

GUJARAT TECHNOLOGICAL UNIVERSITY

DI -3 SEMESTER – OLD PAPER – S23 TO S25 – QUESTION BANK(English)

Subject Name & Code:

Theory Of Machines And Mechanisms- 4331901

Unit 1: Motions & Mechanisms

Repeated Questions:

1. **List the inversions of four bar chain mechanism and explain anyone with neat sketch.**
 - **Appeared in:** S23 (Q1b, 04 Marks), WIN23 (Q1b, 04 Marks)
2. **Differentiate between structure and machine with suitable example.**
 - **Appeared in:** S24 (Q1b, 04 Marks), S25 (Q1b, 04 Marks)
3. **Define the terms: (1) Link (2) Kinematic Pair (3) Machine.**
 - **Appeared in:** WIN23 (Q1a, 03 Marks), S23 (Q1a, 03 Marks - Define Link, Lower pair, Higher pair)

Other Important Questions:

4. Define kinematic link and kinematic chain. (S24-Q1a, 03 Marks)
5. Define following terms: 1) Sliding pair 2) Higher pair 3) Mechanism (WIN24-Q1a, 03 Marks)
6. Define higher pair and lower pair with example. (S25-Q1a, 03 Marks)
7. How are the kinematic pairs classified? Explain with example. (WIN22-Q1b, 04 Marks)
8. With neat sketch explain the Klien's construction to find out the velocity of various links of slider crank chain. (S24-Q1c, 07 Marks) OR (S25-Q1c, 07 Marks)
9. With neat sketch explain four bar chain mechanism and its velocity diagram. (S24-Q1c-OR, 07 Marks) OR (S25-Q1c-OR, 07 Marks)
10. State the types of quick return motion mechanisms and explain any one with neat figure. (WIN24-Q1b, 04 Marks)
11. Differentiate between Mechanism and Inversion. (WIN24-Q2b, 04 Marks)
12. Differentiate between completely constrained motion and successfully constrained motion. (WIN24-Q2b-OR, 04 Marks)
13. Explain in detail double slider crank mechanism. Name all the inversion of double slider crank mechanism. (WIN22-Q2a, 03 Marks)
14. Describe briefly the function of elliptical trammel. (WIN22-Q2a-OR, 03 Marks)

15. Describe the procedure to draw velocity diagram of four link mechanism. (WIN22-Q2b, 04 Marks)
16. Explain with the help of neat sketch a quick return mechanism using four bar chain. (WIN22-Q2b-OR, 04 Marks) OR (WIN23-Q2b, 04 Marks)
17. Draw neat diagram of elliptical trammel. (WIN24-Q2a, 03 Marks)
18. Draw neat diagram of Scotch yoke mechanism. (WIN24-Q2a-OR, 03 Marks)
19. Draw sketch of Elliptical Trammel. (S23-Q2a, 03 Marks)
20. Draw sketch of Oldham Coupling. (S23-Q2a-OR, 03 Marks) OR (WIN23-Q2a, 03 Marks)
21. With neat sketch explain relative velocity method to find velocity and acceleration of four bar chain mechanism. (S23-Q2b, 04 Marks)

Unit 2: Cams and Followers

Repeated Questions:

1. **Draw the profile of a cam operating a knife-edge follower.**
 - **Appeared in:** S23 (Q1c, 07 Marks), WIN23 (Q1c, 06/07 Marks), WIN24 (Q1c, 07 Marks), S25 (Q2c-OR, 07 Marks)
2. **Define terms related to cam: (i) Base circle (ii) Pitch point (iii) Pressure angle.**
 - **Appeared in:** S24 (Q2a-OR, 03 Marks), S25 (Q2a-OR, 03 Marks)

Other Important Questions:

3. Define cam and state the function of cam. (S24-Q2a, 03 Marks)
4. What is the function of cam? What are the components of cam mechanism? (WIN24-Q3a-OR, 03 Marks)
5. List types of followers and explain any one. (S25-Q2a, 03 Marks)
6. Classify the Followers operated by Cams. (WIN23-Q3a, 03 Marks)
7. Explain various types of cams and followers with neat sketches. (WIN24-Q3a, 03 Marks)
8. A flat face follower is moved with simple harmonic motion by a disc cam. Follower rise for 30mm during the cam rotation of 120° , remains in the same position during 30° of cam rotation, follower returns to original position during further 120° of rotation of cam and then for last 90° of rotation follower remains stationary. Minimum radius of cam is 25mm and diameter of the circular flat face of follower is 25mm. Draw the cam profile. (S24-Q2c, 07 Marks) OR (S25-Q2c, 07 Marks)
9. Roller follower rises with uniform acceleration and retardation and the return motion is also having a same motion pattern. Draw the required cam profile for following details. (i) Follower rises for 25mm during 90° of cam rotation (ii) For next 30° , follower remains steady. (iii) For the final period of rotation of cam for 120° , the follower remains steady. Roller diameter=30mm, minimum radius for cam= 25 mm. (S24-Q2c-OR, 07 Marks)
10. Draw a profile of a cam which gives a lift of 25mm to a rod carrying a 16mm diameter roller. The axis of the roller passes through the center of the cam. The least radius of the cam is 32mm. The rod is lifted with SHM during 120° rotation, dwells for 30° rotation then descends during 120° of cam rotation and dwells for 90° of cam rotation with uniform velocity. (WIN24-Q1c-OR, 07 Marks)
11. Draw the profile of cam operating a roller reciprocating follower and with the following data: Minimum radius of cam =25 mm, lift=30 mm, roller diameter =15 mm, the cam lifts the follower for 120° with SHM followed by dwell period of 30° . Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by dwell period. (WIN22-Q1c-OR, 07 Marks)

Unit 3: Bearings, Clutches, Brake & Dynamometer

Repeated Questions:

1. **Differentiate between brake and Dynamometer.**
 - **Appeared in:** S24 (Q2b, 04 Marks), S25 (Q2b, 04 Marks)
2. **In a multi-plate clutch, calculate the power transmitted.**
 - **Appeared in:** S24 (Q3c, 07 Marks), S25 (Q3c, 07 Marks), WIN23 (Q3c, 07 Marks)
3. **In a multi-collar bearing, find the power lost in friction.**
 - **Appeared in:** S24 (Q3c-OR, 07 Marks), WIN24 (Q2c-OR, 07 Marks), S25 (Q3c-OR, 07 Marks)

Other Important Questions:

4. Define Friction and list advantages and Disadvantages of friction. (S24-Q3a, 03 Marks) OR (S25-Q3a, 03 Marks)
5. Define brake and list types of brake. (S24-Q3a-OR, 03 Marks) OR (S25-Q3a-OR, 03 Marks)
6. Classification of Dynamometer. (S24-Q2b-OR, 04 Marks) OR (S25-Q2b-OR, 04 Marks)
7. Draw only neat sketch of single plate clutch with notation. (S24-Q3b, 04 Marks) OR (S25-Q3b, 04 Marks)
8. State the types of thrust bearing and their applications. (S24-Q3b-OR, 04 Marks) OR (S25-Q3b-OR, 04 Marks) OR (WIN24-Q3b, 04 Marks)
9. What are the different types of friction clutches? Describe with neat sketch the working of cone clutch. (WIN22-Q3b, 04 Marks) OR (S23-Q4a, 03 Marks)
10. Explain construction and working of Cone clutch with neat sketch. (WIN23-Q4b, 04 Marks)
11. Explain construction and working of Rope Brake Dynamometer with neat sketch. (S23-Q3b, 04 Marks) OR (WIN23-Q3b, 04 Marks)
12. Explain with neat sketch the construction and working of Differential Band Brake. (S23-Q4b, 04 Marks)
13. Derive the expression for friction torque for a collar thrust bearing assuming uniform pressure. (WIN24-Q3c, 07 Marks)
14. Derive the expression for friction torque for a flat pivot bearing assuming uniform wear. (WIN24-Q3c-OR, 07 Marks)
15. What are uniform pressure theory and uniform wear theories? Deduce expressions for the friction torque considering both the theories for a flat collar. (WIN22-Q2c, 07 Marks)
16. Derive from the first principles the expression for the frictional torque of a conical pivot assuming (i) uniform pressure and (ii) uniform wear. (WIN22-Q2c-OR, 07 Marks)
17. A vertical shaft is supported on foot step bearing having flat end. The diameter of shaft is 90 mm and it rotates at 600 rpm. The axial load on the shaft is 10 kN and coefficient of friction is 0.05. Assuming uniform pressure calculate the power lost in friction. (WIN24-Q2c, 07 Marks)
18. A Conical pivot with angle of cone as 120° supports a vertical shaft of diameter 300 mm. It is subjected to a load of 20 kN. The coefficient of friction is 0.05 and the speed of the shaft is 210 rpm. Calculate power lost in friction assuming (i) uniform pressure and (ii) uniform wear. (WIN22-Q3c, 07 Marks)
19. Prove that the ratio of tension in the tight side and slack side of a band and block brake is given by $\frac{T_n}{T_o} = \left(\frac{1+\mu \tan \theta}{1-\mu \tan \theta}\right)^n$. (WIN23-Q5c, 07 Marks) OR (WIN22-Q3b-OR, 07 Marks)

Unit 4: Power Transmission

Repeated Questions:

1. **Prove the ratio of driving tensions for a flat belt drive.**
 - **Appeared in:** WIN23 (Q2c, 07 Marks), WIN24 (Q4c, 07 Marks)
2. **For a belt drive, find the power transmitted or belt parameters (width/tension).**
 - **Appeared in:** S24 (Q4c, 07 Marks), WIN24 (Q4c-OR, 07 Marks), WIN22 (Q5c, 07 Marks), WIN22 (Q4c-OR, 07 Marks)
3. **For a compound gear train, find the number of teeth on a gear or draw the sketch.**
 - **Appeared in:** S23 (Q3c, 07 Marks), WIN23 (Q4c, 07 Marks)

Other Important Questions:

4. Define term used in gear (i) pitch circle (ii) pitch circle diameter (iii) module. (S24-Q4a, 03 Marks) OR (S25-Q4a, 03 Marks)
5. Classification of gear. (S24-Q4a-OR, 03 Marks) OR (S25-Q4a-OR, 03 Marks)
6. State Advantages and disadvantages of chain drive. (S24-Q4b, 04 Marks) OR (S25-Q4b, 04 Marks)
7. Give the classification of mechanical power transmission and state the advantages of belt drive. (WIN24-Q4a, 03 Marks)
8. Define slip in belt drive and explain the effects of slip. (WIN24-Q4a-OR, 03 Marks)
9. Discuss the advantages of gear drive. (WIN24-Q4b, 04 Marks)
10. State advantages and disadvantages of gear drive. (WIN23-Q3b, 04 Marks)
11. Explain Epicyclic gear train. (S24-Q4b-OR, 04 Marks) OR (S25-Q4b-OR, 04 Marks)
12. Explain the construction and working of epicyclic gear train with neat figure. (WIN24-Q4b-OR, 04 Marks)
13. Two parallel shafts are connected through a pair of gears. Calculate (i) Exact center distance (ii) Train value. (S24-Q4c-OR, 07 Marks) OR (S25-Q4c-OR, 07 Marks)
14. Two parallel shafts A & B are connected by spur gear. Find the numbers of teeth on each gear and the exact distance between two shafts. (S23-Q4c, 07 Marks)
15. What is the difference between a simple gear train and a compound gear train? Explain with help of sketches. (WIN22-Q3a, 03 Marks)
16. List types of gear train and draw neat sketch of any one. (S23-Q2a-OR, 03 Marks)
17. A flat belt drive is used to transmit power. Find the belt speed for maximum power transmission. (S23-Q2c, 07 Marks) OR (WIN23-Q2c, 07 Marks)
18. In a belt drive tight side tension is 2500 N and the ratio of belt tensions is 2.78. If the linear velocity of belt is 720 m/min. then find the power transmitted by the belt drive. (S23-Q2d-OR, 07 Marks)

Unit 5: Flywheel and Governors

Repeated Questions:

1. **Explain the function of the flywheel. State the difference between flywheel and governor.**
 - **Appeared in:** S24 (Q5c, 07 Marks), S25 (Q5c, 07 Marks)
2. **Explain the construction and working of the Hartnell governor with a neat sketch.**
 - **Appeared in:** S23 (Q5c, 07 Marks), S24 (Q5c-OR, 07 Marks), S25 (Q5c-OR, 07 Marks)
3. **Compare Flywheel and Governor.**
 - **Appeared in:** S23 (Q5b-OR, 04 Marks), WIN23 (Q5b, 04 Marks)

Other Important Questions:

4. State the use of a turning moment diagram. (S24-Q5a, 03 Marks) OR (S25-Q5a, 03 Marks) OR (S23-Q5a, 03 Marks)
5. State the different types of flywheels and explain any one in detail with a sketch. (WIN24-Q5a, 03 Marks)
6. Explain the principle and working of a centrifugal governor. (WIN24-Q5b, 04 Marks)
7. Draw and Explain a Simple Watt governor. (WIN23-Q5b, 04 Marks)
8. Explain the Turning Moment Diagram for a single cylinder double-acting steam engine with a neat sketch. (S23-Q5b, 04 Marks)
9. Explain the Turning Moment Diagram for a four-stroke cycle internal combustion engine with a neat sketch. (WIN23-Q5c, 07 Marks)
10. An engine rotating at 90 rpm produces 295 kW power. The coefficient of fluctuation of energy is 0.1 and its speed has to be maintained within 5% of the mean speed. Find the mass of the flywheel having a radius of gyration of 2 m. (WIN23-Q5d, 07 Marks) OR (WIN24-Q5c, 07 Marks)
11. Define the terms used for the centrifugal governor: (1) Height of Governor (2) Equilibrium speed (3) Mean Equilibrium Speed (4) Sleeve Lift. (WIN23-Q5e, 04 Marks)

Unit 6: Balancing and Vibrations

Repeated Questions:

1. **Explain static balancing and dynamic balancing.**
 - **Appeared in:** S24 (Q5b, 04 Marks), S25 (Q5b, 04 Marks), WIN24 (Q5a-OR, 03 Marks)
2. **Define (i) frequency (ii) resonance (iii) free vibration.**
 - **Appeared in:** S24 (Q5a-OR, 03 Marks), S25 (Q5a-OR, 03 Marks), S23 (Q5a-OR, 03 Marks)

Other Important Questions:

3. Define vibration and state the different types of vibrating systems. (WIN24-Q5b-OR, 04 Marks)
4. What is vibration? State causes of vibration & measures to reduce vibrations. (WIN23-Q5f, 04 Marks)
5. Explain different types of vibration with a neat sketch. (S24-Q5b-OR, 04 Marks) OR (S25-Q5b-OR, 04 Marks)
6. Describe the balancing of a single rotating mass by a single mass rotating in the same plane with a formula. (S23-Q5c-OR, 07 Marks)
7. Explain the analytical method of balancing of different masses revolving in the same plane. (WIN22-Q5b, 04 Marks)
8. Explain the graphical method of balancing several masses revolving in the same plane. (WIN24-Q5c-OR, 07 Marks)
