

ANURAG Engineering College

(An Autonomous Institution)

III B.Tech I Semester Regular/Supplementary Examinations, Dec-2023/Jan-2024

**DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)****Time: 3 Hours****Max. Marks: 75****Section – A (Short Answer type questions)****(25 Marks)****Answer All Questions**

	Course Outcome	B.T Level	Marks
1. Define D'Alemberts principle.	CO1	L1	2M
2. Write any one special characteristic exhibited by gyroscope when it is in motion.	CO1	L1	3M
3. Distinguish between clutch and brake.	CO2	L2	2M
4. Sketch the single plate clutch diagram.	CO2	L2	3M
5. Define fluctuation of energy.	CO3	L1	2M
6. Write a note on hunting and sensitiveness of governor.	CO3	L1	3M
7. State the reason why the reciprocating masses are partially balanced.	CO4	L1	2M
8. What do you mean by Primary and Secondary forces with respect to balancing of rotating masses?	CO4	L1	3M
9. What do you mean by vibration isolation?	CO5	L1	2M
10. Define in short, free vibrations and forced vibrations.	CO5	L1	3M

Section B (Essay Questions)**Answer all questions, each question carries equal marks.****(5 X 10M = 50M)**

11. A) The crank and connecting rod of a steam engine are 0.3 m and 1.5 m in length. The crank rotates at 180 r.p.m. clockwise. Determine the velocity and acceleration of the piston when the crank is at 40 degrees from the inner dead centre position. Also determine the position of the crank for zero acceleration of the piston.
- OR**
- B) An aeroplane makes a complete half circle of 60 m radius to the left when flying at 200kmph. The rotary engine and propeller of the aeroplane weigh 4000 N with a radius of gyration 30 cm and engine runs at 2500 rpm clockwise, when viewed from rear end. Find the gyroscopic couple on the aeroplane and state its effect on it.
12. A) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm². If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 r.p.m.
- OR**
- B) A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 225°, while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 300 mm from the fulcrum. The brake lever is 1 meter long. The brake is to absorb a power of 45 kW at 500 r.p.m. Determine the tangential force and tensions at both sides.

13. A) The turning moment diagram for a multi-cylinder engine has been drawn to a scale 1mm = 600 N-m vertically and 1mm = 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.

OR

B) A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of central load on the sleeve is 25 kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.

14. 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.

OR

B) A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.

15. 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 GN/m². Determine the frequency of longitudinal vibration of the shaft.

OR

B) A flywheel is mounted on a vertical shaft as shown in below fig. The both ends of a shaft are fixed and its diameter is 50 mm. The flywheel has a mass of 500 kg and its radius of gyration is 0.5 m. Find the natural frequency of torsional vibrations, if the modulus of rigidity for the shaft material is 80 GN/m².

