BT-4/M06

Dynamics of Machines

Paper : MET-212

Time : 3 Hours] [Maximum Marks : 75

Note : Attempt any **FIVE** questions.

1. (a) What is D-Alembert's Principle ? 3
   (b) What are the forces that act on the reciprocating parts of a horizontal engine ? Give expressions for those forces neglecting the weight of the connecting rod. 12
2. What is the difference between flywheel and governor ?
   A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 rpm. The torque-crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 90N-m at 60° from dead centre of corresponding crank. The torque on the return stroke is zero. Determine (1) power developed (2) co-efficient of fluctuation of speed if the mass of the flywheel is 12 Kg and has a radius gyration of 80 mm (3) co-efficient of fluctuation of energy (4) maximum angular acc^n of flywheel. 15
3. (a) Derive expression for minimum number of teeth on the wheel in order to avoid interference. 6
   (b) An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels; D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft, A co-axial with F. If the wheels have the same pitch and shaft A makes 800 rpm, what is speed of the shaft F ? Sketch the arrangement. 9
4. (a) With neat diagram of Porter governor draw expression for relation between height of governor and angular speed of ball. 10
   (b) In a Hartnell governor if the spring of greater stiffness is used then the governor sensitivity will increase or decrease. Explain clearly. 5
5. (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 expression for moments and torque. 10

6. (a) Explain the terms Precessional motion and Gyroscopic Couple and explain, gyroscopic effect no Naval Ship. 6

(b) A shaft carries four rotating masses A, B, C & D in this order along its axis. The mass A may be assumed to be concentrated at radius 18 cm, B of 24 cm, C of 12 cm and D of 15 cm. The masses of B, C, D are 30 Kg. 50 Kg, 40 Kg respectively. The planes containing B & C are 30 cm apart. The angular spacing of planes containing C & D are 90° and 210° relative to B measured in the same plane. If the shaft and masses are to be in complete dynamic balance, find :

(i) mass & angular position of A.

(ii) position of planes A and D. 9

7. (a) Derive effect of gyroscopic couple and centrifugal couple on two wheel vehicle while taking turn. 6

(b) What is meant by transfer function ? Determine the transfer function of a spring controlled governor. 9

8. Write short notes on following :

(i) Pivoted cradle balancing machine. 5

(ii) Open and close loop control system. 5

(iii) Absorption dynamometer with diagram. 5