22FMPE304 TRACTOR SYSTEMS AND CONTROLS

Source: https://www.agrihub.org.in/courses/tractor-systems-and-controls/

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic concept of Transmission System, Clutch System, Gear Box, Differential and Final Drive, Brakes, Steering System, Hydraulics, Power Transmission, Traction, Tractor Mechanics, Ergonomics.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to impart the knowledge on the basic prime mover of farming activities, its types, functions and capabilities in connecting various implements

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

BASICS OF TRANSMISSION SYSTEM, CLUTCH SYSTEM AND GEAR BOX:

Study of need for transmission system in a tractor: Transmission system - types, major functional systems.

Study of clutch - need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems.

Study of Gear Box: Gearing theory, principle of operation, gear box types, functional requirements and calculation for speed ratio

UNIT-2 **4L+0T+8P=12 Hours**

DIFFERENTIAL SYSTEM, FINAL DRIVE AND BRAKES :

Study of differential system - need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system: Types, principle of operation, construction, calculation for braking torque.

PRACTICES:

- Introduction to transmission systems and components.
- Study of clutch functioning and parts.
- Design problem on clutch system.
- Study of different types of gear box, calculation of speed ratios, design problems on gear box.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

STEERING SYSTEM AND HYDRAULIC SYSTEM :

Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors

Study of Hydraulic system in a tractor - Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets - PTO. PTO standards, types and functional requirements.

SKILLS:

- ✓ *Design of gearbox, clutch assembly and final drive for tractors.*
- ✓ *Apply ergonomics for better comfort and safety in tractor operation wells.*
- ✓ *Operate tractor for field and haulage operations.*

UNIT-2 **8L+0T+8P=16 Hours**

TRACTION, TRACTOR MECHANICS, ERGONOMICS, TRACTOR TESTING:

Introduction to traction: Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres - Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids. Study of tractor mechanics - forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor.

Study of tractor static equilibrium: Tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing, Deciphering the engine test codes.

PRACTICES:

- Study of differential system.
- Study of final drive system.
- Study of planetary gears.
- Study of brake systems and some design problems.
- Steering geometry and adjustments.
- Study of hydraulic systems in a tractor, hydraulic trainer and some design problems.
- Appraisal of various controls in different makes tractors in relation to anthropometric measurements.
- Determination of location of CG of a tractor.
- Determination of Moment of Inertia of a tractor.
- Traction performance of a traction wheel.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply their knowledge and be able to identify the correct size of transmission system for different field operations.	Apply	1	2, 4
2	Apply and develop different components using ergonomic principles.	Apply	2	5, 7, 9
3	Implement the safety aspects in farm operations.	Apply	2	5, 6, 7, 9
4	Analyze the problems and solved the same relating to hydraulic system and three point hitch system.	Analyze	2	2, 3
5	Evaluate the trend for use of different power outlets of tractor for different field operations for safety and economy.	Evaluate	2	3, 4, 5

TEXT BOOKS:

1. Liljedahl J B and Others “Tractors and Their Power Units” 2016.
2. Rodichev V and G Rodicheva “Tractors and Automobiles” 2011.

REFERENCE BOOKS:

1. Singh Kirpal. “Automobile Engineering” – Vol I, 2008.
2. Heitner Joseph. “Automotive Mechanics: Principles and Practices” 2009.
3. C.B.Richey. “Agricultural Engineering Handbook” 2007.
4. John Deere “Fundamentals of Service Hydraulics” 1999.
5. Relevant BIS Test Codes for Tractors, 2015.