Q. Code:969143

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Fourth Semester

MR18012 – MECHANICS OF MARINE MACHINES

(Marine Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Upon completion of the course, students will have the knowledge of velocity and acceleration of four bar and slider crank mechanisms.	**3**
CO 2	At the end of this course, students would have technical knowledge of gears and their tooth profiles.	**3**
CO 3	Upon completion of the course, students will be able to apply the principles of governors and gyroscopes to mechanical engineering application.	**3**
CO 4	At the end of this course, students will be able to know the concepts of balancing of rotating and reciprocating masses.	**3**
CO 5	At the end of this course, students will have the knowledge on vibrations.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	State the condition of Grashoff's law in double crank mechanism.	**1**	**2**
2.	How will you obtain simple double rocker mechanism in four bar kinematic chain?	**1**	**3**
3.	Define diametrical pitch of the gear.	**2**	**2**
4.	What do you understand by the term gear ratio?	**2**	**2**
5.	What do you mean by sensitivity of the governor?	**3**	**2**
6.	What is meant by hunting in Governor?	**3**	**2**
7.	What is meant by static balancing?	**4**	**2**
8.	Define centrifugal force of a rotating body.	**4**	**2**
9.	Why damping of vibration is required and list some methods involved in damping vibration.	**5**	**3**
10.	How does resonance occur in a vibrating body?	**5**	**3**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	**(i)**	Explain Grashoff's law and discuss all the cases with help of a neat sketch.	**(7)**	**1**	**3**
	(ii)	Explain the working of pendulum pump mechanism.	**(7)**	**1**	**3**

(OR)

(b)	In an engine slider crank mechanism, the crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. The crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find: 1).Velocity of G and Angular velocity of AB, and 2).Acceleration of G and Angular acceleration of AB, at a crank angle of 120° from inner dead centre position.	**(14)**	**1**	**3**

12. (a)	**(i)**	Derive an expression for Velocity of sliding in gears.	**(7)**	**2**	**3**
	(ii)	What are the major classification of gears?	**(7)**	**2**	**3**

(OR)

(b)	The following data relate to a pair of 20° involute gears in mesh: Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49; Addenda on pinion and gear wheel = 1 module. Find: 1). The number of pairs of teeth in contact; 2). The angle turned through by the pinion and the gear wheel when one pair of teeth is in contact, and 3). The ratio of sliding to rolling motion when the tip of a tooth on the larger wheel (i) is just making contact, (ii) is just leaving contact with its mating tooth, and (iii) is at the pitch point.	**(14)**	**2**	**3**

13. (a)	A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 300 r.p.m. and 305 r.p.m. for a sleeve lift of 17 mm. The sleeve arms and the ball arms are 80 mm and 115 mm respectively. The levers are pivoted at 120 mm from the governor axis and the mass of each ball is 2.6 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine: a). loads on the spring at the lowest and the highest equilibrium speeds b). Stiffness of the spring.	**(14)**	**3**	**3**

(OR)

(b)	The mass of each ball of a proell governor is 7.5 kg and the load on the sleeve is 80 kg. Each of the arms is 300 mm long. The upper arms are pivoted on the axis of rotation whereas the lower arms are pivoted 40 mm from the axis of rotation. The ball arms are 100 mm long and are parallel to the governor	**(14)**	**3**	**3**

axis at the minimum radius. Determine the equilibrium speeds corresponding to extreme radii of 180 mm and 240 mm.

14. (a)	Briefly explain various methods involved in finding out the balancing of rotating masses in dynamic motion with neat sketches.	**(14)**	**4**	**3**
	(OR)			
(b)	Three masses are attached to a shaft as follows: 10 kg at 90 mm radius, 15 kg at 120 mm radius and 9 kg at 150 mm radius. The masses are to be arranged so that the shaft is in complete balance. Determine the angular position of masses relative to 10 kg mass. All the masses are in the same.	**(14)**	**4**	**3**
15. (a)	**(i)** Calculate the whirling speed of a shaft 20 mm in diameters and 0.6 m in length carrying a mass of 1 kg at its mid-point. The density of the shaft material is 40 mg/m^3, and Young's modulus is 200 GN/m^2. Assume the shaft to be freely supported.	**(7)**	**5**	**3**
	(ii) Derive the expression for the natural frequency of free longitudinal vibration.	**(7)**	**5**	**3**
	(OR)			
(b)	**(i)** A vibrating system consists of a mass of 1500 kg, a spring of stiffness 80 N/mm and a damper with damping coefficient of 850 N/m/s. Determine the frequency of vibration of the system.	**(7)**	**5**	**3**
	(ii) Write a short notes on logarithmic decrement.	**(7)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A flywheel is mounted on a vertical shaft and both the ends of a shaft are fixed and its diameter is 50 mm. The flywheel has a mass of 500 kg and its radius of gyration is 0.5 m. Find the natural frequency of torsional vibrations, if the modulus of rigidity for the shaft material is 80 GN/m^2.	**(10)**	4	**4**

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