C 28759 (Pages 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2012

ME 04 606—DYNAMICS OF MACHINERY

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Missing data, if any may be suitably assumed.

I. (a) Explain static and dynamic force analysis.

(b) Explain about the force analysis bevel gear and worm gears.

(c) Prove that the maximum fluctuation of energy, $\Delta E = E \times 2C_s$.

(d) Write a short note on primary and secondary balancing.

(e) What is whirling speed of the shaft ? Derive the expression.

(f) Explain the torsionally equi . alent system with suitable example.

(g) Explain about beat phenomenon, how it differ from resonance ?

(h) Explain the significance of finding Eigen value and Eigen vector in a vibrating system ?

(8 × 5 = 40 marks)

II. (a) The dimensions of a four link mechanism are AB = 500 mm, BC = 660 mm, CD = 560 mm and AD = 1000 mm. The link AB has an angular velocity of 20.5 rad/s counter clockwise and an angular retardation of 25 rad/s^2 at the instant when it makes an angle of 55° with AD, the fixed link. The mass of the links BC and CD is 4.2 kg/m length. The link AB has a mass of 3.54 kg, the centre of which lies at 200 mm from A and a moment of inertia of 88500 kg.mm^2. Neglecting gravity and friction effects, determine the instantaneous value of the drive torque required to be applied on AB to overcome inertia forces.

Or

(b) The dimensions of a four link mechanism are: AB = 400 mm BC = 600 mm, CD = 500 mm, AD = 900 mm and , ∠DAB = 60°. AD is fixed link E is a point on link BC such that BE = 400 mm and CE = 300 mm (BEC clockwise). A force of 150 ∠45° N acts on DC at a distance of 250 mm from D. Another force of magnitude 230 ∠ 180° N acts at point E. Find the required input torque on link AB for static equilibrium of the mechanism.

Turn over

III. (a) A constant torque 5 kW motor drives a riveting machine. A flywheel of mass 140 kg and radius of gyration of 0.5 m is fitted to the riveting machine. Each riveting operation takes 1 second and requires 5000 Nm of energy. If the speed of flywheel is 450 r.p.m. before riveting, then find: (i) the fall in speed of the flywheel after the riveting, (ii) the number of rivets closed per hour.

Or

(b) The crank of a two cylinder uncoupled inside cylinder locomotive are at right angles and are 300 mm long. The distance between the centre lines of the cylinder is 650 mm. The wheel centre lines are 1.6 m apart. The reciprocating mass per cylinder is 300 kg. The driving wheel diameter is 1.8 m. If the hammer blow is not to exceed 45 KN at 100 km/hr, determine: (i) the fraction of the reciprocating masses to be balanced, (ii) the variation in tractive effort, (iii) the maximum swaying couple.

IV. (a) Find the frequency of the transverse vibrations of a shaft which is simply supported at the ends and is of 40 mm in diameter and 2.5 m in length. The shaft carries three point loads of masses 40 kg, 77 kg and 42 kg at 0.5 m, 1 m and 1.7 m respectively from the left support. The Young's modulus for the material of the shaft is 200 GN/m^2. Neglect the weight of the shaft.

Or

(b) A shaft of length 1.25 m is 75 mm in diameter for the first 275 mm of its length, 125 mm in diameter for the next 500 mm length, 87.5 mm in diameter for the next 375 mm length and 175 mm in diameter for the remaining 100 mm of its length. The shaft carries two rotors at two ends. The mass moment of inertia of the first rotor is 75 kg m^2 whereas of the second rotor is 50 kg m^2. Find the frequency of natural torsional vibrations of the system. The modulus of the rigidity of shaft material may be taken as 80 GN/m^2.

V. (a) In a turned dynamic vibration absorber which is connected to a SDOF system having a mass of 90 kg, the mass of the absorber is 4.5 kg and amplitude of disturbing force is 400 N. If the main mass is at rest when the forcing frequency is 90 Hz. Find the amplitude of vibration of the absorber mass and stiffness of the absorber. Also find the stiffness of the SDOF system.

Or

(b) An automobile has main springs which are compressed 10 cm. under the weight of the body. Assume the tires to be infinitely stiff. The car runs over a road surface consisting of sine waves of 2.54 cm. amplitude (i.e., having 5 cm height difference between crests and valleys) and with distance of 12 m. between consecutive crests. There are no shock absorbers, (i) find the critical speed of the car ; (ii) find the amplitude of vertical vibration of the chassis at a forward speed of 40 m.p.h.

(4 × 15 = 60 marks)