BTS – VI – (S) – 06 – 013 (I)

B. Tech Degree VI Semester (Supplementary) Examination June 2006

ME 601 DYNAMICS OF MACHINERY

(Prior to 1998 & 1998 Admissions)

Time : 3 Hours

Maximum Marks : 100

I a. What is meant by Shaking Force? Explain. (6)

b. The following data relate to a four-link mechanism:

Link	Length	Mass	Moment of Inertia about centre of mass
AB	60 mm	0.2 kg	80 kg.mm^2
BC	200 mm	0.4 kg	1600 kg.mm^2
CD	100 mm	0.6 kg	400 kg.mm^2
AD	140 mm	-	-

AD is the fixed link. The centre of mass of the links lies at their mid points. Link AB rotates with a constant angular velocity of 47.5 rad/s in the counter clockwise direction. $\angle$ DAB = 135°. Determine the shaking force acting on the frame of the mechanism. (14)

OR

II a. Explain the difference between piston effort, crank effort and crank-pin effort. (6)

b. The turning moment curve for an engine is represented by the equation, T = (20,000 + 9500 sin 2θ - 5700 cos 2θ) N.m, where 'θ' is the angle moved by the crank from the inner dead centre. If the resisting torque is constant, determine the moment of inertia of the flywheel if the total fluctuation of speed is not to exceed 2 % of the mean speed, which is 200 rpm. (14)

III a. Derive an expression for the Gyroscopic Couple acting on a spinning disc. (6)

b. A disc with radius of gyration 60 mm and a mass of 4 kg is mounted centrally on a horizontal axle of 80 mm length between the bearings. It spins about the axle at 800 rpm counter clockwise when viewed from the right-hand side bearing. The axle precesses about a vertical axis at 50 rpm in the clockwise direction when viewed from above. Determine the resultant reaction at each bearing due to the mass and the gyroscopic effect. (14)

OR

IV a. Explain the balancing of V-engines. (6)
b. A five cylinder inline engine running at 750 rpm has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of connecting rod to crank is 4. Examine the engine for balance of primary and secondary forces and couples. The reciprocating mass for each cylinder is 15 kg. (14)

V a. What is meant by Coulomb's damping? Explain. (6)
b. The successive amplitudes of vibrations of a vibratory system as obtained under free vibration are 0.69, 0.32, 0.19, 0.099 units respectively. Determine the damping ratio of the system. (14)
OR
VI a. Explain the term ' Whirling Speed' of a shaft. (6)
b. A machine weighing 3.5 kg vibrates in a viscous medium. A harmonic exciting force of 40 N acts on the machine and produces a resonant amplitude of 18 mm with a period of 0.2 second. Determine the damping coefficient. (14)

VII a. Explain with schematic sketch the working of a Seismometer. (6)
b. A Seismic instrument with a natural frequency of 6 Hz is used to measure the vibration of a machine operating at 120 rpm. The relative displacement of the seismic mass as read from the instrument is 0.05 mm. Determine the amplitude of vibration of the machine. Neglect damping. (14)
OR
VIII a. Explain the effect of inertia of a shaft on free torsional vibrations. (6)
b. A motor drives a centrifugal pump through gearing, the pump speed being one-third that of the motor. The shaft from the motor to the pinion is 60 mm diameter and 300 mm long. The moment of inertia of the motor is 400 kg.m^2. The impeller shaft is 100 mm diameter and 600 mm long. The moment of inertia of impeller is 1500 kg.m^2. Neglecting the inertia of the gears and the shaft, determine the frequency of torsional vibration of the system. The modulus of rigidity of the shaft material is 80 GN/m^2. (14)

IX a. What is meant by Coordinate Coupling? Explain. (6)
b. Three rail bogies are connected by two springs of stiffness 4 MN/m each. The mass of each bogey is 20,000 kg. Determine the frequencies of vibration. Neglect friction between the wheels and rails. (14)
OR
X a. Explain the Dunkerley's method in determining the natural frequency of transverse vibrations. (6)
b. Determine the natural frequency of the system shown in figure. m = 1 kg and k = 100 N/m. (14)