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Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Dynamics of Machines

Time: 3 hrs.

Max. Marks: 100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1
 - a. Explain the static force analysis of two and three force members. (06 Marks)
 - b. Explain principle of virtual work application to static force analysis. (06 Marks)
 - c. Explain the procedure for static force analysis of four bar mechanism. (08 Marks)

- 2
 - a. Explain D'Alembert's principle. (04 Marks)
 - b. Explain turning moment diagram of Four – stroke I. C Engine and multi cylinder engine. (04 Marks)
 - c. A punching machine is required to punch 5 holes per minute of 50mm diameter in 40mm thick plate. The ultimate shear strength of plate material is 225MPa. The punch has stroke of 100mm. find the power of motor required if mean speed of flywheel is 18m/sec. If coefficient of fluctuation of speed is 4%, find the mass of the flywheel. (12 Marks)

- 3
 - a. Obtain an expression for ratio of tensions in flat belt drive. (08 Marks)
 - b. The diameter of a pulley mounted on a shaft rotating at 250rpm is 0.75m. A counter shaft is to be driven at 500 rpm by an open belt drive. The coefficient of friction is 0.3 and distance between centers = 2.5m. Determine the necessary belt width to transmit 12kW, if safe pull on the belt is not to exceed 25N/mm width of belt. (12 Marks)

- 4
 - a. Explain briefly static balance and dynamic balance as applied to revolving masses in different planes. (06 Marks)
 - b. Four masses m_1 , m_2 , m_3 and m_4 are 200Kg, 300Kg, 240Kg and 260Kg respectively. The corresponding radiuses of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively. The angles between successive masses are 45° , 75° and 135° . Find the position and the magnitude of the balance mass required if its radius of rotation is 0.2m. (14 Marks)

PART – B

- 5
 - a. What are In – line engines? State how they are balanced? (05 Marks)
 - b. A 5 cylinder inline – engine running at 500rpm has successive cranks at 144° apart. The distance between the cylinder centre line is 300mm. Piston stroke = 240mm. Length of CR = 480mm Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these mechanism values occur. The reciprocating mass for each cylinder is 150N. (15 Marks)

- 6
 - a. What are the differences between a flywheel and a governor? (06 Marks)
 - b. Define stability and sensitiveness of a governor. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

- c. In a Porter governor the arms and links are each 10cm long and intersect on the main axis. Mass of each ball is 9Kg and the central mass is 40Kg. When the sleeve is in its lowest position the arms are inclined at 30° to the axis. The lift of the sleeve is 2cm. What is the force of friction at the sleeves if the speed at the beginning of ascend from the lowest position is equal to the speed of at the beginning of descend from the highest position. What is the range of speed of governor, if all other things remain same? (10 Marks)
- 7 a. Derive an expression for gyroscopic couple. (05 Marks)
 b. A ship is propelled by turbine rotor which has a mass of 5000Kg and has a speed of 2100rpm. The rotor has a radius of gyration of 0.5m and rotates in C.W direction when viewed from stern. Find the gyroscopic effect in the following conditions.
 i) The ship runs at a speed of 16 knots (1knot = 1860 m/hr). It steers to the left in a curve of 60m radius.
 ii) The ship pitches 6° above and 6° below the horizontal position. The bow descends with its maximum velocity. The motion due to pitching is SHM and the periodic time is 20 seconds.
 iii) The ship rolls at a certain instant has angular velocity of 0.03rad/sec clockwise when viewed from the stern. (15 Marks)
- 8 a. Classify the Cams on the basis of their shapes and the followers. (05 Marks)
 b. Obtain an expression for displacement, velocity and acceleration of follower when the roller is in contact with straight flank. (15 Marks)
