Q. Code:274143

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

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fifth -Semester

ME18502 – DYNAMICS OF MACHINERY

(Mechanical Engineering)

(Regulation 2018/2018A)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will evaluate the dynamic forces acting on the elements of any given mechanism	**4**
CO 2	Students will analyze and solve the unbalancing forces for reciprocating and rotating machineries.	**4**
CO 3	Students will apply the vibration and damping principles to evaluate the natural frequency of free vibrating bodies.	**5**
CO 4	Students will apply the concept of vibration transmissibility and isolation for mechanical members.	**4**
CO 5	Students will analyze the motions involved in automotives using governor and gyroscopic concepts.	**4**

PART- A(10x2=20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Distinguish between crank effort and piston effort.	**1**	**3**
2.	List out few machines in which flywheels are used.	**1**	**2**
3.	Define hammer blow in locomotives.	**2**	**2**
4.	What are the conditions required for complete balancing of reciprocating masses.	**2**	**2**
5.	What is meant by logarithmic decrement?	**3**	**2**
6.	Write the advantages of provide damping in a vibrating systems.	**3**	**2**
7.	List out the sources of excitation in forced vibration.	**4**	**2**
8.	Define magnification factor as applied to forced vibrations.	**4**	**2**
9.	Explain sensitiveness of governors?	**5**	**3**
10.	Give the effect of the gyroscopic couple on a 2 wheeled vehicle when taking a turn.	**5**	**3**

PART- B (5x 14=70Marks)

		Marks	CO	RBT LEVEL
11. (a)	The length of crank and connecting rod of the horizontal reciprocating engine are 300 mm and 1.2 m respectively. The cylinder bore is 0.5 m and the mass of the reciprocating parts is 250 kg. The crank is rotating at	**(14)**	**1**	**3**

250 rpm. When the crank has turned through 60° degree from the IDC, the difference of the pressure between the cover and piston end is 0.35N/mm^2 Calculate i) Thrust on sides of the cylinder walls. ii) Thrust in the connecting rod.iii) crank-pin effort iv) Turning moment on crank shaft.

(OR)

(b)	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°. 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 30 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.	**(14)**	**1**	**3**
12. (a)	A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12 kg respectively, and each has an eccentricity of 65 mm. The masses at A and D have an eccentricity of 85 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: 1. The magnitude of the masses at A and D, 2. The distance between planes A and D 3. The angular position of the mass at D.	**(14)**	**2**	**3**

(OR)

(b)	A four crank engine has two outer cranks set at 1200 to each other and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. if the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, the length of each connecting rod is 1.2 m and the speed of rotation is 240 rpm. what is the maximum secondary unbalanced force?	**(14)**	**2**	**3**
13. (a)	A steel shaft 100mm in diameter is supported in bearings 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance	**(14)**	**3**	**3**

0.09m from the right bearing. Find the value of the critical speed by using Dunkerley's method. $E=2X10^{11}$ N/m^2

(OR)

(b)	A vertical shaft of 5 mm diameter is 200 mm long and is supported in long bearings at its ends. A disc of mass 50 kg is attached to the centre of the shaft. Neglecting any increase in stiffness due to the attachment of the disc to the shaft, find the critical speed of rotation and the maximum bending stress when the shaft is rotating at 75% of the critical speed. The centre of the disc is 0.25 mm from the geometric axis of the shaft. Take E = 200 GN/m$^{2.}$	**(14)**	**3**	**3**
14. (a)	A machine part of mass 2kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25N results in resonant amplitude of 12.5mm with a period of 0.2seconds. If the system is excited by a harmonic force of frequency 4Hz what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that damping.	**(14)**	**4**	**3**

(OR)

(b)	A machine has a total mass of 90Kg and unbalanced reciprocating parts of mass 2Kg which moves through a vertical stroke of 100mm with SHM. The machine is mounted on four springs. The machine is having only one degree of freedom and can undergo vertical displacement only. Calculate (i). The combined stiffness is the force transmitted to the foundation is one thirteenth of the applied force. Neglect damping and take the speed of rotation of the machine crank shaft as 1000 r.p.m. When the machine is actually supported on the springs, it is found that the damping reduces the amplitude of the successive free vibrations by 30%. Find (ii). The force transmitted to the foundation at 900 r.p.m.	**(10)**	**4**	**3**
15. (a)	A Proell governor has equal arms of length 250 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor.	**(14)**	**5**	**3**

(OR)

		Marks	CO	RBT LEVEL
(b)	The turbine rotor of a ship has a 2.5 tonnes and rotates at 1750 rpm when viewed from the left. The radius of gyration of the rotor is 300mm.Determine gyroscopic couple and its effect when (i) The ship turns right at a radius of 250m with a speed of 22kmph. (ii) The ship pitches with the bow rising at an angular velocity of 0.85 rad/sec. (iii) The ship rolls at an angular velocity of 0.15rad/s.	**(14)**	**5**	**3**

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	What do you understand by vibration isolation and transmissibility? Explain with suitable examples.	**(10)**	**4**	**5**

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