**20ME501**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **February,2023** | **Mechanical Engineering** | | |
| **Fifth Semester** | **Dynamics of Machines** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |

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| 1. | a) | How governors are classified? | CO1 | L2 | 1M |
|  | b) | Define coefficient of sensitiveness? | CO1 | L1 | 1M |
|  | c) | What is meant by hunting? | CO1 | L1 | 1M |
|  | d) | Define axis of precession? | CO2 | L2 | 1M |
|  | e) | What is the effect of gyroscopic couple on rolling of ship? Why? | CO2 | L3 | 1M |
|  | f) | Define hammer blow? | CO2 | L2 | 1M |
|  | g) | State different methods of finding natural frequency of a system? | CO3 | L2 | 1M |
|  | h) | What do you mean by torsional equivalent shaft? | CO3 | L2 | 1M |
|  | i) | What do you mean by logarithmic decrement? | CO3 | L1 | 1M |
|  | j) | Define viscous damping? | CO3 | L2 | 1M |
|  | k) | What is magnification factor | CO4 | L3 | 1M |
|  | l) | List the vibration measuring instruments | CO4 | L2 | 1M |
|  | m) | What do you understand by transmissibility? | CO4 | L2 | 1M |
|  | n) | Write the expression for the amplitude of forced vibrations | CO4 | L3 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | In a reciprocating engine, length of stroke is 30 cm and connecting rod is 60 cm long between centers. When the piston has travelled 8 cm from the inner dead centre, find i) angular position of the crank ; ii) velocity and acceleration of the piston ; iii) angular velocity of connecting rod, if the engine speed is 240 rpm. | CO1 | L1 | 7M |
|  | b) | What is meant by piston effort and crank effort? | CO1 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | The following particulars refer to a Wilson-Hartnell governor: Mass of each ball = 2 kg ; minimum radius = 125 mm ; maximum radius = 175 mm ; minimum speed = 240 rpm ; maximum speed = 250 rpm ; length of the ball arm of each bell crank lever = 150 mm; length of the sleeve arm of each bell crank lever = 100 mm ; combined stiffness of the two ball springs = 0.2 kN/m. Find the equivalent stiffness of the auxiliary spring referred to the sleeve. | CO1 | L2 | 7M |
|  | b) | A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and mass of the central load on the sleeve is 25kg.The radius of rotation of the ball is 150mm when governor is at maximum speed. Find the maximum and minimum speed and range of speed of the governor | CO1 | L1 | 7M |
|  |  | **Unit -II** |  |  |  |
| 4. | a) | Explain the effect of gyroscopic couple on a naval ship during pitching | CO2 | L3 | 7M |
|  | b) | The turbine rotor of a ship has a mass of 20 tones and a radius of gyration 0.75. Its speed is 2000 rpm. The ship pitches 6° above and below the horizontal position. One complete oscillation takes 18 seconds and the motion is simple harmonic. Determine  (i) The maximum couple tending to shear the holding down bolt of the turbine  (ii) The maximum angular acceleration of the ship during pitching.  The direction in which the bow will tend to turn while, if the rotation of the rotor is clockwise when looking from rear. | CO2 | L4 | 7M |
|  |  | **(OR)**  **P.T.O**  **20ME501** | | | |
| 5. | a) | Describe reasons for partial balancing of reciprocating masses. | CO2 | L1 | 7M |
|  | b) | A rotating shaft carries four radial masses A = 8 kg, B = C = 6 kg, and D = 5 kg. The mass centres are 30 mm, 40 mm, 40 mm, and 50 mm respectively from the axis of the shaft. The axial distance between the planes of rotation of A and B is 400mm, and that between B and C is 500 mm. The masses A and C are at right angles to each other. Find for a complete balance, (**a**) the angle between the masses B and D from mass A, (**b**) the axial distance between the planes of rotation of C and D, and (c) the magnitude of mass B. | CO2 | L3 | 7M |
|  |  | **Unit -III** | |  |  |
| 6. | a) | A vibrating system consists of a mass of 10 kg. Spring stiffness 12 N/mm and a dash pot of damping coefficient of 0.06 N/mm/sec. Determine i. damping factor, ii. Logarithmic decrement and iii. Ratio of the two consecutive amplitudes | CO3 | L4 | 7M |
|  | b) | A shaft of 100 mm diameter and 1 m long is fixed at one end, and the other end carries a flywheel of mass 1 tonne. The radius of gyration of the flywheel is 0.5 m. Find the frequency of torsional vibrations, if the modulus of rigidity of the shaft material is 80 GN/m2. | CO3 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Explain the terms under damping, critical damping and over damping. | CO3 | L1 | 7M |
|  | b) | The machine mounted on springs and fitted with a dashpot has a mass of 60 kg. There are three springs, each of stiffness 12 N/mm. The amplitude of vibrations reduces from 45 to 8 mm in two complete oscillations. Assuming that the damping force varies as the velocity, determine.  i) The damping coefficient,  ii) The ratio of frequencies of damped and un-damped vibrations,  iii) The periodic time of damped vibrations. | CO3 | L2 | 7M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | A machine part of mass 2.5 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 30 N results in a resonant amplitude of 14 mm with a period of 0.22 second. If the system is excited by a harmonic force of frequency 4 Hz what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that with damping. | CO4 | L1 | 7M |
|  | b) | Explain about the forced vibration with rotating and reciprocating unbalance? | CO4 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | Explain about a system subjected to the forced vibrations with constant harmonic excitation? | CO4 | L2 | 7M |
|  | b) | A 75 kg machine is mounted on springs of stiffness k=11.76×106 N/m with a damping factor of 0.2. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 rpm. Assuming the motion of the piston to be harmonic, determine the amplitude of vibration of machine and the vibratory force transmitted to the foundation. | CO4 | L3 | 7M |

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