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Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2015

PTEN/EN 09 105—ENGINEERING MECHANICS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*
Each question carries 2 *marks.*

1. What is free body diagram and explain its importance.
2. State the principle of resultant and equilibrant of coplanar concurrent force systems.
3. State and explain parallel axis theorem.
4. State and explain D'Alemberts principle.
5. With suitable example, explain tangential and normal acceleration.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

6. The point of application of a force $F = 5i + 10j - 15k$ is displaced from the point $A(i + 0j + 3k)$ to the point $B(3i - j - 6k)$. Find the work done by the force.
7. Show that angle of repose is equal to the angle of friction.
8. Locate the centroid of the trapezium with parallel side 'a' and 'b' and height 'h'.
9. Derive an expression for MI of a sphere about its diameter.
10. A train of mass 250×10^3 kg. starts from rest and accelerate uniformly to a speed of 81 km./hr. in 20s. The total frictional resistance to motion is 20 kN. Determine (i) the maximum power required ; (ii) Power required to maintain the speed of 81 km./hr.
11. A particle moves with constant speed of 6 m/s. along the parabolic path $y = kx^2$. Determine its acceleration at a point (10 m. 5m.) on the parabola.

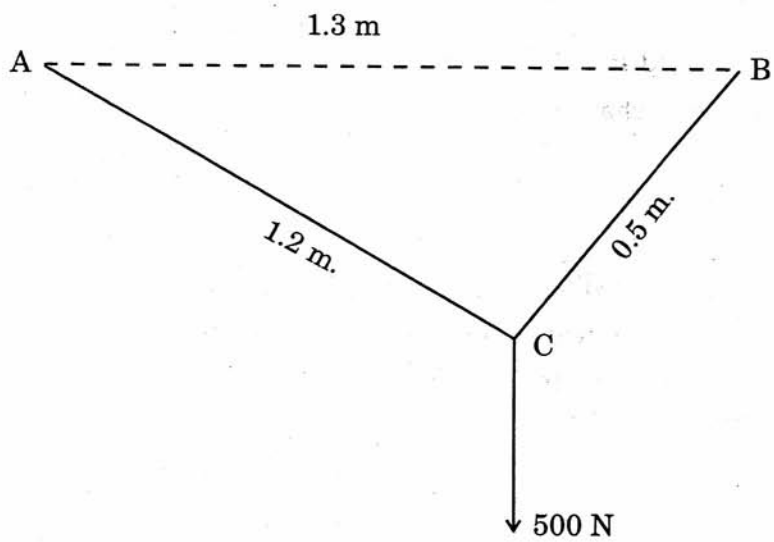
(4 × 5 = 20 marks)

Turn over

Part C

Answer section (a) **or** *section* (b) *of each question.*
Each question carries 10 *marks.*

12. (a) Two cables AC and BC are tied together at the point C to support a load of 500 N at C. A and B are at a distance of 1.3 m. and are on the same horizontal plane. AC and BC are 1.2 m. and 0.5 m. respectively. Find the tensions in AC and BC.



Or

(b) A rope 9 m. long is connected at A and B, two points. On the same level 8 m. apart. A load of 300 N is suspended from a point C on the rope, 3 m. from A. What load connected to a point D, on the rope, 2 m. from B is necessary to keep portion CD parallel to AB.

13. (a) Determine the MI and radii of gyration of a T section about its Centroidal axes of sizes of top flange and web are 80 mm. × 20 mm. and 20 mm × 100 mm respectively.

Or

(b) A ball of mass 2 kg. and moving with a velocity of 6 m/s. impinges on a ball of 4 kg. and moving with a velocity of 2 m/s. If their velocities before impact be parallel and inclined at 30° to the lines of centres, find the magnitude and direction of velocity each ball after impact. Take Coefficients of restitution is 0.5.

14. (a) A solid cylindrical pulley of mass 800 kg. having 0.9 m. radius of gyration and 2 m. diameter is rotated by an electric motor which exerts a uniform torque of 65 kN–m. A body of mass $3t$ is to be lifted by a wire wrapped round the pulley. Find the acceleration of the body and tension of the rope.

Or

(b) A force of 300 N acts on a body of mass 150 kg. calculate the acceleration of the system using D'Alemberts principle.

15. (a) Two weights of 300 N and 450 N are connected to the two ends of a rope passing over a smooth frictionless pulley. With what acceleration the heavier mass comes down ? What is the tension in the string ?

Or

(b) Three bodies, a sphere, a cylinder and a hoop each having the same mass and radius are released from rest from an inclined plane of angle θ. Determine the velocity of each of the bodies after it has rolled down the inclined plane through a distance S.

(4 × 10 = 40 marks)