Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018 - 19 Examination

Semester:5 **Date:23/05/2019**
Subject Code: 03101301 **Time:10:30am to 01:00pm**
Subject Name: Elements of Balancing and Vibration **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **Objective Type Questions** - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) **(15)**

1. Define the term "Dynamic balancing"
2. What is 'Force Transmissibility' (Tr)?
3. What is whirling speed of the shaft?
4. Name any two methods for analysis of multi degree of freedom systems.
5. Define damping ratio.
6. When do you say a vibrating system is under damped?
7. The effect of hammer blow in a locomotive can be reduced by
   (a) decreasing the speed
   (b) using two or three pairs of wheels coupled together
   (c) balancing whole of the reciprocating parts
   (d) both (a) and (b)
8. Determine natural frequency of a system, which has equivalent spring stiffness of 30000 N/m and mass of 20 kg?
   a)12.32 Hz
   b) 4.10 Hz
   c) 6.16 Hz
   d) None of the above
9. Magnification factor is the ratio of_____
   a) zero frequency deflection and amplitude of steady state vibrations
   b) amplitude of steady state vibrations and zero frequency deflection
   c) amplitude of unsteady state vibrations and zero frequency distribution
   d) none of the above
10. Which of the following instruments measure amplitude of a vibrating body?
    a) Vibrometers
    b) Seismometer
    c) Both a. and b.
    d) None of the above
11. Which of the following factors are not responsible for unbalancing in rotating systems?
    a) Errors
    b) Tolerances
    c) Shape of the rotor
    d) None of the above
12. What is the function of the accelerometer?
13. Define "Degrees of Freedom" (D.O.F).
14. Define Resonance & Damping.
15. Give one Example of two degree of freedom system.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Explain concept of critical speed of shaft in brief (Undamped)

B) How and why are reciprocating masses balanced in a piston-cylinder assembly? Why reciprocating masses are partially balanced?

C) Derive an expression for logarithmic decrement. What is the significance of logarithmic decrement?

D) Discuss balancing of 'V' engines.

Q.3 A) A four crank engine has the two outer cranks set at 120° to each other, and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, the length of each connecting rod is 1.2 m and the speed of rotation is 240 r.p.m., what is the maximum secondary unbalanced force? **(07)**

B) The disc of a torsional pendulum has a moment of inertia of 600 kg-cm^2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for successive cycles are 9^0, 6^0, 4^0. Determine **(08)**

1) logarithmic decrement

2) Damping torque at unit velocity

3) The periodic time of vibration

Assume for the brass shaft G= 4.4 * 10^{10} N/m^2

OR

B) The support of a spring mass system is vibrating with amplitude of 5 mm and a frequency of 1150 cycle/min. If the mass is 0.9 kg and the spring has a stiffness of 1960 N/m, determine the amplitude of vibration of the mass. What amplitude will result if a damping factor of 0.2 is included in the system? **(08)**

Q.4 A)

1) If two springs of stiffness K1 and K2 are connected in series and mass m is attached to it. Find its natural frequency of the longitudinal vibration. **(03)**

2) A vertical spring mass system has a mass of 0.5 kg and an initial deflection of 0.2 cm. find the spring stiffness and the natural frequency of the system **(04)**

OR

A) What are various frequency measuring instruments? Explain any one in detail **(07)**

B) A 75 kg machine is mounted on springs of stiffness of 11.76 * 10^5 N/m with an assumed damping factor of 0.20. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 c.p.m. Assuming the motion of the piston to be harmonic , determine the amplitude of vibration of the machine and vibratory force transmitted to the foundation. **(08)**