4E1235
B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020
Automobile Engineering
4AE4 – 07 Theory of Machines
AE, ME

Time: 2 Hours

Maximum Marks: 110
Min. Passing Marks: 39

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____   2. NIL _____

PART – A

(Answer should be given up to 25 words only)   [10×3=30]

All questions are compulsory

Q.1 Define kinematic pair.

Q.2 Explain Lower pair and higher pair.

Q.3 What is Angle of Repose?

Q.4 Write the function of clutch.

Q.5 State the law of gearing.

Q.6 What are the functions of differential?

Q.7 What do you understand by gyroscopic couple?

Q.8 Name the different types of motion with which a following can move?

Q.9 Explain swaying couple.

Q.10 What are in-line engines?

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PART – B

(Analytical/Problem solving questions)

Attempt any four questions

[4×10=40]

Q.1 Sketch and explain the various inversions of a four bar chain.

Q.2 Derive an expression for efficiency of a square thread.

Q.3 A single plate clutch is required to transmit 8 kW at 1000 rpm. The axial pressure is limited to 70 kN/m². The mean radius of the plate is 4.5 times the radial width of the friction surface. If both the sides of the plate are effective and the coefficient of friction is 0.25, find –

    (a) The inner and outer radii of the plate

    (b) The friction of the friction lining

Q.4 Derive the expression of minimum number of teeth on a pinion to avoid interference.

Q.5 Deduce expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion.

Q.6 Discuss the gyroscopic effect on sea vessels.

Q.7 The following data relate to a single-cylinder reciprocating engine –

Mass of reciprocating parts = 40kg

Mass of revolving parts = 30 kg at crank radius

Speed = 150 rpm

Stroke = 350 mm

If 60% of the reciprocating parts and all the revolving parts are to be balanced, determine-

    (a) The balance mass required at radius 320 mm.

    (b) The unbalanced force when the crank has turned 45° from TDC.

PART-C

(Descriptive/Analytical/Problem Solving/Design Questions) [2×20=40]

Attempt any two questions

Q.1 In a slider – crank mechanism, the crank is 480 mm long and rotates at 20 rad/sec. in the counter – clockwise direction. The length of the connecting rod is 1.6 m. when the crank turns 60° from the IDC. determine –

(a) The velocity of the slider

(b) The velocity of point E located at a distance 450mm on the connecting rod extended.

(c) The angular velocity of the connecting rod.

(d) The velocity of rubbing at the crank pin.

Q.2 If the capacity of a single plate clutch decreases by 13% during the initial wear period. determine the minimum value of the ratio of internal diameter to external diameter for the same axial load. Consider both the sides of the clutch plate to be effective.

Q.3 An epicyclic gear train is shown in fig. The number of teeth on A and B are 80 and 200. Determine the speed of the arm a.

(a) If A rotates at 100 rpm clockwise and B at 50 rpm counter – clockwise.

(b) If A rotates at 100 rpm clockwise and B is stationary.
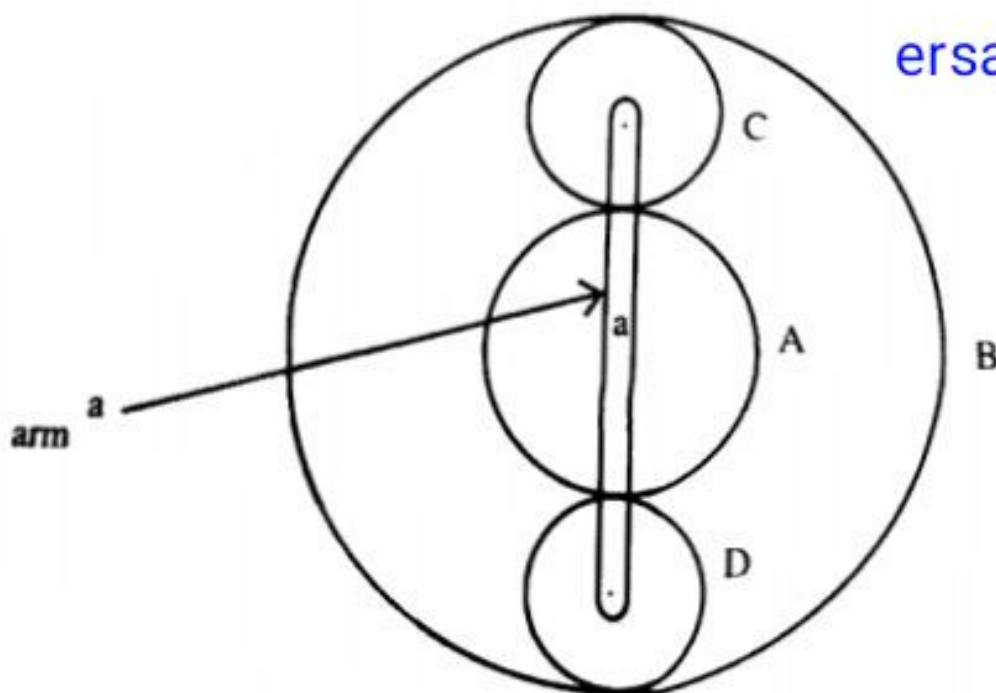
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Q.4 Draw the profile of a cam operating a knife – edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20mm. What will be the maximum velocity and acceleration of the follower during the lift and the return.

Q.5 Deduce expressions for variation in tractive force, swaying couple and hammer blow for an uncoupled two cylinder locomotive engine.