



B.E./B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS APRIL/MAY 2011
MECHANICAL ENGINEERING BRANCH
VII SEMESTER-(REGULATIONS 2004)

ME-507 MECHANICAL VIBRATIONS

Time: 3 hr

Max Mark: 100

Answer ALL Questions
Part-A (10 x 2 =20 mark)

Do you agree or disagree with the statements given below. Substantiate your answers in not more than 3 lines

1. Exciting frequency of most industrial rotors are in the range 200 to 1000cps
 2. Exciting frequency of reciprocating machines is always the operating speed of the crank shaft
 3. Natural frequency of an accelerometer is normally below 5cps.
 4. A reaction type of exciter produces a constant level of displacement
 5. Rayleigh's method is based on the principle of conservation of momentum
- 6 Distinguish static and dynamic coupling
 - 7 How many natural frequencies does a continuous system have?
 - 8 State Rayleighs energy method to determine fundamental natural frequency?
 - 9 Explain why field balancing is necessary?
 - 10 Compare and differentiate vibrometer and accelerometer?

Part – B (5 x 16 = 80 Mark)

11) Using Rayleigh's method compute the fundamental torsional critical speed of a shaft having four discs of mass moments of inertia 2500, 2750, 3000 and 3250 Nmmsec² connected by three shaft stiffness of 16×10^9 , 12×10^9 and 8×10^9 Nmm/rad respectively.

12) A coil of spring stiffness 4N/mm supports vertically a mass of 20 kg at the free end. The motion is resisted by the oil dashpot. It is found that the amplitude at the beginning of the fourth cycle is 0.6 times the amplitude of the previous vibration. Determine the damping force per unit velocity. Also find the ratio of the frequency of damped and undamped vibrations. OR

12) (b) A single cylinder vertical engine weighing half a tonne with a vertical line of stroke has a predominant exciting frequency of 6000 rpm. It is supported by four helical springs. Transmissibility of the isolator is 1/10. What should be the natural frequency of the system? What is the required stiffness of each helical spring? Each helical spring has a number of active coils $n=10$. What is the mean

diameter D of the coils? G for spring steel 80,000 MPa. Stiffness of spring = $Gd^4/8D^3n$ ($D/d=1/2$)

13) (a) A piping system experiences resonance when the pump supplying the power to the system operates at 500 rpm. When a 5kg absorber tuned to 500 rpm is added to the pipe, the system new natural frequencies are measured as 380 & 624 rpm. Determine the natural frequency of the piping system and its equivalent mass. (OR)

13) (b) In a longitudinal 2 degree freedom system, the mass m_1 is acted upon by a harmonic force of amplitude F_0 and frequency ω . The amplitude of mass m_1 reaches zero under what condition? Find the amplitude of vibration of the mass m_2 under this condition.

14) (a) A commercial vibration pick up has a damped natural frequency of 5 cps and a damping ratio of 0.45. What is the lowest natural frequency in the range upto infinity at which the amplitude can be read from the pick up not exceeding 3% of the actual amplitude? (OR)

14 (b) Write short notes on

(1) Band pass filter (2) Mechanical Exciter (3) Carrier frequency amplifier

15(a) Determine the natural frequencies of a uniform beam of length l clamped at both ends.

(OR)

15) (b) A steel wire of 2mm diameter fixed between two points located 2m apart. The tensile force in the wire is 250N. Determine (a) fundamental natural frequency of vibration (b) the velocity of wave propagation in the wire.