Q. Code: 367534

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

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

Fifth Semester

ME16505 – DYNAMICS OF MACHINES

(Mechanical Engineering)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	Why flywheels are needed in forging and pressing operations?	1	AP
2.	Draw the turning moment diagram of a single cylinder double acting steam engine.	1	U
3.	State the conditions for static and dynamic balancing.	2	U
4.	Why complete balancing is not possible in reciprocating engine?	2	AP
5.	State different methods of finding natural frequency of a system.	3	U
6.	What are the factors that affect the critical speed of a shaft?	3	U
7.	What is meant by harmonic forcing?	3	U
8.	What are the methods in isolating the vibration?	3	U
9.	What is meant by sensitiveness of a Governor?	4	U
10.	What is the effect of Gyroscopic couple on rolling of ship? Why?	4	AP

PART B - (5 X16 = 80 Marks)

11.	(a)	The length and connecting rod of a horizontal reciprocating engine are 200mm and 1meter respectively. The crank is rotating at 400rpm. When the crank has turned 30° from the inner dead center, the difference of pressure between cover end and piston rod is 0.4 N/mm^2. If the mass of the reciprocating parts is 100Kg and a cylinder bore is 0.4 meters. Calculate (i) Inertia force (ii) Force on piston (iii) Piston effort (iv) Thrust on the side of the cylinder walls (v) Thrust in the connecting rod (vi)Crank effort.	**(16)**	1	AN

(OR)

(b) A multi-cylinder engine is to run at a speed of 600 r.p.m. On drawing the turning moment diagram to a scale of 1 mm = 250 N-m and 1 mm = 3°, the areas above and below the mean torque line in mm ^{2} are : + 160, – 172, + 168, – 191, + 197, – 162. The speed is to be kept within ± 1% of the mean speed of the engine. Calculate the necessary moment of inertia of the flywheel. Determine the suitable dimensions of a rectangular flywheel rim, if the breadth is twice its thickness. The density of the cast iron is 7250 kg/m^3 and its hoop stress is 6 MPa. Assume that the rim contributes 92% of the flywheel effect. **(16) 1 AN**

12. (a) Four masses A, B, C and D as shown below are to be completely balanced. **(16) 2 AP**

	A	B	C	D
Mass (kg)	-	30	50	40
Radius (mm)	180	240	120	150

The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°. B and C make angles of 210° and 120° respectively with D in the same sense. Find :

1. The magnitude and the angular position of mass A ; and
2. The position of planes A and D.

(OR)

(b) A four cylinder engine has the two outer cranks at 120° to each other and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 400 mm, 700 mm, 700 mm and 500 mm. Find the reciprocating mass and the relative angular position for each of the inner cranks, if the engine is to be in complete primary balance. Also find the maximum unbalanced secondary force, if the length of each crank is 350 mm, the length of each connecting rod 1.7 m and the engine speed 500 r.p.m. **(16) 2 AP**

13.	(a)	(i)	A shaft of 40 mm diameter and 2.5 m length has a mass of 15 kg per meter length. It is simply supported at the ends and carries a three masses of 90kg, 140kg and 60 kg at 0.8m, 1.5m and 2m respectively from the left support. Taking E=200 GN/m^2, find the frequency of the transverse vibrations.	**(12)**	**3**	**AP**
		(ii)	Find the relation for natural frequency of a torsional vibratory system consisting of a single rotor.	**(4)**	**3**	**U**
			(OR)			
	(b)	(i)	In a single- degree damped vibrating systems, a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the (i) stiffness of the spring, (ii)logarithmic decrement (iii) damping factor and (iv) damping coefficient.	**(12)**	**3**	**AP**
		(ii)	Discuss the effect of damping on vibratory systems. What is meant by under damping, over damping and critical damping?	**(4)**	**3**	**U**
14.	(a)		A single- cylinder vertical diesel engine has a mass of 400 kg and is mounted on a steel chassis frame. The static deflection owing to the weight of the chassis is 2.4 mm. The reciprocating masses of the engine amounts to 18 kg and stroke of the engine is 160 mm. A dashpot with a damping coefficient of 2 N/mm/s is also used to dampen the vibrations. In the steady state vibrations, determine the 1. the amplitude of the vibrations, if the driving shaft rotates at 500 r.p.m., and 2. the speed of the driving shaft when resonance occurs.	**(16)**	**3**	**AP**
			(OR)			
	(b)		A machine of mass 75 kg is mounted on springs of stiffness 1200 kN/m and with an assumed damping factor of 0.2. A piston within the machine of mass 2 kg has a reciprocating motion with a stroke of 80 mm and a speed of 3000 cycles/ min. Assuming the motion to be simple harmonic, find : 1. the amplitude of motion of the machine, 2. its phase angle with respect to the exciting force, 3. the force	**(16)**	**3**	**AP**

transmitted to the foundation, and 4. the phase angle of transmitted force with respect to the exciting force.

15.	(a)	Each arm of a porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of the rotation of the balls at the minimum and maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24kg and each ball is 4 kg. Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve is 18 N.	**(16)**	**4**	**AP**
		(OR)			
	(b)	(i) An aeroplane flying at 240km/h turns towards the left and completes a quarter circle of 60m radius. The mass of the rotary engine and the propeller of the plane is 450 kg with a radius of gyration of 320mm .The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and state its effect. In what way is the effect changed when the (i) aeroplane turns towards right (ii) engine rotates clockwise when viewed from the front(nose end) and the aeroplane turns (a) left (b) right?	**(10)**	**4**	**AP**
		(ii) Explain the application of gyroscopic principles to aircrafts and the gyroscopic effect on sea going vessels.	**(6)**	**4**	**AP**