**Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_**

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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April / May – 2017**

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| **Code :** | **14CE3005** | **Duration :** | **3hrs** |
| **Sub. Name :** | **STRUCTURAL DYNAMICS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a.  b. | Develop the equation of motion for damped free vibration of a SDoF system and hence explain the under damped critically damped and overdamped sytem with neat sketch  A free vibration test is conducted on an empty elevated water tank. A cable attached to the tank applies a lateral horizontal force of 73 kN and pulls the tank horizontally by 50mm. The cable is suddenly cut and the resulting free vibration is recorded. At the end of four complete cycles, the time is 2.0 sec and the amplitude is 25mm compute the following:  i)damping ratio ii)natural period of undamped vibration iii) stiffness  iv). weight v).damping coefficient vi).number of cycles required for the displacement amplitude to decrease to 5mm. | CO1  CO1 | 10  10 |
| (OR) | | | | |
| 2. | a.  b.  c. | Explain Dynamic load factor and magnification Factor.  A machine, having a mass of 250 kg is supported by springs of total stiffness k = 21.5 kN/m. assuming that the damping ratio is 0.15. The machine incorporates a piston whose mass is 5 kg and it has a stroke of 200 mm. for operations at 1500 rpm. Determine the dynamic amplitude of the machine.  A tower modeled as a SDOF system has stiffness of 1.2X106 N/m and its weight with full of water is 2000kN. It is subjected to ground acceleration a(t)=0.98 t 2 m/sec2 . Determine the relative displacement at the top of the tower at time t = 1 sec. Neglect damping. | CO1  CO1  CO1 | 3  7  10 |
| 3. | a.  b. | Explain how the following arbitrary periodic loading is converted into simple periodic loadings    Determine the response with zero initial conditions for the forced vibration phase of the SDOF system shown below | CO1  CO1 | 10  10 |
| (OR) | | | | |
| 4. | a.  b. | Determine the dynamic response of the tower, subjected to a blast loading. The Idealization of the structure and the blast loading are shown.    Determine the natural frequencies and mode shapes for the system shown below | CO1  CO1 | 10  10 |
| 5. | a.  b. | Prove that the vibration modes are orthogonal.  Determine the first two natural frequencies of a uniform cantilever beam by Rayleigh Ritz method by taking | CO2  CO2 | 5  15 |
| (OR) | | | | |
| 6. | a.  b. | Determine the natural frequencies and mode shapes of the three storey shear building shown in Fig. M1, M2 & M3 are lumped masses, and k1, k2 & k3 are storey stiffnesses.    Using Rayleigh Ritz method, determine the first two natural frequencies and mode shapes of a four storeyed frame whose mass and stiffness matrices are given by | CO2  CO2 | 12  8 |
| 7. | a.  b. | Obtain the expression for a uniform beam subjected to free flexural vibration and hence obtain the first three natural frequencies and mode shapes of a simply supported beam subjected to free flexural vibrations. Sketch the mode shapes.  Derive the equation of motion for undamped free longitudinal vibration of a uniform bar and hence obtain the solution for the bar fixed at the left end and carrying a concentrated mass ‘M” at the right end. | CO1  CO1 | 10  10 |
| (OR) | | | | |
| 8. | a.  b. | A simply supported beam of span 8m is subjected to a concentrated force of 700 N applied suddenly at a point 2m from the left end. Mass of the beam is 750 kg/m & EI = 30 x 106 Nm2. Determine the response by considering first two modes only.    Determine the first two natural frequencies of a uniform cantilever beam by Rayleigh-ritz method. Assume ø(x)= C1x2 +C2x3 Compare the fundamental frequency with that of exact solution. | CO1  CO1 | 10  10 |

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|  | | **Compulsory:** |  |  |
| 9. | a.  b.  c. | Find the response of a two degree of freedom system whose mass and Stiffness  Matrices are given by the following.  and    The forcing function .The system starts at rest. Find its response by Central Difference method. Use time step as 0.28 sec  Explain the step by step procedure for the solution of equilibrium  equation in dynamic analysis using Newmark Beta method  Write a brief note on wind induced vibration. | CO2  CO2  CO2 | 10  7  3 |