FIRST SEMESTER B.TECH DEGREE EXAMINATION, MAY 2016

MODEL QUESTION PAPER -1

BE 100 ENGINEERING MECHANICS

Time :3Hour  Maximum Marks :100

PART B (Answer all questions)

1. State and prove Varignons theorem
2. A Force F has the components Fx=200N Fy= -300N, Fz=600N. Determine its magnitude F and the angle \( \theta_x, \theta_y, \theta_z \), it makes with the axes of coordinates
3. State and prove Pappus Guldinus theorem
4. Explain laws of friction
5. State and explain d’Alemberts principle
6. A car is moving with a velocity of 15 m/s. The car is brought to rest by applying breaks in 5s. Determine the retardation and distance travelled by the car after applying breaks
7. Explain the following (i) Free vibration ; (ii) Torsional vibration
8. Find the time period of a pendulum having 0.6m long string and weight of bob as 80g. (8x5=40)

PART B Set 1 (Answer any two questions)

9 a) ABCD is weightless rod under an action of 4 forces P, Q, S & T as shown in figure.5. If P=20N, Q=5N, S=8N & T=12N. Calculate resultant in magnitude and direction, and also locate its point of application with respect to the end A of the rod.

9 b) Determine force S in the string AB and the reaction produced at D and E for the figure shown. Assume all surfaces smooth. Radius of the cylinders is 15 cm. Length of AB=40 cm.
10 a) The forces 30N, 40N, 50N, 60N and 70N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force.

10 b) Determine support reactions at A, B and D for the beam shown below.

11 a) A package of mass 4500 N is supported by three ropes AD, AC and AB as shown in figure below. Determine the tension in ropes.

11 b) Calculate the support reactions at A and B for the beam shown below.
PART B Set 2 (Answer any two questions)

12. a) Calculate the moment of inertia of the section shown in fig about the centroidal axis.

12 b) Calculate the centre of gravity of the section shown in fig about the centroidal axis.

13 a) State and prove parallel & perpendicular axis theorem
13(b) Two blocks A& B weighs 500N & 1000N are placed on an inclined plane. The blocks are connected by a string parallel to the inclined plane. The coefficient of friction between the inclined plane and block A is 0.15 and that for the block B is 0.4. Find the inclination of plane when the motion is about to take place. Also calculate tension in the string.

14 a) A uniform ladder 3m long weighs 200N is placed against a vertical wall with which it makes an angle of 30°. The coefficient of friction between the wall and ladder is 0.25 & that between the floor and ladder is 0.35. The ladder in addition to its own weight has to support a load of 1000N at its top end. Find 
   i) the horizontal force P to be applied to the ladder at the floor level to prevent slipping.
   ii) If the force P is not applied, what should be the minimum inclination of ladder with the horizontal so that there is no slipping of it with the load at its top end.

14. b) Determine the reactions at the supports, using principle of virtual work for the beam shown below.

15 a) The crank of a reciprocating engine is rotating at 210 r.p.m. The length of the crank and connecting rod are 20cm & 100cm respectively. Find the velocity of point A (velocity of piston) when crank has turned an angle of 45° with the horizontal.

15b) Two blocks A and B of weight 80N and 60N are connected by a string and passes over a frictionless pulley as shown. Determine the acceleration of blocks A and B and the tension in the string.
16 a) An elevator weighs 500N is ascending with an acceleration of 3 m/s². During this ascent its operator whose weight is 700N is standing on the floor. What will be the reaction produced by the floor on the operator, what will be the total tension in the cable on the elevator.

16 b) A 50 kg block is supported by two springs connected from the ceiling. The spring constants are 4KN/m and 6kN/m. The block is pulled 40mm down from its equilibrium position and then released. Determine the period of vibration, maximum velocity, and acceleration of the block when the springs are kept in (i) series (ii) parallel.

17 a) A vertical shaft 100mm in diameter and one meter in length has its upper end fixed to the ceiling and carries a disc of 5000N having a radius of gyration 450mm at other end. Modulus of rigidity is 0.8x10⁵ N/mm². Determine the frequency of torsional vibrations and transverse vibration if E = 2x10⁵ N/mm².

17 b) The weight of an empty railway wagon is 24tf. On loading it with goods weighing 32tf its spring gets compressed by 8cm. Calculate its natural period of vibration when empty and when loaded as above.

2x10=20

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