Faculty of Engineering & Technology

Third Semester B.E. (Mechanical Engg./Power Engg.)

(C.B.S.) Examination

KINEMATICS OF MACHINES

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve **SIX** questions as follows :

Q.No. **1** OR Q.No. **2**

Q.No. **3** OR Q.No. **4**

Q.No. **5** OR Q.No. **6**

Q.No. **7** OR Q.No. **8**

Q.No. **9** OR Q.No. **10**

Q.No. **11** OR Q.No. **12**.

(3) Due credit will be given to neatness and adequate dimensions.

(4) Illustrate the answers with necessary figures/ drawings wherever necessary.

(5) Retain the construction lines.

(6) Use of Drawing instruments is permitted.

(7) Use of non-programmable calculator is permitted.

(8) Assume suitable data wherever necessary.

1. (a) Differentiate between machine and mechanism. Give at least three examples of each. 3

(b) Explain how slider crank mechanism is an extension of 4-bar mechanism. 3

(c) Draw neat sketch of any class two 4-bar mechanism assuming suitable dimension and with help of Granhoff's law, prove that it is class-II mechanism. 5

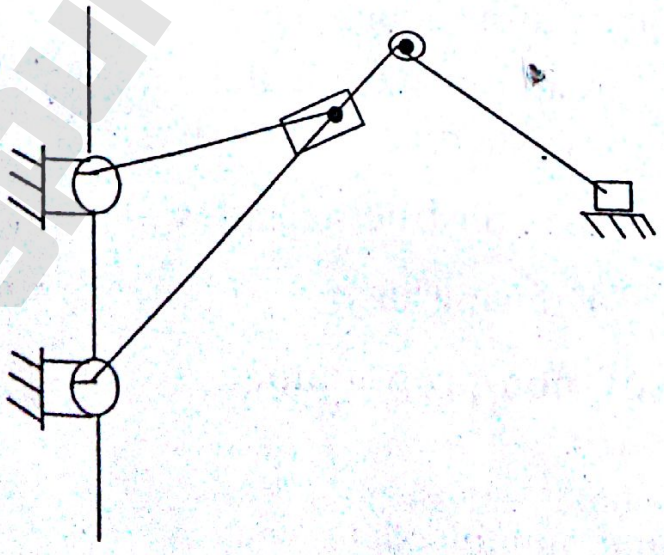
(d) Draw neat sketch of any two mechanism with two degree of freedom. 3

OR

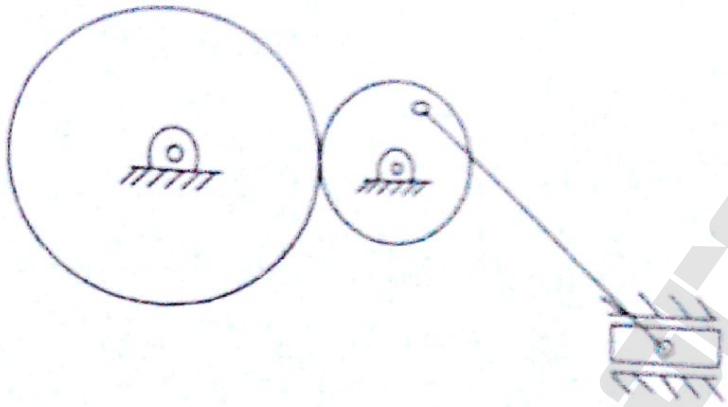
2 (a) Define mobility and derive its relation. Explain how Grubler's criterion is derived from Kutzbach's theory. 6

(b) Determine the degree of freedom for the following mechanisms :

(i)



(ii)



4

(c) Draw neat sketch of pantograph mechanism and state two applications. 4

3. In a slider crank mechanism, the crank is 480 mm long and rotates at 20 rad/sec in counterclockwise direction. The length of connecting rod is 1600 mm (AB).

(a) Draw velocity acceleration diagram

(b) Determine velocity and acceleration of the slider at B

(c) The velocity of a point E locates at distance 450 mm on connecting rod extended. 13

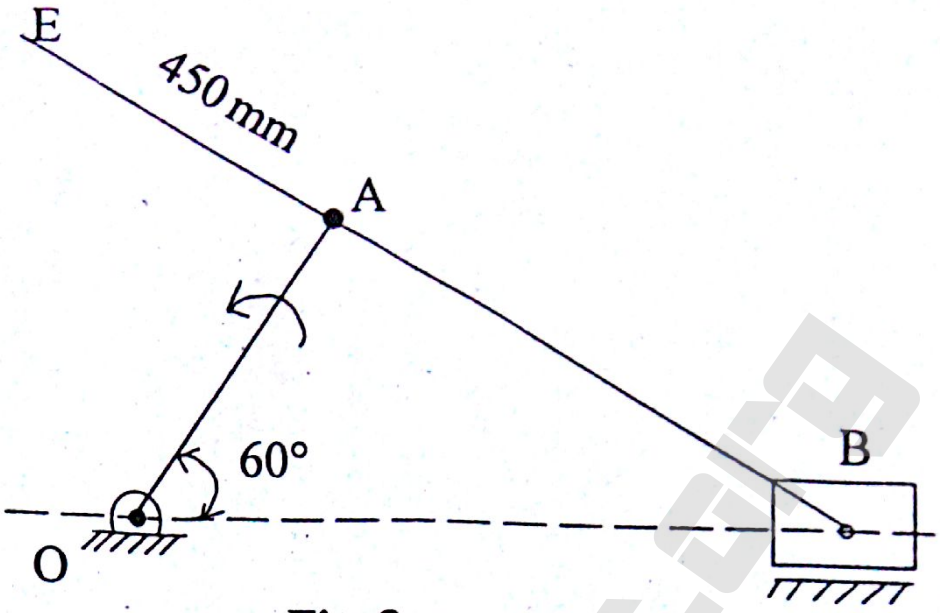


Fig. 3

OR

4. (a) Define instantaneous centre. State and prove Kennedy's theorem. 4

(b) Determine the angular velocities of the links AB and O_4B for the mechanism shown in Fig. 4.1 using instantaneous centre. 9

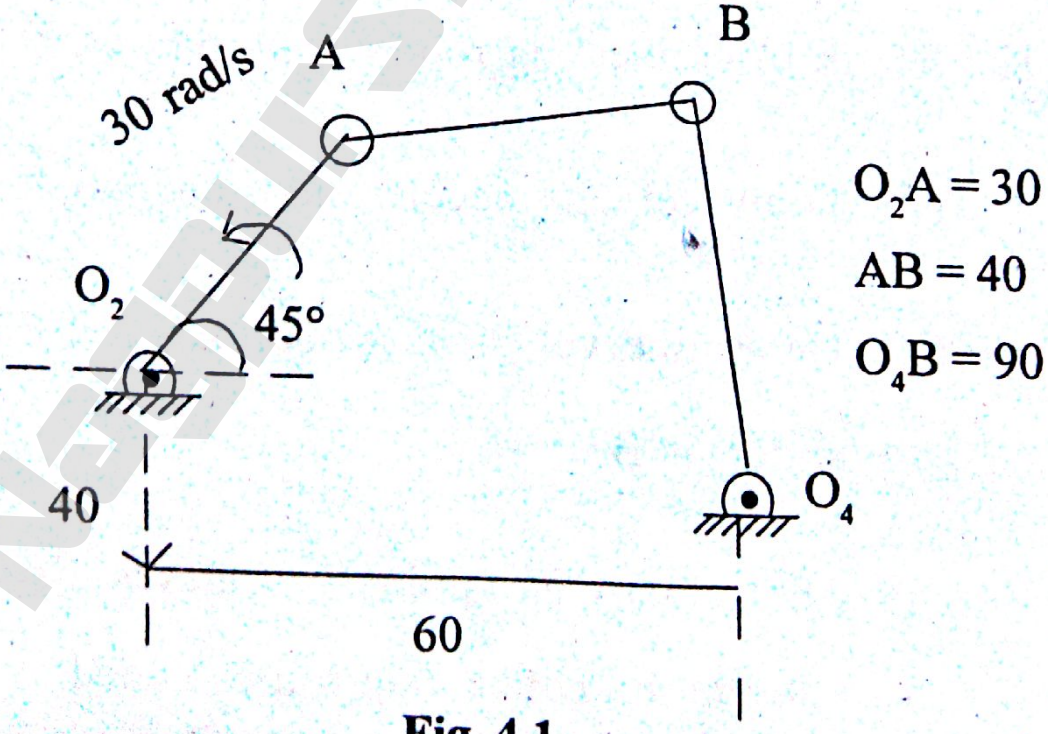


Fig. 4.1

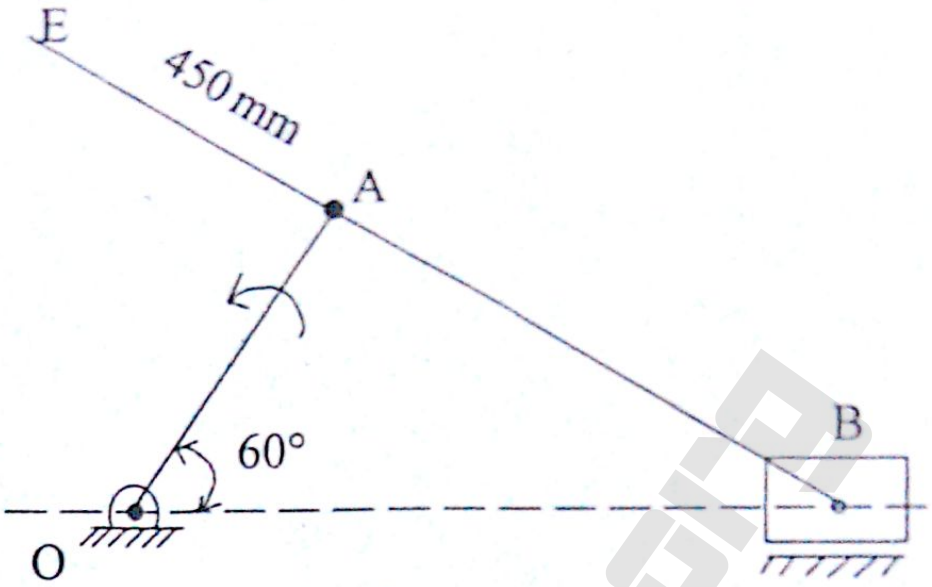


Fig. 3

OR

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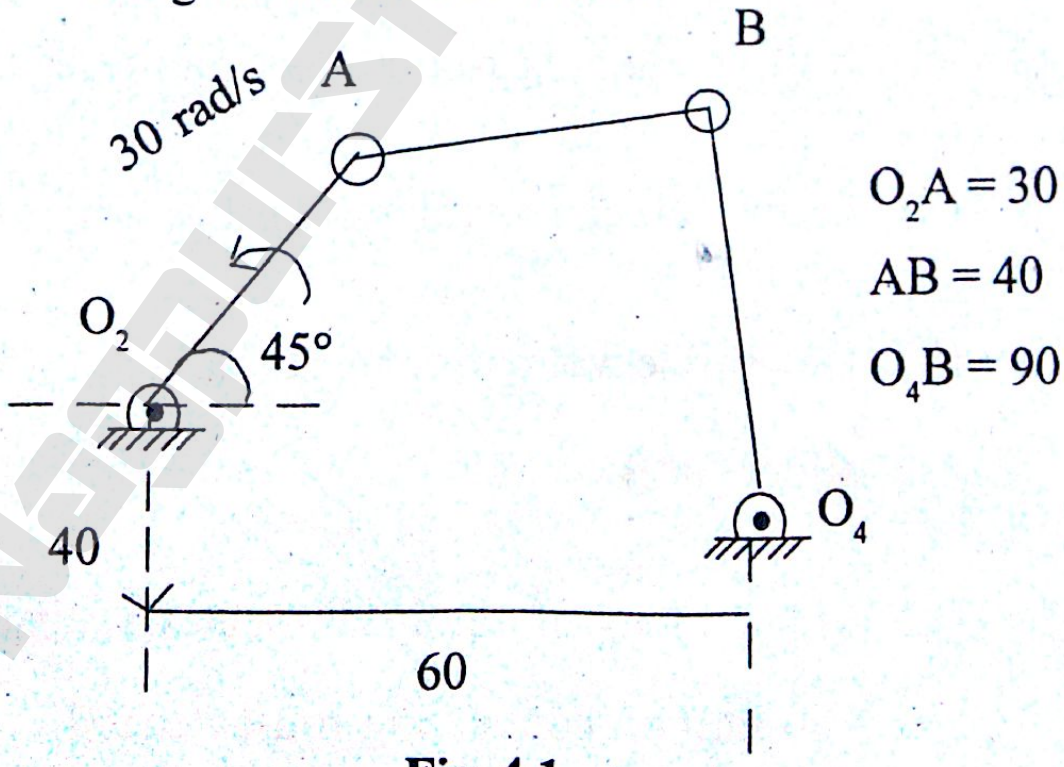

Fig. 4.1

5. Construct the cam profile for roller reciprocating radial follower

Roller radius = 10 mm

Min. radius of cam = 30 mm

Rise with SHM for 120° of cam rotation. Dwell 30° and return of 150° following parabolic motion.

Lift = 45 mm

Determine the maximum velocity and acceleration during rise when the cam rotates at 400 rpm. 13

OR

6. (a) With the help of neat sketch define the following for a cam follower arrangement :

(i) Base circle

(ii) Prime circle

(iii) Prime curve

(iv) Pitch curve

(v) Pressure angle

(vi) Pitch point. 7

(b) What is undercutting in cams ? Explain with neat sketch. 4

(c) What are different type of followers ? 2

7. (a) State and discuss Law of Gearing. 4

(b) What is interference in gears ? How it is eliminated ? 4

(c) Pressure angle of two gears in mesh is 20° and module 5 mm. Number of teeth on pinion and gear are 20 and 60 respectively. If addendum is one times module, determine contact ratio. 5

OR

8. (a) Centre distance between two meshing spiral gears in 200 mm. The gear ratio is 2 and the angle between shafts is 75°. If the driven gear has angle of helix 35° determine for 12 mm normal circular pitch :

(i) No. of teeth on each wheel

(ii) Exact centre distance. 4

(b) For the epicyclic gear train shown in Fig. 8.1, determine the speed of annular (72 T) if the arm rotates at 300 rpm CW and the sun (36 T) is fixed. The planet (18 T) mounted on arm and meshes

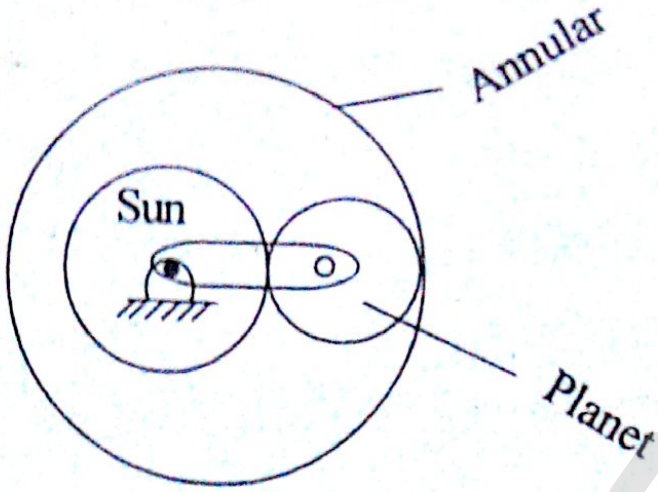

Fig. 8.1

9. (a) What is kinematic synthesis ? What are the different methods of synthesis ? 4

(b) Derive Frudenstine's equation for analytical synthesis of Q 4-bar linkage. 9

OR

10. Design crank-rocker mechanism for a machine with following requirements :

(i) Time ratio = 1.25

(ii) Follower link length = 300 mm

(iii) Follower oscillation = 80°

Show the designed mechanism in toggled position. Determine the minimum and maximum transmission angles and explain its significance in relation to the mechanism. 13

11. (a) A multi disk clutch consists of five steel plates and four bronz plates. The inner and outer diameter of the disks are 75 mm and 150 mm respectively. The co-efficient of friction is 0.1 and intensity of pressure on friction lining is limited to 0.3 N/mm^2. Assuming uniform wear, calculate :

(i) Required force to engage clutch

(ii) Power transmitting capacity at 750 rpm. 8

(b) State the laws of friction. 3

(c) Discuss the friction circle. 3

OR

12. (a) What are dynamometer and its types ? Explain with neat sketch the working of Rope dynamometer. 6

(b) The band brake shown in Fig. 12.1 is applied to a shaft carrying a flywheel of 300 kg mass with a radius of gyration of 400 mm and running at 340 rpm. Find the torque applied due to a pull of

100 N if $\mu = 0.25$. Also find the number of revolutions of the flywheel before it comes to rest. 8