MODEL PAPER
DME– FIRST YEAR END EXAMINATION
ENGINEERING MECHANICS (M-105)

Time : 3 hours Max Marks : 80

Part – A 10 x 3 = 30

Instructions : 1) Answer ***all*** questions
2) Each question carries ***three*** marks
3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1. Briefly explain the following system of forces:
a. Concurrent forces
b. Coplanar forces
2. State (i) Lami's theorem (ii)Varignon's theorem.
3. What is the horizontal force required to pull a body of weight 500N along the horizontal surface? Take the coefficient of friction as 0·3.
4. State the laws of solid friction.
5. Define (a) Centroid and (b) Radius of gyration.
6. State the importance of moment of inertia in engineering applications.
7. State Work energy principle.
8. A bullet of mass 30 g is fired horizontally with a velocity of 250 m/sfrom a gun of mass 25 kg. Find the velocity with which the gun will recoil.
9. Define the following :
    a) Idle Machine
    b) Reversible Machine
    c) Self-locking Machine
10. Define *(a)* lower pair, and *(b)* higher pair and give at least one example of each.

Part – B **5 x 10 = 50**

Instructions : 1) Answer any ***five*** questions
2) Each question carries ***ten*** marks
3) Answer should be comprehensive and criteria for valuation is content, but not the length of the answer.

11. Find the magnitude and direction of the resultant force of the following forces system :
A force of 20 N acting due to East
A force of 25 N acting 40° North of East
A force of 10 N acting 50° West of North
A force of 30 N acting vertically down words.

12. A body of weight 100 N is to be pulled up an inclined plane whose angle of inclination with the horizontal is 20°. If the coefficientof friction between the plane and the body is 0·28. Determine the effor required—*(a)* when the effort is parallel to the plane and (b)when the effort is parallel to the base.

13. Calculate moment of inertia about centroidal axes for the given I-section. The dimensions are as follows : Top flange : 90 mm × 20 mm ; Web : 20 mm × 100 mm ; Bottom flange : 150 mm × 40 mm
14. (a) The resultant of two equal forces acting at a point with an angle of 60° between them is 80 N. Find the magnitude ofeach force.

(b) State and explain parallel axis theorem.

15. (a) A car of mass 1000 kg moves on a level road under the action of 981 N of propelling force. Determine the time taken by thecar to increase its velocity from 24 kmph to 48 kmph and distance travelled during this time.

(b) A body of mass 0·1 kg starts falling freely under gravity froma height of 3 m. Calculate the potential and kinetic energies ofthe body when it is at a height of 1 m from the ground. Assume $g = 9{\cdot}81$ m/s^2.

16. (a) A wheel rotating about a fixed axis at 30 r.p.m. is uniformly accelerated for 50 seconds during which it makes 40 revolutions. Determine— *(a)* angular velocity at the end of this interval and *(b)* time required for the speed to reach 80 rpm.

(b) A body moving with simple harmonic motion has an amplitude of 1m and period of oscillation of 2 seconds. What will be its velocity and acceleration after 0·4 second after passing an extreme position?

17. The larger and smaller diameters of differential wheel and axle are 80 mm and 70mm respectively. The effort is applied at the end of lever which is 120mm long. What is the velocity ratio and the efficiency when the load lifted is 800 N with an effort of 32N.
18. (a) Explain the conditions for reversibility and self-locking of a simple machine.

(b) Explain any one of the inversions of a quadratic chain with a neat diagram.