FARM MACHINERY AND EQUIPMENT

ENAE 302

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 2

Course Objectives:
The objective of this course is to provide the principles and applications of appropriate farm machinery and equipment for soil preparation, planting, crop care, and harvesting, in order to enhance efficiency, ensure timely farm operations, improve crop productivity, reduce labor requirements, and promote sustainable farming practices.

1 Introduction (2 hours)

1.1 Objectives of farm mechanization
1.2 Scope and limitations of farm mechanization
1.3 Strategies and policies of farm mechanization: Agricultural development strategies; Farm mechanization policies; Responsible institutions and stakeholders for farm mechanization in Nepal

2 Basics of Tillage (2 hours)

2.1 Concept and objectives of tillage
2.2 Physical, chemical and biological effects of tillage on soil properties
2.3 Classification of tillage; New technologies and changing views on tillage

3 Primary Tillage Implements (4 hours)

3.1 Mould board plough
  3.1.1 History, classification, construction and working principle
  3.1.2 Accessories, attachments and adjustment
  3.1.3 Performance, evaluation and draft requirements
  3.1.4 Forces acting on the plough bottom
3.2 Disc ploughs
  3.2.1 Introduction and function of disc plough
  3.2.2 Types, construction, working principle and uses
  3.2.3 Accessories, attachments and adjustment
  3.2.4 Forces acting on plough bottom

4 Secondary Tillage Implements (7 hours)

4.1 Harrows
  4.1.1 Introduction and classification of harrow

4.1.2 Construction, working principle and function of harrows
4.1.3 Type of harrows; Selection and use of harrows
4.1.4 Forces acting on disk harrow and their analysis

4.2 Rotary tillage tools and implements
4.2.1 Types, construction and working principles of rotavator, stirring plough and auger plough
4.2.2 Advantages and limitations of rotary tillage tools
4.2.3 Forces acting on rotary tillage tools

4.3 Specialized tillage implements and tools: Sub-soiler, chisel ploughs, rider, bundformer and puddler

4.4 Tools and implements for intercultural operations
4.4.1 Objectives of intercultural operations
4.4.2 Types, construction and working principle of cultivator
4.4.3 Types of intercultural tools: Sweep, shovel, hoe, rotary hoe and weeder
4.4.4 Horticultural tools and equipments

5 Seeding and Planting Machines (4 hours)

5.1 Introduction and classification of seeding and planting machines
5.2 Components and functional elements of machine
5.3 Methods of seeding and planting
5.4 Seeding mechanism, types, construction and working principles of drills and planters
5.5 Types, construction and working principle of paddy trans-planters
5.6 Fertilizer metering devices in drills and planters
5.7 Calibration, performance and efficiency of seed drills and planters
5.8 Furrow openers and covering devices in drills and planters
5.9 Sugarcane and potato planters
5.10 Modern development of climate smart technology

6 Machines and Equipment for Plant Protection (3 hours)

6.1 Introduction and objectives of plant protection machines and equipments
6.2 Types of sprayers and dusters
6.3 Working principle and components of sprayers
6.4 Working principle and components of duster
6.5 Methods and techniques of application of pesticide
6.6 Safety in handling plant protection machines
6.7 Selection and calibration of sprayers

7 Harvesting Machines (8 hours)

7.1 Crop harvesting methods and their mechanization
7.2 Mowers: Types, working principles and constructional details; Adjustments and balancing of cutter-bar

7.3 Reapers and windrowers: Types, working principle, constructional details, reaper-binder and adjustments and performance

7.4 Harvesters for other crops: Working principle and constructional components of potato digger, groundnut harvester, sugarcane harvester and fruit harvesting machinery

7.5 Combined Harvesters

7.5.1 Working principle, classification and functional components of grain combines

7.5.2 Adjustments and trouble-shooting in combined harvesters

8 Threshing Machines (3 hours)

8.1 Threshing mechanisms and their mechanization

8.2 Types of threshers, their working principles and constructional details

8.3 Factors affecting thresher performance

8.4 Adjustments and trouble-shooting in mechanical threshers

9 Chaff and Silage Cutters and Forage Harvesters (2 hours)

9.1 Working principle and constructional details

9.2 Types of cutter heads

9.3 Forage blower, straw baler and silage making machine

10 Hill Agricultural Machinery and Tools (2 hours)

10.1 Indigenous wooden plough

10.2 Millet planter, harvester and thresher

10.3 Ginger and turmeric cleaning machines

10.4 Spade, knife and sickle

11 Selection and Economics of Farm Machines and Equipment (2 hours)

11.1 Selection criteria of farm machines and equipment

11.2 Cost of operation of farm machines

11.3 Management of farm machines and equipments

12 Custom Hiring of Agricultural Machinery and Tractor (2 hours)

12.1 Importance of custom hiring

12.2 Feasibility of custom hiring of farm machine and equipment

Tutorial (15 hours)

1. Performance, evaluation and draft requirements mould board plough
2. Forces acting on the plough bottom (Mould board and disc plough)
3. Analysis of forces acting on disk harrow
4. Calibration, performance and efficiency of seeding and planting machines
5. Construction, adjustment and trouble-shooting of threshing machines
6. Cost analysis of operation of farm machines

Practical **(30 hours)**

1. Familiarization with farm operations, farm machines and equipment
2. Safety measures in farm machinery operation
3. Measurement of size of mould board plough and disc plough in the lab and in the field
4. Measurement of power requirement in the field by using spring dynamometer for any types of tillage implements
5. Determination of efficiency of tillage implements in the field
6. Seed drill and planter calibration; Uniformity of metering mechanism
7. Evaluation of performance of sprayer and mechanical weeder
8. Demonstration/operation of sub-soiler and chisel plough
9. Observation of paddy trans-planters and seeder
10. Observation of mowers and reapers
11. Determination of efficiency of mechanical thresher
12. Observation of combined harvesters
13. Trouble shooting and maintenance of agricultural machineries

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1 and 2	4	6
3 and 4	11	14
5	4	6
6	3	4
7 and 8	11	14
9 and 10	4	6
10 and 11	4	6
11 and 12	4	4
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Kepner, R. A., Bainer, R., Barger, E. L. (2005). Principles of farm machinery (Latest Edition). CBS Publishers & Distributors.
2. Smith, P. H., Wilcke, L. H. (1976). Farm machinery & equipment (Latest Edition). Tata McGraw-Hill Publishing Co. Ltd.
3. Michal, A. M., Ojha, T. P. (2012). Principles of agricultural engineering (Vol. 1). Jain Brothers.
4. Culpin, C. (1975). Farm machinery (Latest Edition). ELBS.
5. Shrivastava, A. C. (1991). Elements of farm machines (Latest Edition). Oxford & IBH Publishing Co. Ltd.
6. Kelin, N. I., Popov, I. F., Sakur, A. V. A. (1978). Agricultural machines (Latest Edition). Amerind Publishing.