ME-505

B. E. (Fifth Semester) EXAMINATION, Dec., 2011

(Mechanical Engg. Branch)

DYNAMICS OF MACHINES

(ME–505)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit. All questions carry equal marks. Assume suitable data wherever necessary.

Unit—I

1. (a) Differentiate between piston effort, crank effort and crank pin effort. 6

   (b) An IC engine working on four stroke Otto cycle has a bore of 25 cm and stroke of 50 cm. The length of connecting rod is 100 cm and mass of receprocating parts is 80 kg. The crank rotates at 240 r. p. m. The compression ratio is 5, the gas pressure at the end of constant volume heat addition is $30 \times 10^5 \, N/m^2$. Suction pressure is $-0\cdot1 \times 10^5 \, N/m^2$ and exhaust pressure is $1\cdot5 \times 10^4 \, N/m^2$. The law of compression may be assumed as $PV^{1\cdot34} = $ constant. Atmospheric pressure being $1\cdot03 \times 10^5 \, N/m^2$. Find the turning moment on crankshaft when crank has turned 45° from IDC during power stroke. 14

Or

2. A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 r. p. m. The torque crank angle diagram for each cycle is a triangle for the power stroke with maximum torque of 90 N-m at 60° from dead centre of corresponding crank. The torque on return stroke is sensibly zero. Determine : 20

   (i) Power developed.

   (ii) Coefficient of fluctuation of speed, if mass of flywheel is 12 kg and has radius of gyration of 80 mm.

   (iii) Coefficient of fluctuation of energy.

   (iv) Maximum angular acceleration of flywheel.

Unit—II

3. (a) Explain briefly the following terms relating to Governors : 10

   (i) Stability (ii) Isochronism

   (iii) Hunting (iv) Controlling force

   (b) In a Porter governor, upper and lower arms are 200 mm and 250 mm respectively and pivoted on axis of rotation. The mass of central load is 15 kg and mass of each ball is 2 kg and friction of sleeve is equal to load of 25 N at sleeve. If limiting inclination of upper arms to the vertical are 30° and 40°. Find taking friction into account, range of speed of governor. 10

Or

4. (a) What is power of a governor ? How is it determined ? 8

   (b) In a spring loaded Hartnell governor, the extreme radii of rotation of balls are 80 mm and 120 mm. The ball arm and sleeve arm of bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at

two extreme positions are 400 and 420 r. p. m., find out :   12

(i)   Initial compression of central spring.

(ii) Spring constant.

Unit—III

5. A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12·5 kg respectively and each has an eccentricity of 60 mm. The masses at A and D have eccentricity of 80 mm. The angle between masses at B and C is 100° and that between masses at B and A is 190°, both being measured in same direction. The axial distance between plane A and B is 100 mm and between B and C is 200 mm. If shaft is in complete dynamic balance, determine :   20

(i)   Magnitude of masses at A and D.

(ii) Distance between planes A and D.

(iii) Angular position of mass at D

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Or

6. (a) Discuss balancing of V-engines.   10

(b) Explain principle of balancing of Inline engines in brief.   10

Unit—IV

7. (a) Explain the term friction circle and friction axis. What is their importance in force analysis ?   10

(b) A cone clutch with a semicone angle of 15° transmits 10 kW at 600 r. p. m. The normal pressure intensity between surfaces in contact is not to exceed 100 kN/m^2. The width of the friction surfaces is half of the mean diameter. Assuming $\mu = 0.25$, determine :   10

(i)   Outer and inner diameters of plate.

(ii) The axial force to engage clutch.

Or

8. (a) Derive an expression for friction moment for a flat collar bearing in terms of inner radius r_1, outer radius r_2, axial thrust W and coefficient of friction μ. Assume uniform intensity of pressure.   10

(b) What is a clutch ? State its different types. Describe a single plate clutch with the help of diagram.   10

Unit—V

9. (a) Explain the phenomena of "Slip" and "Creep" in a belt.   10

(b) 2·5 kW of power is transmitted by a open belt drive. The linear velocity of the belt is 2·5 m/s. The angle of lap of smaller pulley is 165°. The coefficient of friction is 0·30. Determine the effect of power transmission in the following cases :   10

(i)   Initial tension in belt is increased by 8%.

(ii) Angle of lap is increased by 8% by use of an idler pulley, for same speed and tension on the right side.

Or

10. (a) Discuss "Jump phenomena" in cams.   6

(b) Differentiate between brake and dynamometer.   4

(c) In a band brake one end of band is attached at the fulcrum of braking lever. The angle of contact of band with brake is θ and coefficient of friction between band and drum is μ. While braking force is applied at the end of the lever, the tight or slack side of band tightned depending upon direction of rotation of drum. Show that the braking torque when the brake lever tightens slack side is $e^{\mu \theta}$ times the braking torque, when the brake lever tightens the tight side.   10