R20 Regulation *Subject code: 3P5CA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech V Semester Regular/Supplementary Examinations, February 2024

Dynamics of Machinery

(Mechanical Engineering)

Maximum Marks: 70 Date:15.02.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10x2M=20 Marks)			
1	Analyze the principle of gyroscope?	1	L4
2	Apply the effect of precession motion on the stability of moving vehicles?	1	L3
3	Explain turning moment diagram or crank effort diagram?	2	L2
4	What do you mean by fluctuation of energy and fluctuation of speed of crank shaft?	2	L2
5	State the laws of (i) Solid friction (ii) Dynamic friction and (iii) Fluid friction	3	L5
6	Explain the function of a governor? How does it differ from that of flywheel?	3	L5
7	Explain requirement of balancing of rotating masses are required?	4	L3
8	Explain about hunting in governors?	4	L5
9	Explain sources of Vibrations and how they can be eliminated?	5	L5
10	Explain the necessity of forced damped vibration?	5	L5
	Part-B		
Answer All the following questions. (5X10M=50Marks)			Bloom Tx level
11	(a) The turbine rotor of a ship has a mass of 20 tones and a radius of gyration 0.75. Its speed is 2000 rpm. The ship pitches 6° above and below the horizontal position. One complete oscillation takes 18 seconds and the motion is simple harmonic. Determine (i) the maximum couple tending to shear the holding down bolt of the turbine (ii) The maximum angular acceleration of the ship during pitching. The direction in which the bow will tend to turn while, if the rotation of the rotor is clockwise when looking from rear. (b) Explain in what way the gyroscopic couple effects the motion of an aircraft while taking a turn. [5+5]	1	L3
	OR		
12	(a) Explain the expression for Gyroscopic Couple. (b) The rotor of a marine turbine has a moment of inertia of 750kg.m^2 and rotates at 3000rpm clockwise when viewed from aft. If the ship pitches with angular simple harmonic motion having a periodic tile of 16 seconds and amplitude of 0.1 radian, find the (i) maximum angular velocity of the rotor axis (ii) maximum value of the gyroscopic couple. [5+5]	1	L5

13	(a) Derive the equation for the energy stored in fly wheels? (b)The turning moment diagram for a petrol engine is drawn to vertical scale of 1mm to 6 N-m, and a horizontal scale of 1 mm to 10 .The turning moment repeats itself after every half revolution of the engine. The areas above and below the mean torque line are 305, 710, 50, 350, 980, and 275 mm^2 . The rotating parts amount to a mass of 40 kg at a radius of gyration of 140 mm. Calculate the co-efficient of fluctuation of speed if the speed of engine is 1500 rpm. [5+5]	2	L4
	OR		
14	(a) Discuss the method of finding the crank effort and piston effort in reciprocating single acting, single cylinder petrol engine? (b)The turning moment requirement of a machine is represented by the equation T = (1000+500 sin 2θ-300cos 2θ) N-m. Where θ is the angle turned by the crankshaft of the machine? If the supply torque is constant, determine: i) The moment of inertia by the flywheel. The total fluctuation of speed is not to exceed one percent of the mean speed of 300 rpm. ii) Angular acceleration of the flywheel when the crankshaft has turned through 450 from the beginning of the cycle. iii) The power required to drive the machine. [5+5]	2	L4
15	(a) Which of the two assumptions-uniform intensity of pressure or uniform rate of wear, would you make use of in designing friction clutch and why? (b) A cone clutch with cone angle 20^0 is to transmit 7.5 kW at 750 rpm. The normal intensity of pressure between the contact faces is not to exceed 0.12N/mm^2 . The coefficient of friction is 0.2. If face width is 1/5th of mean diameter, find: (i) The main dimensions of the clutch and (ii) Axial force required while running. [5+5]	3	L4
	OR		
16	(a) Evaluate the construction and operation of Rope brake dynamometer? (b)A bicycle and rider of mass 100 kg are travelling at the rate of 16km/h on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter, and this is the only resistance acting. How far will the bicycle travel and how many turns will it make before it comes to rest? Take pressure applied on the brake is 100 N and μ = 0.05. [5+5]	3	L4
17	(a) State the different methods to determine the equilibrium speed of a Porter Governor. (b) A Porter governor has arms 250 mm each and four rotating fly balls of mass 0.8 kg each the sleeve movement is restricted to ±20 mm from the height when the mean speed is 100 rpm calculate the central dead load and sensitivity of the governor neglecting friction when the fly ball exerts the centrifugal force of 9.81 N. Also determine the effort and power of the governor for 1% speed change. [5+5]	4	L3
	OR		
18	(a) Evaluate the differences of Static Balancing from Dynamic Balancing. (b) Four masses M1, M2, M3 and M4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and	4	L3

	0.3m respectively and the angle between successive masses are 45°, 75° and 135°. Find the position and magnitude of balance mass required if its radius of rotation is 0.25m. [5+5]		
19	(a) Discuss briefly with neat sketches the longitudinal transverse and torsional free vibrations. (b) A shaft of 10 cm diameter and 100 cm long is fixed at one end and other end carries a flywheel of mass 80 kg. Taking young's modulus for the shaft material as 2 x 10^6 kg/cm^2 , find the natural frequency of longitudinal and transverse vibrations. [5+5]	5	L4
	OR		
20	(a) Explain over damped, critical damped and under damped systems (b)A vibrating system consists of a mass of 10 kg. spring stiffness 12 N/mm and a dash pot of damping coefficient of 0.06 N/mm/sec. Determine (i). damping factor, (ii). logarithmic decrement and (iii). ratio of the two consecutive amplitudes. [5+5]	5	L4