

PTX5D001 MECHANICS OF TEXTILE MACHINERY
(Honours)

Course Objectives

- To gain knowledge about various design concepts on shedding tappets, speed frame cone drums and ring frame shaper cams.
- To know about power transmissions
- To acquire knowledge about application of principle of moments on various textile machineries

Course Outcomes

After successful completion of this course, the students should be able to

- Define the importance of gear and belt drives
- Express the relationship between tensions in belt drives and also the condition for maximum power transmission
- Design the profiles of cone drums used in speed frames as well as scutcher, plain and twill tappets and ring frame builder motion cams
- Calculate the picking force, shuttle velocity and acceleration in weaving machines
- Justify the use of kinetic energy, potential energy and principle of moments in textile industry
- Use the equations of motions in textile applications
- Explain the importance of friction in textile applications
- Point out the applications of brakes and clutches in textile industry and to derive the expressions for the torque transmitting capacity of various types of clutches

Course Content

Module-I (14 Hours)

1. Drives and Power Transmission:

Belt Drives (mathematical representation of open and cross drives), Concept of Flat and V pulley, timing belt drive. Chain & sprocket drum, Gear Drives- study of gears, type of gears in spinning preparatory machines, Ring frame, looms etc., worm and worm wheels in looms and ring frames, Bevel gears in carding, speed frames etc., epicyclic and differential gearing in comber and speed frames, rack & pinion, movement of bobbin drive in speed frame, idea of double hook joint, planetary mechanism in coiling. Screw traversing mechanism.

2. Intermittent Rotary motion:

Ratchet and pawl mechanism, Let off and Take up motion in weaving machines, Geneva wheel, special oscillatory mechanism, detaching roller drive in combing

3. Cams:

Introduction, types of cams, types of follower, follower displacement programming, motions of the follower, cams with specified contours- tappets, winding cams, ring frame builder cams, picking cam, knitting cam, etc.

4. Clutches & Brake:

Clutches- Jaw/toothed clutches, friction clutches, cone clutches. Brakes-Mechanical brakes, Block brake with short shoe, Pivotal double block brake, Internal expanding brake, Band brake.

Module-II (14 Hours)

5. Linkage Mechanisms: Link , kinematic pair, degrees of freedom, kinematic chain, linkage mechanism and structure, Classification of mechanisms, Velocity & acceleration diagrams of four and six bar linkage mechanisms, Relative velocity and instantaneous method. Applications of different mechanism for the sley driving.

6. Control mechanisms: Introduction- elements of control mechanism- open loop and closed loop systems, the detecting elements - detection of broken yarns and slivers, pick finding devices on loom, control of yarn and cloth tension, stretch control in sizing, control of temperature and liquor ratio in textile processing.

Module-III (12 Hours)

7. Friction and lubrication: introduction, the nature of friction, lubrication by means of chemical films, lubrication by thick films of fluid, the use rolling instead of sliding contact, journal and roller bearing - classification of bearings used in textile machines, special lubrication techniques in textile machines, friction in textile materials, friction clutches and brakes in textile machines, friction drives, cone drum drives in speed frame, indirect loom beam drive, friction tensioner in winding etc.

8. Balancing of Machine parts: Basic concepts with reference to balancing of card cylinder, bobbin rail of speed frame, flyer balancing, ring rail & spindle in ring frame, rotor, crank shaft balancing etc.

9. Vibration: Basic concepts, vibration in looms, ring frame, speed frame etc.

Module-IV (12 Hours)

10. Static and Dynamic force analysis:

Introduction, basic concepts, static equilibrium; concept of dynamic analysis, D'Alemberts principle, dynamic analysis of crank sley mechanism, turning moment of ring frame main shaft, crank shaft of loom etc., fly wheels on looms etc., moment of inertia, centripetal and centrifugal forces, Mathematical concept of balloon formation in ring frame and winding, Forces acting on yarn in ring frame, roller movement and loading in drafting, motion of winding traverse, motion of beams and drums, Mathematical analysis of beat-up mechanism. Dynamics of shedding, dynamics of Torsion bar picking mechanism.

Books Recommended:

1. Mechanics for Textile Students –W.A.Hantoon, Textile Institute, Butterworth,1960.
2. Textile Mechanics Vol. I & II – K. Slater, Textile Institute, Manchester, 1977
3. Textile Mechanics – W.M.Taggart
4. An Introduction to Textile Mechanisms – P. Grosberg, Ernest Benn Ltd., London,1968
5. Textile Mathematics, Vol-I, II & III - J.E.Booth, Textile Institute, Butterworth
6. Mechanics of Spinning Machines-R.S.Rengaswamy, NCUTE Publication