B.E./B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS APRIL/MAY 2012
MECHANICAL ENGINEERING BRANCH
VII SEMESTER-(REGULATIONS 2004)

25

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. The damping co efficient present in a vibrating system can only be indirectly determined only by the two system constants k and m.
2. Torsional oscillations are associated with clockwise and anti clockwise rotation of the shaft and hence have no industrial relevance
3. If industrial structures experience steady state vibration velocity of the order of 100mm/sec they can be permitted to operate in that environment
4. For purely rotating machines direction of excitation is always along the axis of the shaft
5. A rotating shaft in mech engg cannot have built in ends

6 Distinguish static and dynamic coupling

7 Compare and differentiate vibrometer and accelerometer?

8 State the Duhamel's integral and mention its application

9 Write down the general response equations of a two degree freedom free vibration.

10 Define mass ratio of undamped dynamic absorber systems. What is the main advantage of having higher mass ratio.

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 $Nmmsec^2$ connected by three shaft stiffness of $16x10^9$, $12x10^9$ and $8x10^9$ Nmm/rad respectively.

12) a) A shaft 25 mm in diameter with a span of 900 mm has simply supported ends. It carries a disc 125 N midspan. The eccentricity of the disc is 0.25mm. What is the lateral critical speed of the shaft? If the bending stress of the shaft is not to exceed 100 MPa. Determine the range of speed in which it is unsafe to run this rotor.

(OR)

12)b) A rectangular beam of cross section 25mmx50mm is supported with a span of 2m. It carries a load of 2000N at a distance of 0.7m from one end. Calculate the fundamental frequency of transverse oscillation when (i) the inertia of the beam is neglected (ii) when inertia is included.

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) Accelerometers (2) FFT (3) Vibration Signatures

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

(OR)

15) (b) A steel wire of 5mm diameter fixed between two points located 2m apart. The tensile force in the wire is 500N. Determine (a) fundamental natural frequency of vibration (b) the velocity of wave propagation in the wire.