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

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

Fifth Semester

ME18502 - DYNAMICS OF MACHINERY

(Mechanical Engineering)

(Regulation 2018)

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

CO 1 The students will compete to evaluate the dynamic forces acting on the elements of the mechanisms.
CO 2 The students will be proficient to analyze the unbalancing in reciprocating and rotating masses.
CO 3 The Students will be able to evaluate the natural frequency of free vibration and its damping coefficient.
CO 4 The Students will be skillful to interpret and apply the concept of vibration transmissibility and isolation.
CO 5 The Students will be capable to analyze the controlling principles of Gyroscopes and Governors.

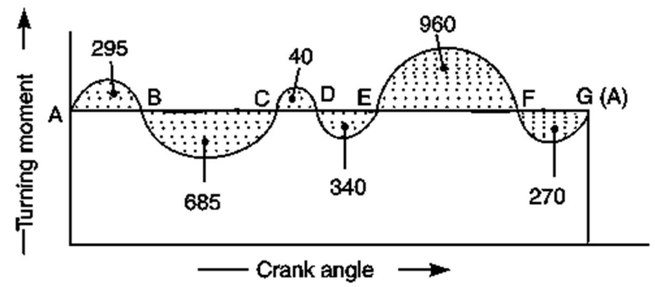
PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	In an engine, the work done by inertia forces in a cycle is _____	**1**	**2**
2.	Explain how dynamical equivalent system can be used to determine the direction of inertia force on it.	**1**	**2**
3.	How the different masses rotating in different planes are balanced ?	**2**	**1**
4.	It is possible to balance inline IC Engines completely? Justify.	**2**	**1**
5.	Why are free vibrations practically not possible?	**3**	**1**
6.	Can vibration exist without motion.	**3**	**1**
7.	Which type of vibration is not a free vibration?	**4**	**2**
8.	Is vibration a renewable source of energy.	**4**	**2**
9.	Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve.	**5**	**2**
10.	Why is the Porter governor preferred over a Watt governor?	**5**	**1**

PART- B (5 x 14 = 70 Marks)

		Mark	CO	RBT LEVEL
11. (a)	The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2. The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate: 1. pressure on slide bars, 2. thrust in the connecting rod, 3. tangential force on the crank-pin, and 4. turning moment on the crank shaft.	**(14)**	**1**	**3**
	(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 36 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, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.	**(14)**	**2**	**3**
	(OR)			

(b)	An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m	**(14)**	**2**	**3**

13. (a)	A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GPa. Determine the frequency of longitudinal and transverse vibrations of the shaft.	**(14)**	**3**	**3**
	(OR)				
(b)	A coil of spring stiffness 4 N/mm supports vertically a mass of 20 kg at the free end. The motion is resisted by the oil dashpot. It is found that the amplitude at the beginning of the fourth cycle is 0.8 times the amplitude of the previous vibration. Determine the damping force per unit velocity. Also find the ratio of the frequency of damped and undamped vibrations.	**(14)**	**3**	**3**

14. (a)	A mass of 10 kg is suspended from one end of a helical spring, the other end being fixed. The stiffness of the spring is 10 N/mm. The viscous damping causes the amplitude to decrease to one-tenth of the initial value in four complete oscillations. If a periodic force of 150 cos 50 t N is applied at the mass in the vertical direction, find the amplitude of the forced vibrations. What is its value of resonance ?	**(14)**	**4**	**3**
	(OR)				
(b)	A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a harmonic force of frequency 4 Hz what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that with damping.	**(14)**	**4**	**3**

15. (a)	An aeroplane makes a complete half circle of 50 metres radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it.	**(14)**	**5**	**4**
	(OR)				
(b)	A loaded Porter governor has four links each 250 mm long, two revolving masses each of 3 kg and a central dead weight of mass 20 kg. All the links are attached to respective sleeves at radial distances of 40 mm from the axis of rotation. The masses revolve at a radius of 150 mm at minimum speed and at a radius of 200 mm at maximum speed. Determine the range of speed.	**(14)**	**5**	**4**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO LEVEL	RBT
16.	A punching press is driven by a constant torque electric motor. The press is provided with a flywheel that rotates at maximum speed of 225 r.p.m. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour; each punching operation takes 2 second and requires 15 kN-m of energy. Find the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 r. p. m.	**(10)**	**5**	**5**

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