4. A shaft has three eccentrics of mass 1 kg each. The central plane of eccentrics is 50 mm apart. The distance of the centers from the axis of rotation are 20 mm, 30 mm and 30 mm and their angular position are 120º apart. Find the amount of out-of-balance force and couple at 600 r.p.m. If the shaft is balanced by adding two masses at radius of 70 mm and at a distance of 100 mm from the central plane of the middle eccentric. Find the amount of masses and their angular position. **20**

5. (a) Explain the balancing of Radial Engines. **6**

(b) The cranks of a two cylinder uncoupled inside cylinder locomotive are at right angled and are 300 mm long. The distance between the centre lines of the two cylinders is 650 mm. Wheel centre lines are 1.6 meters apart. Reciprocating mass per cylinder is 300 kg. Driving wheel diameter is 1.8 meters. If the

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B. Tech. EXAMINATION, May 2019

(Sixth Semester)

(Old Scheme) (Re-appear Only)

EE

ME302

Dynamics of Machines

Time : 3 *Hours*]   [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt any *Five* questions. All questions carry equal marks.

1. (a) How does a centrifugal governor differ from an inertia governor ? **6**

(b) The following data refers to a Hartnell governor :

Length of horizontal arms of bell crank lever = 40 mm and length of vertical arms of bell crank lever = 80 mm, mass of each flying ball 1.2 kg., the maximum radius of rotation = 100 mm, the minimum radius of rotation = 70 mm, the distance of fulcrum to axis of rotation = 75 mm, minimum equilibrium speed = 400 rpm, maximum equilibrium speed 5% higher than minimum equilibrium speed. Neglecting obliquity of arms determine : (i) spring stiffness, (ii) initial compression. **14**

2. (a) Explain with neat sketches the Bevis-Gibson flash light dynamometer. **6**

(b) A torsion dynamometer is fitted on a propeller shaft of marine engine. It is observed that the shaft twists 2.5° in a length of 20 meters at 120 r.p.m. The shaft is hollow with 40 cm external diameter and 30 cm internal diameter; if the modulus of rigidity for the shaft material is 8×10^{10} N/m^2, find the power transmitted by the engine. **14**

3. (a) Derive an expression for angle of heel of a two wheeler when taking the turn. **6**

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

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

(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. **14**

expansion stroke when the crank has turned 30º from the top dead center, the gas pressure is 600 kN/m^2. Determine :

(a) Net force on the piston

(b) Net load on gudgeon pin

(c) Thrust on the cylinder walls

(d) Turning moment on crankshaft. **20**

8. Explain the following : **20**

(a) Balancing of In-line two cylinder engine

(b) Different types of engine shaking forces

(c) Stability and Sensitiveness of the governor with controlling force curve

(d) Static balancing and dynamic balancing.

hammer blow is not to exceed 45 kN at 100 km/hour. Determine :

(i) Fraction of reciprocating masses to be balanced

(ii) Variation in tractive effort

(iii) Maximum Swaying Couple. **14**

6. A four bar mechanism with the following dimensions is acted upon by a force of 50 ∠45º N on DC at point E. AB = 500 mm, AD = 800 mm, DC = 300 mm, BC = 450 mm, DE = 150 mm ∠ DAB = 60º AD is the fixed link. E is a point on the link CD. Find the required input torque on the link AB for static equilibrium of the mechanism. Also find the forces in the joints. **20**

7. The crank and connecting rod of a vertical petrol engine running at 1500 r.p.m. are 80 mm and 250 mm respectively. The diameter of piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During the