Code No. 3047

FACULTY OF ENGINEERING

B.E. 3/4 (Mech./Prod.) I-Semester (Supplementary) Examination, June/July 2011

DYNAMICS OF MACHINES

Time : Three Hours] [Maximum Marks : 75

Answer **ALL** questions from Part-A.

Answer any **FIVE** questions from Part-B.

PART—A (Marks : 25)

1. Explain the terms : piston effort, crank effort.
2. Explain the parameters involved in balancing of a two-wheeler.
3. Define the terms : Stability of a governor, isochronism, hunting.
4. Differentiate between the engine flywheels and machine flywheels.
5. Explain why partial balancing of reciprocating masses is done instead of complete balancing.
6. Explain the whirling phenomenon in shafts.
7. Explain various kinds of damping process in structural parts.
8. Define damping factor and logarithmic decrement.
9. Define magnification factor and resonance.
10. Define : Torsionally equivalent shaft. Give the expression.

PART—B (Marks : 50)

11. A horizontal steam engine running at 120 rpm has a bore of 250 mm and a stroke of 400 mm. The connecting rod is 0·6 m and mass of the reciprocating parts is 60 kg. When the crank has turned through an angle of 45° from the inner dead centre, the steam pressure on the cover end side is 550 kN/m^2 and that on the crank end side is 70 kN/m^2. Considering the diameter of the piston rod equal to 50 mm, determine :
    (i) Turning moment on the crank shaft,
    (ii) Thrust on the bearings, and
    (iii) Acceleration of the flywheel,
    if the power of the engine is 20 kW, mass of the flywheel is 60 kg and radius of gyration 0·6 m.
12. A four wheel motor car of mass 2000 kg has a wheel base 2·5 m, track width 1·5 m and height of centre of gravity 500 mm above the ground level and lies at 1 m from the front axle. Each wheel has an effective diameter of 0·8 m and a moment of inertia of 0·8 kg-m^2. The drive shaft

engine flywheel and transmission are rotating at 4 times the speed of road wheel, in a clockwise direction when viewed from the front, and is equivalent to a mass of 75 kg and having a radius of gyration of 100 mm. If the car is taking a turn of 60 m radius at 60 km/h, find the load on each wheel.

13. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively.

    Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

14. In a spring loaded governor of Hartnell type, the mass of each ball is 1 kg, length of vertical arm of the bell crank lever is 100 mm and that of the horizontal arm is 50 mm. The distance of fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor. The extreme radii of rotation of the balls are 75 mm and 112·5 mm. The maximum equilibrium speed is 5 percent greater than the minimum equilibrium speed which is 360 rpm. Find, neglecting the obliquity of the arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100 mm.

15. Calculate the whirling speed of a shaft 20 mm diameter and 0·6 m long carrying a mass of 1 kg at its mid-point. The density of the shaft material is 40000 kg/m^3 and Young's modulus is 200 GPa. Assume the shaft to be freely supported.

16. A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12·5 mm with a period of 0·2 second. If the system is excited by a harmonic force of frequency 4 Hz, what will be the percentage increase in the amplitude of vibration when damper is removed as compared to that with damping ?

17. A single cylinder oil engine drives directly a centrifugal pump. The rotating mass of the engine, flywheel and the pump with the shaft is equivalent to a three rotor system as shown in Fig. 1.

    The mass moment of inertia of the rotors, A, B and C are 0·15, 0·3 and 0·09 kg-m^2. Find the natural frequency of the torsional vibration. The modulus of rigidity of the shaft material is 84 kN/mm^2.

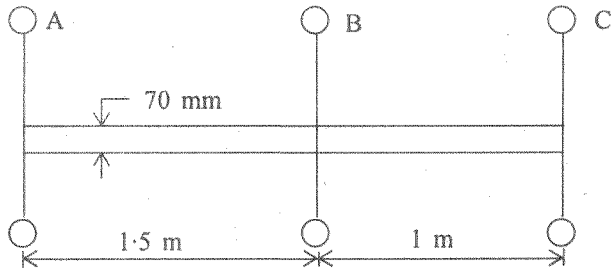

Fig. 1