U.S.N.										

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

Autonomous Institute Affiliated to VTU

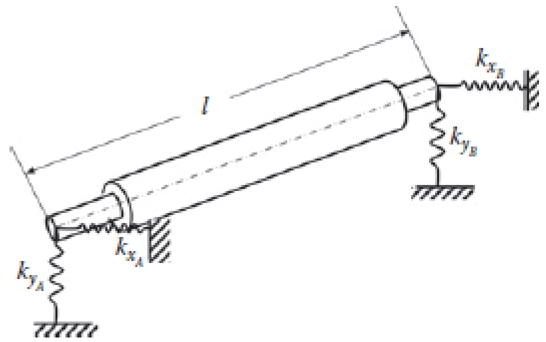
January 2024 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 21AE7DERDY **Max Marks: 100**
Course: Rotor Dynamics

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

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.

		UNIT - I	CO	PO	Marks
1	a)	Define the following: i) Whirling of the shaft, ii) Critical speed, iii) Asynchronous whirl, iv) Synchronous whirl, v) Instability of rotor system, vi) Anti-Synchronous whirl.	CO1	PO1	**06**
	b)	Derive the governing differential equation of motion and natural frequency of single degree of freedom Un-damped free and forced rotor model.	CO1	PO1 PO2	**10**
	c)	Explain the Rankine rotor model concerning the different orbital motions of the mass.	CO1	PO1	**04**
		OR			
2	a)	Derive the governing differential equation of motion and natural frequency of single degree of freedom damped free rotor model.	CO2	PO1 PO2	**08**
	b)	Derive the governing differential equation of motion and natural frequency of Jeffcott rotor model.	CO2	PO1 PO2	**07**
	c)	Explain the different methods of attenuation of vibration.	CO2	PO1	**05**
		UNIT - II			
3	a)	List the Reynolds equation assumptions for calculating the performance of the hydrodynamic bearing.	CO2	PO1	**06**
	b)	Explain the guidelines for selecting a proper type of bearing.	CO2	PO1	**04**
	c)	A 360^0 or Full journal bearing (Hydrodynamic) supports a load of 20 kN when operating at 1000 rpm for a steam turbine if the allowable bearing pressure is 1.6 N/mm^2. Determine diameter, length, clearance ratio of bearing, minimum oil film thickness, viscosity of oil, and the coefficient of friction.	CO2	PO1 PO2 PO3	**10**
		OR			

	4	a)	Explain the following with neat sketches: i)Un-grooved plain seals ii) Contact seals iii) Floating-ring oil seals iv) Labyrinth seals v) Honeycomb pattern seals	*CO2*	*PO1*	**10**
		b)	Explain the influence of pivot stiffness and the influence of bearing length or pad length.	*CO2*	*PO1*	**10**
			UNIT - III			
	5	a)	Derive the governing equations for instability analysis due to rotary seals.	*CO3*	*PO1* *PO2*	**10**
		b)	Explain the effect of the L/D ratio on the seal's dynamic coefficients.	*CO3*	*PO1*	**06**
		c)	Explain with a neat sketch invention of the pocket damper seal.	*CO3*	*PO1*	**04**
			UNIT - IV			
	6	a)	Derive the four critical speeds of a rigid rotor mounted on simple anisotropic springs as bearings.	*CO4*	*PO1* *PO2*	**10**
		b)	Find the critical speeds of a rotor system as shown in Figure 6b. The bearing stiffness properties are $k_{x\,A}$ =1.1 kN/mm, k_{yA} =1.8 kN/mm, $k_{x\,B}$ = 3.1 kN/mm, and k_{yB} = 3.8 kN/mm. The disc has m= 10 kg and I_d = 0.1 kg-m^2 and length of rotor l = 1 meter.  **FIGURE 6b.** A long rigid rotor on flexible bearings	*CO4*	*PO1* *PO2* *PO3*	**04**
		c)	Derive the gyroscopic moment's equation for motion of a rotor mounted on two bearings.	*CO4*	*PO1* *PO2*	**06**
			UNIT - V			
	7	a)	Describe the process of run-out correction in vibration signal conditioning with brevity.	*CO5*	*PO1*	**06**
		b)	Explain with neat sketches of vibration signature analysis.	*CO5*	*PO1*	**06**
		c)	Illustrate vibration measurements through the creation of clear diagrams, including waterfall and Campbell diagrams, with a visual presentation.	*CO5*	*PO1*	**08**

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