U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: 7th**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS7PERDY/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.

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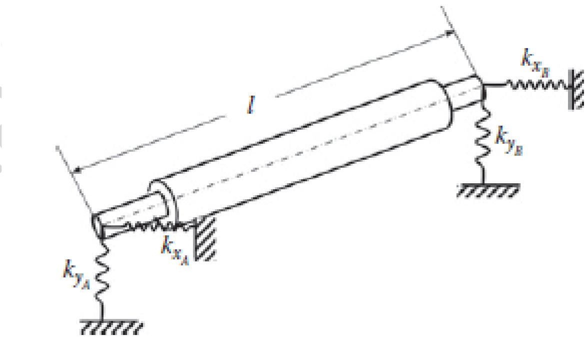
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	*PO*	Marks
		UNIT - I			
1	a)	A rotor has a mass of 10 kg and the operational speed of 100 ± 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.	*CO1*	*PO2*	**04**
	b)	Explain any three methods of attenuation of vibration.	*CO1*	*PO1*	**06**
	c)	Derive the governing differential equation of motion and natural frequency of Jeffcott rotor model.	*CO1*	*PO1*	**10**
		OR			
2	a)	Derive the governing differential equation of motion and natural frequency of single degree of freedom damped free rotor model	*CO1*	*PO1*	**08**
	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*	**12**
		UNIT - II			
3	a)	Explain the influence of load between pivots versus load on pivot.	*CO2*	*PO1*	**05**
	b)	Explain the failures in rolling contact bearing.	*CO2*	*PO1*	**05**
	c)	Explain the influence of Number of Pads and influence of preload on the dynamic coefficients in tilt pad bearings.	*CO2*	*PO1*	**10**
		OR			
4	a)	Explain with neat sketches, which describe the three regimes of operation a fluid film bearing.	*CO2*	*PO1*	**07**
	b)	List the types of fixed-geometry sleeve bearing and explain any two with neat sketches.	*CO2*	*PO1*	**08**

		c)	Explain with a neat sketch i) Pressure dam bearings, ii) Rocker back tilt pad bearing, iii) Cross-coupling, iv) boundary friction, v) Lemon bore bearing.	*CO2*	*PO1*	**05**
			UNIT - III			
	5	a)	Derive the governing equations for instability analysis due to rotary seals.	*CO3*	*PO1*	**10**
		b)	Explain the influence of the rotational speeds and pressure differences on the seal's dynamic coefficients.	*CO3*	*PO1*	**10**
			OR			
	6	a)	Explain with a neat sketch invention of the pocket damper seal	*CO3*	*PO1*	**06**
		b)	Compute the advantages, disadvantages, and applications of rolling contact bearings.	*CO3*	*PO1*	**08**
		c)	Explain the effect of the L/D ratio on the seal's dynamic coefficients.	*CO3*	*PO1*	**06**
			UNIT - IV			
	7	a)	Determine The four critical speeds of rigid rotor mounted on simple anisotropic springs as bearings.	*CO4*	*PO1*	**10**
		b)	Derive the gyroscopic moments equation for motion of a rotor mounted on two bearings.	*CO4*	*PO1*	**10**
			OR			
	8	a)	Find the critical speeds of a rotor system as shown in Figure 8a. The bearing stiffness properties are k_{xA} =1.1 kN/mm, k_{yA} =1.8 kN/mm, k_{xB} = 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 the rotor (l) = 1 m.  Figure 8a.	*CO4*	*PO2*	**08**
		b)	Explain the whirl directions with respect to the shaft spin frequency with neat sketches.	*CO4*	*PO1*	**06**
		c)	The rotor of a jet aeroplane engine is supported by two bearings 2.14 m apart. The rotor assembly including compressor, turbine and shaft has a mass of 688 kg.If C.G being situated at 0.92 m from the left bearing and has radius of gyration 0.229 m.Determine the maximum bearing force on the aeroplane when it undergoes a pullout on a 1830 m radius curve at a constant speed of aeroplane 960 km per hour and engine rotor speed of 10,000 rpm, including	*CO4*	*PO2*	**06**

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			the effect of centrifugal force due to the pull out as well as gyroscopic effect.			
			UNIT - V			
	9	a)	Illustrate the vibration-based identification of faults.	*CO5*	*PO1*	**10**
		b)	Explain with neat sketches, visual presentation of vibration measurements- waterfall and campbell diagram.	*CO5*	*PO1*	**10**
			OR			
	10	a)	Write a note on the electrical noise.	*CO5*	*PO1*	**04**
		b)	Explain with neat sketches of vibration signature analysis.	*CO5*	*PO1*	**08**
		c)	Briefly explain run-out correction in vibration signal conditioning.	*CO5*	*PO1*	**08**

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