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**B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019**

Fifth Semester

**MR16001 – MECHANICS OF MARINE MACHINES***(Marine Engineering)***(Regulation 2016)****Time: Three Hours****Maximum : 100 Marks**Answer **ALL** questions**PART A - (10 X 2 = 20 Marks)**

	<b>CO</b>	<b>RBT</b>
1. State the condition of Grachoff's law in double crank mechanism.	<b>1</b>	<b>U</b>
2. Differentiate between Machine and Structure.	<b>1</b>	<b>U</b>
3. What is meant by Backlash clearance in gears?	<b>2</b>	<b>U</b>
4. Define diametrical pitch of the gear.	<b>2</b>	<b>U</b>
5. What do you mean by sensitivity of the governor?	<b>3</b>	<b>U</b>
6. What is meant by hunting in Governor?	<b>3</b>	<b>U</b>
7. What is meant by static balancing?	<b>4</b>	<b>U</b>
8. How balancing of the rotor shafts are achieved in machinery?	<b>4</b>	<b>U</b>
9. What is meant by critical speed of a shaft?	<b>4</b>	<b>U</b>
10. Why damping of vibration is required and list some methods involved in damping vibration.	<b>4</b>	<b>U</b>

**PART B - (5 X16 = 80 Marks)**

11. (a) (i) What is meant by flywheel? Derive an expression for the energy stored in flywheel. **(8)** **1** **U**
- (ii) Discuss any two inversions of slider crank mechanism. **(8)** **1** **U**

**(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<sup>2</sup>. 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. **(16)** **1** **AP**

12. (a) (i) Differentiate between Cycloid and Involute tooth profiles of gear. (8) 2 AP
- (ii) Derive an expression for Velocity of sliding in gears. (8) 2 AP
- (OR)**
- (b) (i) Two 20 degree involute spur gears have a module of 10mm. The addendum is one module. The larger gear has 50 teeth and the pinion has 13teeth. Does interference occur? If occurs, to what value the pressure angle should be changed to eliminate interference. (8) 2 AP
- (ii) Write a short notes on Interference and Undercut and list down the methods to eliminate Interference. (8) 2 AP
13. (a) 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 axis at the minimum radius. Determine the equilibrium speeds corresponding to extreme radii of 180 mm and 240 mm. (16) 3 AP
- (OR)**
- (b) Explain the gyroscopic expression for Airplane and the Naval ships during Rolling, Pitching, and Turning. (16) 3 AP
14. (a) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B  $45^\circ$ , B to C  $70^\circ$  and C to D  $120^\circ$ . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. (16) 4 AP

(OR)

- (b) (i) Why reciprocating mass needs to be balanced? Discuss. (6) 4 AP
- (ii) The following data refer to two cylinder locomotive with (10) 4 AP  
 cranks at  $90^\circ$  : Reciprocating mass per cylinder = 300 kg ;  
 Crank radius = 0.3 m ; Driving wheel diameter = 1.8 m ;  
 Distance between cylinder centre lines = 0.65 m ; Distance  
 between the driving wheel central planes = 1.55 m. Determine:  
 1. The fraction of the reciprocating masses to be balanced, if  
 the hammer blow is not to exceed 46 kN at 96.5 kmph ; 2. The  
 variation in tractive effort and 3. The maximum swaying  
 couple.
15. (a) (i) Derive an equation for natural frequency of longitudinal (10) 4 AP  
 vibrations.
- (ii) Write a short notes on logarithmic decrement. (6) 4 AP
- (OR)
- (b) (i) The mass of a single degree damped vibrating system is 7.5 kg (10) 4 AP  
 and makes 24 free oscillations in 14 seconds when disturbed  
 from its equilibrium position. The amplitude of vibration  
 reduces to 0.25 of its initial value after five oscillations.  
 Determine: 1. stiffness of the spring, 2. logarithmic decrement,  
 and 3. damping factor, i.e. the ratio of the system damping to  
 critical damping.
- (ii) A flywheel is mounted on a vertical shaft and both the ends of (6) 4 AP  
 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  $80 \text{ GN/m}^2$ .