude 5 kN, 8 kN, 6 kN and 4 kN respectively acting on a body are shown in rectangular coordinates as shown in Fig. 11 (a). Find the moments of the forces about the origin O. Also, find the resultant moment of the forces about O. The distances are in metres.
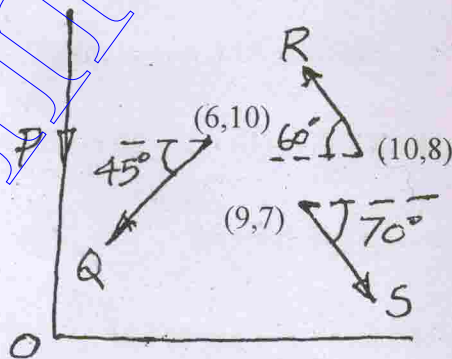

Figure 11 (a)

Or

(b) A body is acted upon by a system of forces and a couple as shown in Fig 11 (b). Determine the resultant of the system of forces. Also locate the points of intersection of the system of forces. Also locate the points of intersection of the resultant with the arm PQ, QR and RS.
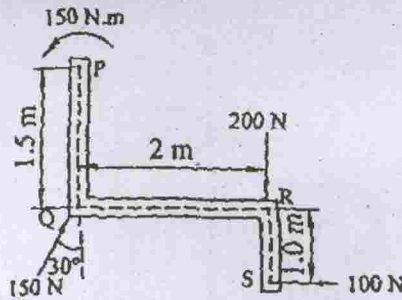

Figure 11 (b)

12. (a) 4000 N load acts on the beam held by a cable PQ as shown in Fig. 12 (a). The weight of the beam can be neglected. Draw the free-body diagram of the beam and find the tension in the cable PQ. Also find the reaction force at R.
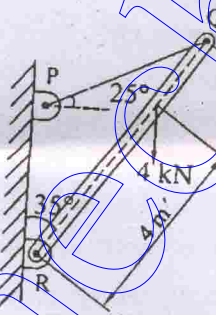

Figure 12 (a)

Or

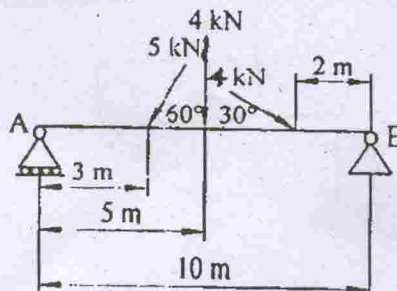(b) A beam is acted upon by a system of forces as shown in Figure 12 (b). Find the support reactions.

Figure 12 (b)

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13. (a) Find the position of the centroid of the solid combination shown in Fig. 13 (a) consisting of a solid cone of height 50 mm and base diameter 80 mm and a cylinder of height 100 mm and diameter 80 mm with a semicircular cut as shown.
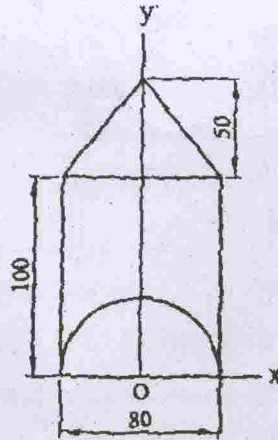

Figure 13 (a)

Or

(b) A rectangular R.C.C. column is centrally cast over a concrete bed. R.C.C. in Figure 13 (b) column is of section 30×45 cm and height 4 m. The concrete bed is of size 3×4.5 m and thickness 30 cm. find the mass moment of inertia of the column and bed combination about its vertical centroidal axis. Mass density of concrete = 2500 kg/m^3.
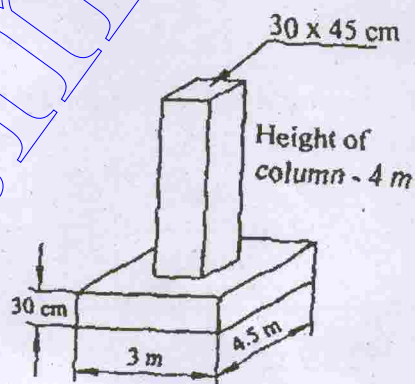

Figure 13 (b)

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14. (a) Water drips from a tap fitted to a barrel at the rate of four drops per second as shown in Figure 14 (a). Find the vertical separation between two consecutive drops after the lower drops has attained a velocity of 3 m/s.
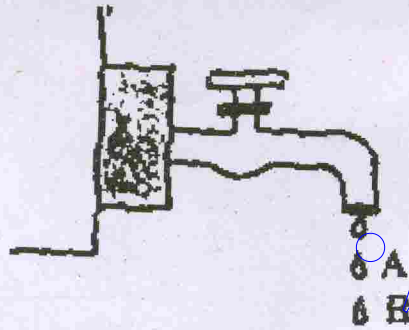

Figure 14 (a)

Or

(b) Block P of weight 100 N and block Q of weight 50 N are connected by a cord that passes over a smooth pulley as shown in Figure 14 (b). Find the acceleration of the blocks and the tension in the cord when the system is released from rest. Neglect the mass of the pulley. Use the principle of work and energy.
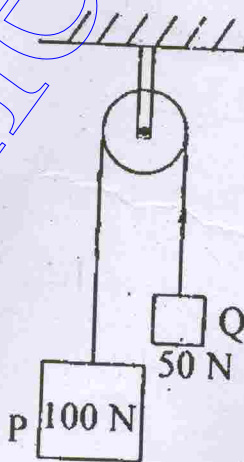

Figure 14 (b)

15. (a) A force of 300 N is required just to move a block up a plane inclined at 20° to the horizontal, the force being applied parallel to the plane Figure 15(a) . If the inclination of the plane is increased to 25°, the force required just to move the block up is 340 N, (the force is acting parallel to the plane). Determine the weight of the block and the coefficient of friction.
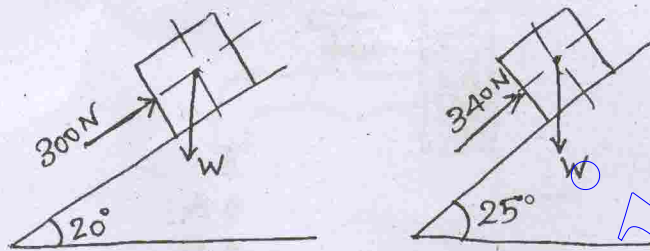

Figure. 15 (a)

Or

(b) A cast iron hoop of radius 200 mm is released from rest on a 25° incline as shown in Fig 15 (b). Find the angular acceleration of the hoop and the time taken by it to move a distance of 4 m down the slope. $\mu_s = 0.25$.
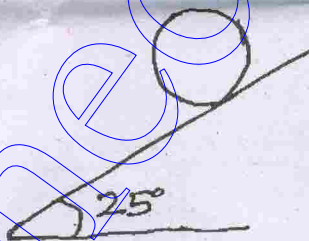

Figure 15 (b)

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