Hall Ticket Number:

Code No. : 16501

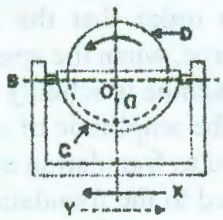
VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.: CBCS) VI-Semester Main Examinations, May-2018

Dynamics of Machines

Time: 3 hours Max. Marks: 70

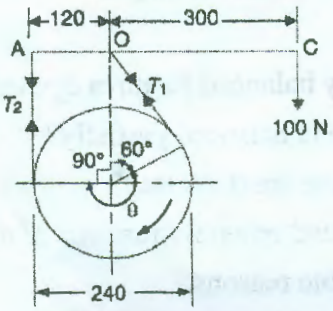
***Note:** Answer ALL questions in Part-A and any FIVE from Part-B*

Q.No.	Stem of the question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	What is a free body diagram? Explain with suitable example.	2	1	1	1
2.	Explain gyroscopic stabilization of ship.	2	2	1	1
3.	Describe whether a rotor which is statically balanced requires dynamic balancing.	2	1	2	1
4.	Why a single cylinder reciprocating engine is balanced partially?	2	2	2	1
5.	What is meant by dry and wet clutch? Where are they used?	2	1	3	1
6.	What is the difference between absorption and transmission type of dynamometer?	2	1	3	1
7.	Explain the need of governors giving suitable reasons.	2	1	4	1
8.	What is meant by the controlling force curve of a governor?	2	1	4	1
9.	Define natural frequency? What is its importance?	2	1	5	1
10.	Contrast between transient and steady state response.	2	1	5	1
	Part-B (5 × 10 = 50 Marks)				
11. a)	Summarize the conditions that a system should satisfy, to become a dynamically equivalent system?	3	2	1	1
b)	A gyro-wheel D of mass 0.5 kg, with a radius of gyration of 20 mm, is mounted in a pivoted frame C as shown in Fig. 1. The axis AB of the pivots passes through the centre of rotation O of the wheel, but the centre of gravity G of the frame C is 10 mm below O. The frame has a mass of 0.30 kg and the speed of rotation of the wheel is 3000 r.p.m. in the anticlockwise direction as shown. The entire unit is mounted on a vehicle so that the axis AB is parallel to the direction of motion of the vehicle. If the vehicle travels at 15 m/s in a curve of 50 meters radius, find the inclination of the gyro-wheel from the vertical, when i) The vehicle moves in the direction of the arrow 'X' taking a left hand turn along the curve, and ii) The vehicle reverses at the same speed in the direction of arrow 'Y' along the same path.	7	5	1	2
	 Figure 1				
12. a)	Why balancing of rotating parts necessary for high speed engines.	3	1	2	1
b)	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 10kg, 5kg and 4kg respectively. Find the required mass A and the angular settings of the four masses so that the shaft shall be in complete balance.	7	3	2	2

Contd... 2

Code No. : 1.

13. a)	Derive an equation for the Torque Required to Lift the Load by a Screw Jack?	4	2	3	1
b)	The simple band brake, as shown in Fig.2, is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find: i) the torque applied due to a hand load of 100 N, ii) the number of turns of the wheel before it is brought to rest, and iii) the time required to bring it to rest, from the moment of the application of the brake.	6	4	3	2



All dimensions in mm

Figure 2

14. a)	Contrast between functioning of a governor and a flywheel.	3	1	4	1
b)	Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort and power of the governor in the following cases: i) When the friction at the sleeve is neglected, and ii) When the friction at the sleeve is equivalent to 10 N.	7	3	4	2
15. a)	Describe the term 'logarithmic decrement'.	3	2	5	1
b)	A machine has a mass of 100 kg and unbalanced reciprocating parts of mass 2kg, which move through a vertical stroke of 80 mm with simple harmonic motion. The machine is mounted on four springs, symmetrically arranged with respect to center of mass, in such a way that the machine has one degree of freedom and can undergo vertical displacements only. Neglecting damping, calculate the combined stiffness of the spring in order that the force transmitted to the foundation is 1 / 25th of the applied force, when the speed of rotation of machine crankshaft is 1000 r.p.m. When the machine is actually supported on the springs, it is found that the damping reduces the amplitude of successive free vibrations by 25%. Find: i) the force transmitted to foundation at 1000 r.p.m., ii) the force transmitted to the foundation at resonance.	7	4	5	2
16. a)	Discuss direct and reverse crank method of balancing by taking a suitable example.	5	2	2	1
b)	A horizontal gas engine running at 210 rpm has a bore of 220 mm and a stroke of 440 mm. The connecting rod is 924 mm long and the mass of the reciprocating parts is 20 kg. When the crank has turned through an angle of 30^0 from the inner dead center, the gas pressure on the cover and crank sides are 500 kN/m^2 and 60 kN/m^2 respectively. Diameter of the piston rod is 40 mm. Determine the turning moment on the crank shaft.	5	2	1	2

Contd... 3

Code No. : 16502

Answer any ***two*** of the following:				
a) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear.	5	2	3	2
b) A shaft fitted with a flywheel rotates at 250 r.p.m. and drives a machine. The torque of machine varies in a cyclic manner over a period of 3 revolutions. The torque rises from 750 N-m to 3000 N-m uniformly during 1/2 revolution and remains constant for the following revolution. It then falls uniformly to 750 N-m during the next 1/2 revolution and remains constant for one revolution, the cycle being repeated thereafter. Determine the power required to drive the machine and percentage fluctuation in speed, if the driving torque applied to the shaft is constant and the mass of the flywheel is 500 kg with radius of gyration of 600 mm.	5	4	4	2
c) The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, find: i) critical damping coefficient, ii) damping factor, iii) Logarithmic decrement, and iv) ratio of two consecutive amplitudes.	5	3	5	2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	54.0
2	Knowledge on application and analysis (Level-3 & 4)	39.0
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	7.0