NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR(H.P.)177 005

B.Tech. End Semester Examination 3rd Year (5TH Semester)

Branch: Mechanical Engineering **Semester:** Fifth

Course name: Dynamics of Machines **Course Code:** MED-314

Time allowed: TWO hours **Maximum marks:** 50

Date of exam: 14.12.2020 **Session** A (10:00-12:00)

NOTE: Attempt all the questions which carry marks as indicated in the bracket.

I(a) Explain clearly the function of a cam and follower. Draw neat sketches of various types of followers according to the surface in contact. **(6)**

(b) The mass of flywheel of an engine is 6500 kg and the radius of gyration is 1.8 m. The fluctuation of energy as obtained from the turning moment diagram is 56 kN-m. If the mean speed of the engine is 120 r.p.m then determine the maximum and minimum speeds. Also Derive the expression for the fluctuation of energy used to solve the above problem. **(6)**

II A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg revolving at radii 80 mm, 70 mm, 60 mm and 80 mm respectively in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45^0, B to C 70^0 and C to D 120^0. The balancing masses are to be placed in planes X and Y and the distance between the planes A and X is 100 mm, between X and Y 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions**.** **(13)**

III(a)Draw a neat schematic diagram of a slider crank mechanism showing clearly the various forces acting on the different parts and also write the expression of each force. **(6)**

(b) In a Porter governor, each of the four arms is 400 mm long. The upper arms are pivoted on the axis of the sleeves, whereas the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and load on the sleeve is 60 kg. What will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation of the governor balls? **(6)**

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IV (a) Show with the help of neat sketches the various terms used in a Naval ship. What is the effect of gyroscopic couple on a ship during steering, pitching and rolling? **(6)**

(b) The turbine rotor of a ship has a mass of 3500 kg, a radius of gyration of 0.45 m and a speed of 3000 r.p.m clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship:

(i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/hr.

(ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees**.** **(3,4)**

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