IX. (b) Determine the influence coefficient of the spring-mass system shown in figure 1. (14)

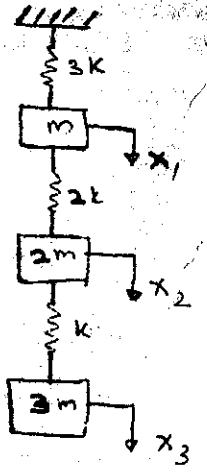

Fig. 1

OR

X. (a) What is meant by natural mode vibration? (6)

(b) Using matrix method, determine the natural frequencies of the system shown in figure 2. (14)

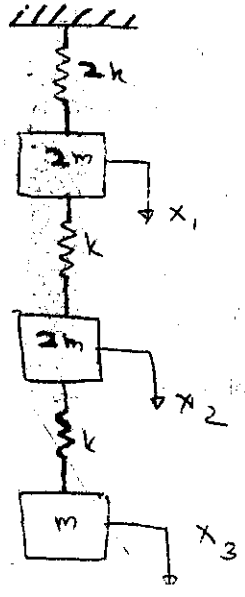

Fig. 2

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B.TECH. DEGREE VI SEMESTER EXAMINATION IN MECHANICAL ENGINEERING
NOVEMBER 2001

ME 601 DYNAMICS OF MACHINERY

(1995 & 1998 Admissions)

Time: Hours Maximum Marks: 100

MODULE - I

I. (a) Explain the conditions of equilibrium of a member under action of two forces and a Torque. (6)

(b) The effective steam pressure on the piston of a vertical steam engine is 20N when the crank is 40° from the inner-dead centre on the down stroke. The crank length is 300mm and the connecting rod length 1200mm. The diameter of the cylinder is 800mm. What will be the torque on the crank shaft if the engine speed is 300 rpm and the mass of the reciprocating parts 250 Kg? (14)

OR

II. (a) Derive the expression for the acceleration of a piston. (6)

(b) A constant torque 2.5 KW motor drives a rivetting machine. The mass of the moving parts including the flywheel is 125 Kg at 700mm radius. One rivetting operation absorbs 10,000 J of energy and takes one second. Speed of the flywheel is 240rpm before rivetting. Determine:

(i) The number of rivets closed per hour, and

(ii) The reduction in speed after the rivetting operation. (14)

MODULE - II

III. (a) Explain the gyroscopic effect of steering, pitching and rolling on naval ships. (6)

(Turn overr)

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

OR

(a) Explain Hammer blow and swaying couple. (6)

(b) Four masses A, B, C & D are completely balanced. Masses C & D makes angle of 90° and 195° respectively with B in the same sense. The rotating masses have following properties:

$m_b = 25Kg$	$r_a = 150mm$
$m_c = 40Kg$	$r_b = 200mm$
$m_d = 35Kg$	$r_c = 100mm$
	$r_d = 180mm$

Planes B & C are 250mm apart. Determine:

(i) The mass A and its angular position.

(ii) The positions of planes A and D. (14)

MODULE - III

(a) Derive the expressions for equivalent stiffness when two springs are connected - (i) parallel (ii) series. (6)

(b) A vibrating system consists of a mass of 50 Kg, a spring of stiffness 30kN/m and a damper. The damping provided is only 20% of the critical value. Determine:

(i) The damping factor.

(ii) The critical damping coefficient

(iii) The natural frequency of damped vibrations

(iv) The logarithmic decrement.

(v) The ratio of two consecutive amplitudes. (14)

OR

Contd.....3.

VI. (a) Explain over damped, critically damped and under damped system. (6)

(b) A horizontal spring mass system with Coulomb damping has a mass of 5.0 Kg attached to a spring of stiffness 980 N/m. If the coefficient of friction is 0.025, calculate-

(i) the frequency of free oscillations,

(ii) the number of cycles corresponding to 50% reduction in amplitude if the initial amplitude is 5.0 cm, and

(iii) the time taken to achieve this 50% reduction. (14)

MODULE - IV

VII. (a) Explain the working principle of a vibrometer. (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 if the seismic mass as read from the instrument is 0.05mm. Determine the amplitude of vibration of the machine. Neglect damping. (14)

OR

VIII. (a) Explain the working of a torsional vibration absorber. (6)

(b) Calculate the natural frequency of a shaft of diameter 10 cm and length 300 cm carrying two discs of diameters 125 cm and 200 cm respectively at its ends and weighing 480 Kg and 900 Kg respectively.

Modulus of rigidity of the shaft is $2 \times 10^6 Kgf/cm^2$. (14)

MODULE - V

IX. (a) What is meant by coupled vibration? (6)

Contd.....4.