CBCS SCHEME

USN | | | | | | | | | | |

21AE/AS51

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Mechanism and Machine Theory

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) Kinematic link
ii) Machine
iii) Degree of freedom
iv) Structure
v) Kinematic pair **(10 Marks)**

b. Determine the DOF of the mechanism shown below:

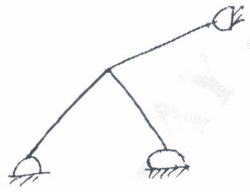

Fig.Q.1(b) (i)

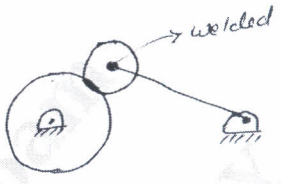

Fig.Q.1(b) (ii)

(10 Marks)

OR

2 a. Explain crank and slotted lever mechanism with a neat diagram. **(10 Marks)**

b. Prove the Peaucellier's mechanism traces exact straight line motion. **(10 Marks)**

Module-2

3 a. Describe angular velocity and relative velocity. **(04 Marks)**

b. A four bar mechanism is shown in Fig.Q.3(b). Calculate the required value of T_2 and various forces on links for the equilibrium of the system. **(16 Marks)**

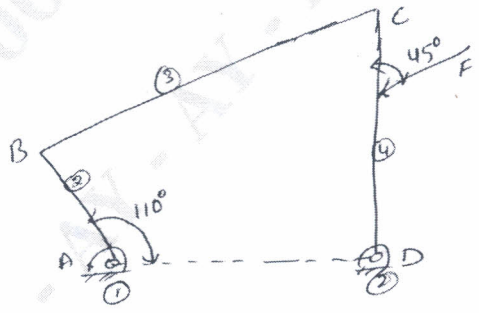

Fig.Q.3(b)

OR

4 a. Define free body diagram with principle of virtual work. **(04 Marks)**

b. A four bar mechanism under the action of two external forces shown in Fig.Q.4(b). Determine the torque to be applied on the link AB for static equilibrium. The dimensions of the links are AB = 50 mm, BC = 66 mm, CD = 55 mm, CE = 25 mm, CF = 30 mm, BAD = 60° and AD = 100 mm. **(16 Marks)**

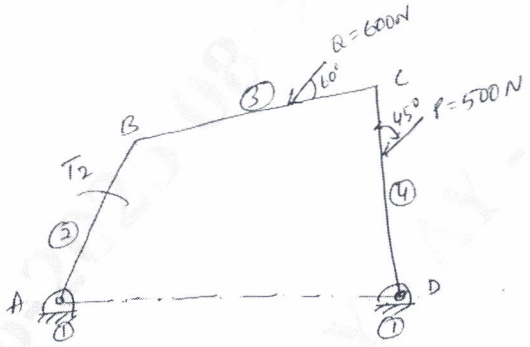

Fig.Q.4(b)

Module-3

5 a. State and prove law of gearing and condition for correct gearing. **(08 Marks)**

b. Two gears in mesh have a module of 8 mm and a pressure angle of 20°. The larger gear has 57 teeth while the pinion has 23 teeth. If the addendum on pinion and gear wheel are equal to one module. Find:

i) Number of pairs of teeth in contact

ii) Angle of action of the pinion and the gear wheel. **(12 Marks)**

OR

6 a. Explain with neat sketches:

i) Simple gear train

ii) Compound gear train. **(04 Marks)**

b. In an epicyclic gear train where the arm A the driver and the annular wheel D is the follower. The wheel D has 112 teeth and B has 48 teeth. B runs freely on pin 'P' and D is seperatively driven, if the arm A runs at 100 rpm and wheel 'D' at 50 rpm in the same direction. Find the speed of wheel B and C as shown in Fig.Q.6(b). **(16 Marks)**

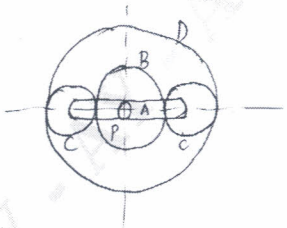

Fig.Q.6(b)

Module-4

7 a. Define static and dynamic balancing. **(04 Marks)**

b. A, B, C and D are 4 masses carried by a rotating shaft at radius 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses B, C and D are 10, 5, 4 kg respectively. Find the required mass A and the relative angular positions of the 4 masses to keep the shaft in balance. **(16 Marks)**

OR

8 The firing order in a 6 cylinder vertical 4 stroke in line engine is 1 – 4 – 2 – 6 – 3 – 5, the piston stroke is 100 mm length, length of each C·R = 200 mm. The pitch distance between cylinder centrelines are 100 mm, 100 mm, 150 mm, 100 mm and 100 mm. Determine the out of balance primary and secondary forces and couples on this engine taking a plane midway between cylinders 3 and 4 as reference plane. The reciprocating mass per cylinder is 2 kg and engine runs at 1500 rpm (graphical method). **(20 Marks)**

Module-5

9 a. Define the following respect to the working of governors :
   i) Governor power
   ii) Sensitiveness
   iii) Governor effort
   iv) Hunting
   v) Controlling force. **(10 Marks)**

   b. In a porter governor the arms and links are each 10 cm long and intersect on the main axis. Mass of each ball is 9 kg and the central mass is 40 kg. When the sleeve is in its lowest position the arms are inclined at 30° to axis. The lift of the sleeve is 2 cm. What is the force of friction at the sleeve, if the speed at the beginning of ascend from the lowest position is equal to the speed at the beginning of descend from the highest position. What is the range of speed of governor if all other things remain same? **(10 Marks)**

OR

10 Define Gyroscopic couple and explain gyroscopic effect on aero plane for different turning conditions. **(20 Marks)**

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