QP Code: SN23BTECH205 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fifth Semester - Regular) Examinations, November 2025

23BMEPC35001-Dynamics of Machinery

(Mechanical Engineering)

Time: 3 hrs | Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	State and explain D'Alembert's principle	CO1	K1
b.	Explain the terms spin, precession, and gyroscopic planes in the context of gyroscopic motion.	CO3	K2
c.	Differentiate between a governor and a flywheel based on their function and working principle	CO4	K2
d.	Distinguish between brakes and dynamometers.	CO5	K2
e.	Define, in short, free vibrations, forced vibrations and damped vibrations.	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

	Answer **ALL** the questions	Marks	CO #	Blooms Level
2. a.	If the crank and the connecting rod are 300 mm and 1 m long respectively and the crank rotates at a constant speed of 200 r.p.m., determine:**1.** The crank angle at which the maximum velocity occurs, and **2.** Maximum velocity of the piston.	5	CO1	K3
b.	The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 metres. It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds.	5	CO2	K2
	(OR)			
c.	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/mm2. 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.	5	CO1	K3
d.	The turning moment diagram for a multicylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: + 52, – 124, + 92, – 140, + 85, – 72 and + 107 mm2, when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the necessary mass of the flywheel of radius 0.5 m.	5	CO2	K2
3.a.	Describe how gyroscopic action affects the rolling and pitching motion of a ship.	5	CO3	K2
b.	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	5	CO3	K3

	on the aircraft and state its effect on it.			
	(OR)			
c.	Explain the principle of a gyroscope and its importance in the stability of moving vehicles.	5	CO3	K2
d.	A uniform disc of diameter 300 mm and of mass 5 kg is mounted on one end of an arm of length 600 mm. The other end of the arm is free to rotate in a universal bearing. If the disc rotates about the arm with a speed of 300 r.p.m. clockwise, looking from the front, with what speed will it precess about the vertical axis?	5	CO3	K3
4.a.	Explain the term height of the governor. Derive an expression for the height in the case of a Watt governor. What are the limitations of a Watt governor ?	5	CO4	K2
b.	A 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 minimum and maximum speeds and range of speed of the governor.	5	CO4	K3
	(OR)			
c.	Describe the working of a centrifugal governor with a neat diagram.	5	CO4	K2
d.	A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine : **1.** loads on the spring at the lowest and the highest equilibrium speeds, and **2.** stiffness of the spring.	5	CO4	K3
5.a.	Describe with a neat sketch the working of a single plate friction clutch.	5	CO5	K2
b.	A conical pivot supports a load of 20 kN, the cone angle is 120º and the intensity of normal pressure is not to exceed 0.3 N/mm2. The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure.	5	CO5	K3
	(OR)			
c.	Explain the working of an internal expanding shoe brake with neat diagram.	5	CO5	K2
d.	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	CO5	K3
6.a.	Explain the terms ‘under damping, critical damping’ and ‘over damping’ with suitable example.	5	CO6	K2
b.	A vibrating system consists of a mass of 200 kg, a spring of stiffness 80 N/mm and a damper with damping coefficient of 800 N/m/s. Determine the frequency of vibration of the system.	5	CO6	K3
	(OR)			
c.	Explain the term 'Logarithmic decrement' as applied to damped vibrations.	5	CO6	K2
d.	Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	5	CO6	K3

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