Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2152509 **Date: 21/11/2019**

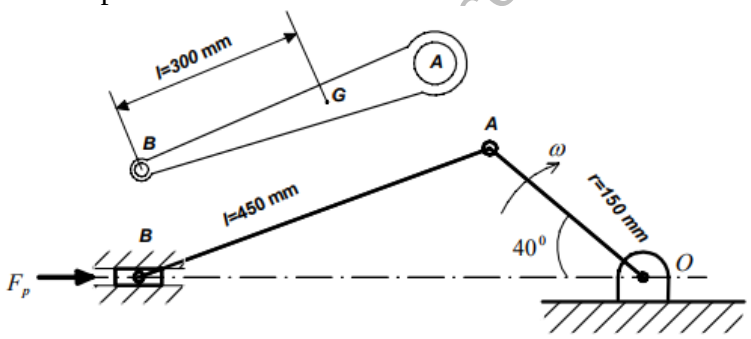
Subject Name: Machine Dynamics

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Explain D'Alembert's principle.	**03**
	(b)	What is the difference between piston effort, crank effort and crank pin effort?	**04**
	(c)	Derive an expression of Forces on the reciprocating parts of an engine, Neglecting the weight of the Connecting rod.	**07**
Q.2	**(a)**	Explain Hammer Blow.	**03**
	(b)	Derive the expression of Variation in tractive force for an uncoupled two cylinder locomotive engine.	**04**
	(c)	The connecting rod of an IC engine is 450 mm long and has a mass of 2 kg. The center of the mass of the rod is 300 mm from the small end and its radius of gyration about an axis through this center is 175 mm. The mass of the piston and the gudgeon pin is 2.5 kg and the stroke is 300 mm. The cylinder diameter is 115 mm. Determine the magnitude of the torque applied on the crankshaft when the crank is at 40 degree and the piston is moving away from the inner-dead center under an effective gas pressure of 2 N/mm2. The engine speed is 1000 rpm.	**07**



OR

	(c)	A four masses A,B,C and D carried by a rotating shaft are at radii 20,15,25 and 30 mm are 20,30,24 and 26 kg in magnitude respectively. The angle between the successive masses are 45°,75° and 135° respectively. Find the position and magnitude of balancing mass required to be placed at radius of 20 mm.	**07**
Q.3	**(a)**	Define: Free vibration, Forced vibration, Damped vibration	**03**
	(b)	Derive the equation of Torsionally equivalent shaft.	**04**
	(c)	Prove that whirling speed of the rotating shaft is the same as the frequency of natural transverse vibration.	**07**

OR

Q.3	**(a)**	Define: Under damping, Critical damping, Over damping.	**03**
	(b)	Derive the equation of Natural frequency of free Torsional vibration of single rotor system.	**04**
	(c)	A shaft 1.5 m long, supported in flexible bearing at the ends carries two wheels each of 50 kg mass. One wheel is situated at the center of the shaft and the other at a distance of 375 mm from the center towards left. The external OD of shaft is 75 mm and internal OD is 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^3.Find the lowest whirling speed of the shaft, taking into account the mass of the shaft.	**07**
Q.4	**(a)**	What are the causes and effects of Vibrations?	**03**
	(b)	What do you understand by Transmissibility?	**04**
	(c)	A machine having a mass of 800 kg rest on four springs each having a stiffness of 4000 kN/m. The machine runs at 2500 rpm. The damping factor is 0.25. Under the operating condition, the machine is found to deflect by 0.08 mm. Determine: Magnification factor, Force transmitted through each mountings.	**07**

OR

Q.4	**(a)**	Explain the term Logarithmic decrement.	**03**
	(b)	A shaft of length 1 m supported freely at the ends, is carrying a body of mass 100 kg at 0.25 m from one end. Find the natural frequency of transverse vibration. Assume E = 200 GN/m^2 and shaft diameter = 60 mm	**04**
	(c)	Derive an expression for the natural frequency of Transverse vibration.	**07**
Q.5	**(a)**	What is the function of Governor? How does it differ from Flywheel?	**03**
	(b)	Calculate vertical height of watt governor when it rotates at 60 rpm. Also find the change in vertical height when its speed increases to 62 rpm.	**04**
	(c)	The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 25 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor.	**07**

OR

Q.5	**(a)**	Why Porter governor cannot be a Isochronous?	**03**
	(b)	Derive the equation of height of the watt governor.	**04**
	(c)	State the different types of governor. What is the difference between the inertia and centrifugal type of governor? Why is the former preferred to the latter?	**07**

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