

CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

18MR42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023 Theory of Machines

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define: i) Link ii) Machine iii) Structure iv) Kinematic pair. (10 Marks)
b. Write about Grashott's law. (10 Marks)

OR

- 2 a. With neat sketch, explain oscillating cylinder engine. (10 Marks)
b. Write about peaucellier mechanism. (10 Marks)

Module-2

- 3 a. State the D'Alembert's principle. (08 Marks)
b. Define friction. Write types of friction. (06 Marks)
c. Write law of solid friction. (06 Marks)

OR

- 4 a. Derive an expression for the ratio of tensions in flat belt drive. (08 Marks)
b. A belt which embracing 165° of a pulley of effective diameter 1000mm is transmitting 10kW. The pulley is running at 250rpm. The coefficient of friction is 0.3. Mass of belt material 0.0012gm/mm^3 thickness of belt = 10mm. Considering centrifugal tension, find width of belt. Safe working stress is 1.5MPa. Also determine the initial tension in the belt drive. (12 Marks)

Module-3

- 5 A rotating shaft carries four radial masses A = 8kg, B, C = 6kg, D = 5kg. The mass centres are 30, 40, 40 and 50mm respectively the axis of shaft. The axial distance between planes of rotation of A and B is 400mm and between B and C is 500mm. The masses AGC are at right angle to each other. Find for a complete balance i) The angle of masses B and D from A ii) the axial distance between planes of rotation ACGD iii) Magnitude of mass B. (20 Marks)

OR

- 6 The cranks and connecting rod of a 4 cylinder incline engine running at 1800rpm are 50mm, 250mm each respectively and the cylinders are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end and the cranks appear at intervals of 90° in an end view in order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5kg. Determine: i) Unbalanced primary and secondary forces. If any ii) Unbalanced primary and secondary couples with reference to central plane of engine. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Explain the terms sensitiveness, stability, effort and power of a governor. (08 Marks)
- b. The length of upper arm and lower arms of a Portar Governor are 200mm and 250mm respectively. Both the arms are pivoted to the axis of rotation. The central load is 150N, the weight of each ball is 20N and the of the sleeve together with the resistance of the operating gear is equivalent to a force of 30 N at the sleeve. If the limiting inclinations of the upper arm to the vertical are 30° and 40° , determine the range of speed of the governor. (12 Marks)

OR

- 8 a. Derive an expression for the gyroscopic couple. (05 Marks)
- b. The motor of a marine having a mass of 1000kg and radius of gyration 300mm rotates at 1550rpm clockwise when looking from the bow. Determine the gyroscopic couple and its effect on ship in following:
- When ship pitches an angular velocity of 1 rad/sec at rising and falling.
 - When ship is speeding at 40km/hr and takes a right turn in circular path 200m radius.
 - When ship rolls at certain instant, it has an angular velocity 0.5 rad/sec when viewed from stern. (15 Marks)

Module-5

- 9 Draw the profile of a cam operating a knife edge follower from the following data:
- Follower to move outward through a distance of 20mm during -120° .
 - Follower to dwell for the next -60° .
 - Follower to return to its initial position during -90° .
 - Follower to dwell for the remaining 90° of cam uniform speed of 500rpm in clockwise. Radius of cam 40mm and line of stroke of the follower is offset 15mm from the axis of the cam and displacement of the follower is to take place with uniform of equal acceleration and retardation both the inward and return stroke.
- Determine 1 – The maximal acceleration during outward and return stroke. (20 Marks)

OR

- 10 Draw the cam profile for cam with roller reciprocating follower. Then axis of the follower passes through the axis of cam.
Roller diameter = 5mm, minimum radius of cam = 30mm and total lift = 25mm. The cam has to lift the follower with SHM during 180° of cam, then allow the follower to drop suddenly half way and further return the follower with uniform velocity during the remaining 180° of cam rotation. Determine the maximum velocity and maximum acceleration on the out stroke. If cam rotates at a uniform speed of 100rpm. (20 Marks)
