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Total No. of Questions: 09 **Total No. of Pages: 02**

B. Tech. (MARINE) (Sem. 3)
THEORY OF MACHINES - I
Subject Code: BTME-302
Paper ID: A1139

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:

1. **Section A is COMPULSORY consisting of TEN Questions carrying TWO marks each.**
2. **Section B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **Section C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION A

1.

(a) How are kinematic pairs classified?
(b) Differentiate between analysis and synthesis of mechanisms.
(c) What do you understand by a Pentograph?
(d) Enumerate various types of belts used for the transmission of power.
(e) How does the velocity ratio of a belt drive effect, when some slip is taking place between the belt and the two pulleys?
(f) What is the function of a flywheel?
(g) How dynamometers can be classified?
(h) Differentiate between watt and porter governors.
(i) Why a roller follower is preferred to that of a knife-edged follower?
(j) Explain the term 'fluctuation of energy' as applied to flywheels.

SECTION B

2. With the help of a neat sketch, construct and explain the working of Ackerman steering gear mechanism.

3. A casting weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 r.p.m. The other end of the rope is pulled by a man. The coefficient of friction is 0.25. Determine the force required by the man, and the power to raise the casting.

4. Discuss relative merits and demerits of belt, rope and chain drive for transmission of power.

5. Distinguish between brakes and dynamometers. Discuss the various types of the brakes.

6. The flywheel of a steam engine has a radius of gyration of 1 m and mass 2500 kg. The starting torque of the steam engine is 1500 N-m and may be assumed constant. Determine the angular acceleration of the flywheel and the kinetic energy of the flywheel after 10 seconds from the start.

SECTION C

7. Sketch and explain the various inversions of a slider crank chain.

8. A cam is to be designed for a knife edge follower with the following data:
Cam lift = 40mm during 90° of cam rotation with simple harmonic motion; Dwell for the next 30°; During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion; Dwell during the remaining 180°. Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m.

9. A Porter governor has equal arms each 250mm 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.