

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE  
SEMESTER END EXAMINATION

B. Tech. (Agri. Engg.)

Semester : I (New)	Term : I	Academic Year : 2019-20
Course No. : FS-111	Title : Engineering Mechanics	
Credits : 3(2+1)	Time : 10.00 to 13.00	Total Marks : 80
Day & Date : Monday, 30.12.2019		

- Note :
1. Solve ANY EIGHT questions from SECTION "A".
  2. All questions from SECTION "B" are compulsory.
  3. All questions carry equal marks.
  4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 a) What are the various characteristics of a force?  
b) A triangle ABC has its side AB=40mm along positive X-axis and side BC=30mm along positive Y axis. Three forces of 40 N, 50N and 30 N act along the sides AB, BC, and CA respectively. Determine magnitude of the resultant of such a system of forces.
- Q.2 a) Two parallel forces of 50N and 100N act at the ends of a rod 360 mm long. Find the magnitude of the resultant force and the point which it acts.  
b) Two unlike parallel forces of magnitude 400 N and 100 N are acting in such a way that their lines of action are 150mm apart. Determine the magnitude of the resultant force and the point at which it acts.
- Q.3 a) State and prove Lami's theorem.  
b) Discuss the various types of equilibrium.
- Q.4 a) Find the center of a gravity of a 100mm x 150mm x 30mm T- section.  
b) Find the centroid of an unequal angle section 100mm x 80mm x 20mm.
- Q.5 a) Derive the expression for MI (Moment of Inertia) of a rectangular section about centroidal axis.  
b) Find out the M.I of triangular section about the base and also M.I about an axis through its center of gravity and parallel to XX-axis.
- Q.6 a) Explain laws of static friction.  
b) A body of weight 300 N is lying on a horizontal plane having a coefficient of friction as 0.3 find the magnitude of the force, which can move the body, while acting at an angle of  $25^{\circ}$  with the horizontal.
- Q.7 a) In a lifting machine, whose velocity ratio is 50, an effort of 100 N is required to lift a load of 4 KN. Is the machine reversible? If so, what effort should be applied, so that the machine is at point of reversing?  
b) In a certain machine, an effort of 100 N is just able to lift a load of 840 N, calculate efficiency and friction both on effort and load side, if the velocity ratio of the machine is 10.

(P.T.O.)

- Q.8 a) The larger and smaller diameters of a differential wheel and axle are 80mm and 70mm respectively. The effort is applied to the wheel of diameter 250mm. What is the velocity ratio? Find the efficiency and frictional effort lost, when a load of 1050 N is lifted by an effort of 25 N.
- b) In a differential pulley block, a load of 1800 N is raised by an effort of 100 N. The number of teeth on the larger and smaller blocks are 12 and 11 respectively. Find the velocity ratio, mechanical advantage and efficiency of the machine.
- Q.9 a) A simply supported beam AB of total span 5.0m is loaded with 3 KN, 4KN and 5KN, at a distance of 2m, 3m and 4m from left end support A. Find reactions at supports A and B. Solve analytically.
- b) A simply supported beam of span 6m is carrying a uniformly distributed load of 2KN/m over a length of 3m from right end B. Calculate the support reactions.
- Q.10 a) State clearly the difference between a perfect frame and imperfect frame.
- b) State the assumptions made while finding out the forces in the various members of a perfect frame structure?

#### SECTION "B"

Q.11 State True or False.

- 1) A resultant force is a single force which produces the same effect as produced by all the given forces acting on a body.
- 2) The units of moment of inertia of a mass are  $\text{kg/m}^2$ .
- 3) The ratio of limiting friction to the normal reaction is known as coefficient of friction.
- 4) Sliding friction is experienced by body when it slides over another body.
- 5) The plane figures have only areas, but no mass.
- 6) The forces meeting at a point are called non concurrent forces.
- 7) Input of machine is the work done on the machine.
- 8) Force is a vector quantity.

Q.12 Define the following terms.

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|---------------------|-----------------------|
| 1) Statics          | 2) Compound machine   |
| 3) Like vectors     | 4) Redundant frame    |
| 5) Sliding friction | 6) Ideal machine      |
| 7) Centroid         | 8) Compressive stress |

