Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2021

Subject Code:3151911 **Date:17/12/2021**

Subject Name:Dynamics of Machinery

Time:02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain the function of flywheel and how it is different from governor?	**03**
	(b)	Explain effect of gyroscopic couple on aeroplane.	**04**
	(c)	The following data refers to an outside cylinder uncoupled locomotive;	**07**

Weight of rotating parts per cylinder 300 Kg
Weight of reciprocating parts per cylinder 270 Kg
Angle between cranks 90^0
Crank Radius 300 mm
Distance between wheels 1550 mm
Distance between cylinder centers 1750 mm
Diameter of driving wheels 2000 mm
Radius of balancing weight 700 mm

If whole of the revolving and 2/3 of reciprocating masses are to be balanced, determine the magnitude and position of the balancing mass required in the planes of driving wheels.

Q.2	**(a)**	What are the requirements of an equivalent dynamically system?	**03**
	(b)	Define the terms i) Longitudinal vibrations, ii) damped vibrations, iii) resonance, iv) amplitude of vibration	**04**
	(c)	Find the natural frequency of the system shown in figure 2.1. Given $K_1=K_2=1500$ N/m and $K_3 = 2000$ N/m, m = 5 Kg.	**07**

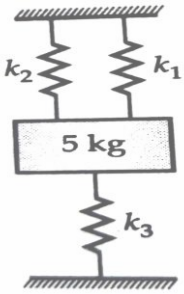

Figure 2.1

OR

	(c)	Derive an expression for equation of motion of under-damped system.	**07**
Q.3	**(a)**	Explain the term hammer blow and how to control it.	**03**
	(b)	A gun barrel having mass of 560 Kg is designed with the following data; Initial recoil velocity 36 m/s, recoil distance on firing 1.5 m. Calculate the spring constant, natural frequency of vibration and damping coefficient of the spring.	**04**

	(c)	The crank and connecting rod of a steam engine are 300 mm and 1500 mm in length respectively. The crank rotates at 180 rpm clockwise. Determine the velocity and acceleration of the piston when the crank is at 40 degrees from the inner dead center position. Also determine the position of the crank for zero acceleration of the piston.	**07**

OR

Q.3	**(a)**	Explain in brief vibration isolation and isolation materials.	**03**
	(b)	Explain the following terms with neat sketch, i) axis of spin, ii) angular velocity of spin, iii) axis of precession, iv) angular velocity of precession.	**04**
	(c)	The turning moment diagram for a petrol engine is drawn to the following scales; turning moment 1 mm = 5 N-m, crank angle 1 mm = 1^0. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36 Kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 rpm.	**07**
Q.4	**(a)**	Why reciprocating massed are partially balanced?	**03**
	(b)	Explain method of balancing of radial engines.	**04**
	(c)	Find the angle of inclination with respect to the vertical of a two wheeler negotiating a turn for the following given data; Combined mass of the vehicle with its rider is 250 Kg, Moment of inertia of the engine flywheel 0.3 Kg-m^2, Moment of inertia of each road wheel 1 Kg-m^2, Speed of engine flywheel 5 times that of road wheels and in the same direction, Height of center of gravity of rider with vehicle = 0.6 m, Two wheeler speed 90 kmph, wheel radius = 300 mm, radius of turn = 50 m.	**07**

OR

Q.4	**(a)**	Explain the working principle of seismic instruments.	**03**
	(b)	Differentiate between static balancing and dynamic balancing system. State the 2 practical example of each.	**04**
	(c)	A spring-mass-dashpot system having stiffness of 30 KN/m, mass of 100 Kg has the damping only 25 % of the critical value. Determine, the damping ratio, the critical damping coefficient, the natural frequency of damped vibration, logarithmic decrement and ratio of two successive amplitudes.	**07**
Q.5	**(a)**	Why balancing of rotating and reciprocating masses is necessary? What are effects of unbalancing?	**03**
	(b)	Define damping. Explain different ways of providing the damping for reducing vibrations.	**04**
	(c)	A machine of mass 1000 Kg is acted upon by an external force of 2450 N at 1500 rpm. To reduce the effect of vibration, isolators or rubbers having a static deflection of 2 mm under machine weight and an estimated damping factor of 0.2 are used. Determine the amplitude of vibration of machine and force transmitted to the foundation.	**07**

OR

Q.5	**(a)**	Explain with neat sketch any one type of frequency measuring instrument.	**03**
	(b)	Derive an expression for critical speed of shaft carrying a single rotor and having damping.	**04**
	(c)	Explain the torsional vibration of three rotor system.	**07**

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