INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examination Dec 2019/Jan 2020

B.Tech (Marine Engineering)

Semester -I

UG11T3105 - Engineering Mechanics I

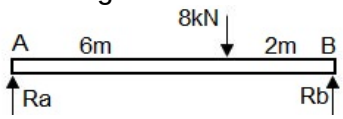
Date: 19.12.2019 **Max Marks: 70**

Time: 3 Hours **Pass Marks: 35**

Part – A (compulsory)

Answer the following (10x2=20 Marks)

1. Define lames theorem.
2. State the characteristics of a force?
3. In general, a section with circular cut out hole is given, how will you find out the centre of gravity of whole section and write the C.G mathematically?
4. What do you understand the term 'axis of reference'?
5. Which type of a machine is not capable of doing any work in the reversed direction for sometimes, after the effort is removed? and write the condition for a machine.
6. Define 'trajectory' draw simple schematic diagram to support your answer.
7. How to find, linear velocity of a rotating body with help of diagram?
8. Determine the distance covered by the car in 20 sec. When a car starting from rest is accelerated at the rate of 0.4 m/s^2.
9. Write any two principles of equilibrium.
10. Find R_a and R_b of the simply supported beam of length 8m and a point load is acting 6m from 'A' as shown in figure.

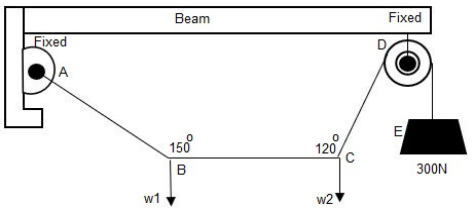


Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

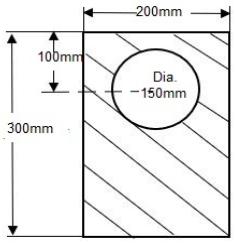
11.(a) The force 20 N is acting at point B, 30 N at point C, 40 N at point D, 50 N at point E and 60 N at point F of an angular point's regular hexagon AB, BC, CD, DE, EF and FA, taken in order. Find the magnitude and direction of the resultant force. (5marks)

(b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Figure. If in the equilibrium position, BC is horizontal and angle ABC is 150°and angle BCD is 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2. (5marks)



12.(a) State and prove the parallel axis theorem in the determination of moment of inertia of areas with the help of a neat sketch. (5marks)

(b) A rectangular section of size 300mm x 200mm with cut out circular holes of dimeter 150mm as shown in figure. Determine the moment of inertia of a hollow section about an axis passing through its centre of gravity or parallel X-X axis. (5marks)



13. (a) Draw a simple square threaded screw jack and mark all the parts neatly. On what principle the screw jack works? Derive a relation for the velocity ratio of a simple screw jack. (5marks)

(b) With the help of a differential wheel and axle machine, an effort of 6 N raised a load of 60 N. If the machine efficiency at this load is 80 percentage, Determine the velocity ratio of the differential wheel and axle lifting machine. If the effort wheel diameter is 300 mm, Determine the difference between the diameters of the axles. If the sum of the diameters of the axles is 280 mm, Find out the diameter of each axle. (5marks)

14. At 200 km. p. h. an aeroplane is flying on a straight level at a height of 1Km above the ground. An anti-aircraft gun located on the ground fires a shell with an initial velocity of 300 m/s, at the instant when the plane is vertically above it. At what inclination, to the horizontal, should the gun be fired to hit the plane? What time after firing, the gun shell will hit the plane? What will then be the horizontal distance of the plane from the gun? (10marks)

15. Determine (i) angular velocity and acceleration at start (ii) time when the particle reaches its maximum angular velocity; and (iii) maximum angular velocity of the particle. The equation for angular displacement of a particle, moving in a circular path of radius 200 m is given by $\theta = -2t^3 + 3t^2 + 18t$, where θ is the angular displacement at the end of t sec. (10marks)

16. A and B are two train leaves from the central station on parallel lines. The train A starts from rest with a uniform acceleration of 0.2 m/s^2 and attains a speed of 45 km.p.h., which is maintained constant afterwards. The train B leaves 1 minute after with a uniform acceleration of 0.4 m/s^2 to attain a maximum speed of 72 km.p.h., which is maintained constant afterwards. When will the train B overtake the train A? (10marks)

17. What is 'energy'? List out the different forms of energy? Describe the various forms of mechanical energies. (10marks)
