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# B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

## February / March 2023 Semester End Main Examinations

**Programme: B.E.**

**Branch: Aerospace Engineering**

**Course Code: 21AE7DERDY**

**Course: Rotor Dynamics**

**Semester: VII**

**Duration: 3 hrs.**

**Max Marks: 100**

**Date: 05.03.2023**

**Instructions:** 1. Answer any FIVE full questions, choosing one full question from each unit.  
2. Missing data, if any, may be suitably assumed.

### UNIT - I

- 1 a) Derive the governing differential equation of motion and natural frequency of Jeffcott rotor model. **10**
- b) Explain the different methods of attenuation of vibration. **6**
- c) Explain the Rankine rotor model with respect to the different orbital motions of the mass **4**

**OR**

- 2 a) Derive the governing differential equation of motion and natural frequency of single degree of freedom Un-damped free and forced rotor model. **12**
- b) A rotor has a mass of 10 kg and the operational speed of  $100 \pm 1$  rad/s. What are the bounds of the effective stiffness of the shaft so that the critical speed does not fall within 5% of the operating speed? Assume that there is no damping the rotor system. **4**
- c) Define i) Whirling of shaft, ii) Critical speed, iii) Asynchronous whirl iv) Synchronous whirl **4**

### UNIT – II

- 3 a) Explain the influence of Number of Pads and influence of preload on the dynamic coefficients in tilt pad bearings. **8**
- b) List the Reynolds equation assumptions for calculating the performance of the hydrodynamic bearing. **6**
- c) Explain the influence of Pivot Stiffness and influence of bearing length or pad length. **6**

**OR**

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

- |   |    |   |   |
|---|----|---|---|
| 4 | a) | List the types of rolling contact bearings and explain any two with neat sketches.      | 8 |
|   | b) | List the types of fixed-geometry sleeve bearing and explain any two with neat sketches. | 8 |
|   | c) | Explain the failures in rolling contact bearing.  | 4 |

### **UNIT - III**

- |   |    |   |    |
|---|----|---|----|
| 5 | a) | Derive the governing equations for instability analysis due to rotary seals.                                | 10 |
|   | b) | Explain the influence of the rotational speeds and pressure differences on the seal's dynamic coefficients. | 10 |

### **UNIT - IV**

- |   |    |  |    |
|---|----|--|----|
| 6 | a) | Determine the four critical speeds of rigid rotor mounted on simple anisotropic springs as bearings. | 10 |
|   | b) | Derive the gyroscopic moments equation for motion of a rotor mounted on two bearings.                | 10 |

### **UNIT - V**

- |   |    |   |    |
|---|----|---|----|
| 7 | a) | Illustrate the vibration-based identification of faults.  | 10 |
|   | b) | Explain with neat sketches, visual presentation of vibration measurements- waterfall and campbell diagram | 10 |

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