

BT-4/M05

Dynamics of Machines

Paper : MET-212

Time : 3 Hours]

[Maximum Marks : 75

Note : Attempt any FIVE questions.

1. (a) Explain the importance of free body diagrams in case of static force analysis. 3
(b) The variation of crankshaft torque of a four cylinder petrol engine may be represented by taking a torque as zero for crank angles 20° and 45° , the intermediate portions of the torque graph being straight lines. The cycle is being repeated in every half revolution. The average speed is 600 r.p.m. Determine the mass of the flywheel of radius of gyration 250 mm which must be provided so that total variation of speed shall be 1%. 12
2. (a) Explain how will you find the line of action of inertia force for a link by the use of dynamically equivalent system. 5
(b) Determine the torque exerted on crank shaft by analytical method, considering the weight of piston and connecting rod in 4 stroke I.C. engine. 10
3. (a) Determine the minimum number of teeth on pinion for involute rack in order to avoid the interference. 5
(b) Define the pressure angle in meshing gears. Establish a relation between arc of contact and path of contact in terms of pressure angle. 5
(c) A 20° involute pinion with 20 teeth drives a gear having 60 teeth module is 10 mm. State whether interference occurs or not, give reasons. 5
4. (a) Differentiate between self-locking and self-energizing brakes. 5
(b) Explain with neat sketch, the working principle of internal expanding shoe brake and derive expressions for moments and torque. 10
5. (a) In a Hartnell governor if the spring of greater stiffness is used then the governor sensitivity will increase or decrease. Explain clearly. 5
(b) With neat sketch, explain the working of Wilson-Hartnell governor and derive an expression for its equilibrium speed. 10

6. (a) Prove that in single cylinder engine the resultant unbalance force is minimum when half of the reciprocating masses are balanced by rotating masses. 7
- (b) Each crank of a four cylinder vertical engine is 225 mm. The reciprocating masses of the first, second and fourth cranks are 100 kg, 120 kg, 100 kg and the planes of rotation are 600 mm, 300 mm and 300 mm from the plane of rotation of the third crank respectively. Determine the mass of the reciprocating parts of the third cylinder and relative angular positions of the crank if the engine is in complete primary balance. 8
7. (a) Derive an expression for the gyroscopic stability of two wheel vehicle when taking a turn. 7
- (b) What is meant by Transfer function ? Determine the transfer function of a spring controlled governor. 8
8. Explain the following :
- (a) Pre selective gear box 5
- (b) Pivoted cradle balancing machine 5
- (c) Open and closed loop control systems. 5