



S.No.	Practical	No. of Lectures
15.	Machines for fertilizer application: Discs type broadcasters.	1
16.	Organic fertilizer application: Properties of organic manure spreading machines. Liquid fertilizer distributors.	2
17.	Planting and transplanting: Paddy transplanters, potato planters.	1
18.	Case studies	2
	Total	30

IX. List of Practicals

S.No.	Practical	No of Practicals
1.	Design of mould board: Coulter, frog, share	1
2.	Design of mould board: mould board plough working surface, jointer.	1
3.	Trailed, semi mounted and mounted ploughs.	1
4.	Design of disc plough	1
5.	Design of disc harrow	1
6.	Design of peg tooth harrow	1
7.	Design of cultivators and sweep.	1
8.	Design of rotary tiller.	1
9.	Design of traction and transport devices.	1
10.	Design of seed drills: Metering mechanisms	1
11.	Design of seed drills: hopper and furrow opener.	1
12.	Design of Fertilizer application equipment: fertilizer spreaders	1
13.	Design of Fertilizer application equipment: liquid fertilizer applicators and design of its sub systems	1
14.	Design of paddy transplanters	1
15.	Design of potato planters.	1
	Total	15

X. Suggested Reading

- Bernacki C, Haman J and Kanafajski Cz. 1972. *Agricultural Machines Theory and Construction*. Vol.I. U.S. Dept. of Commerce, National Technical Information Service, Springfield, Virginia 22151.
- Bosoi ES, Verniaev OV, Smirnov II and Sultan-Shakh EG. 1990. *Theory, Construction and Calculations of Agricultural Machinery - Vol. I*. Oxonian Press Pvt. Ltd. No.56, Connaught Circle, New Delhi.
- Gill R and Vanden Berg GE. 2013. *Soil Dynamics in Tillage and Traction*. Scientific Publishers (India) ISBN-10: 8172338031.
- Yatsuk EP 1981. *Rotary Soil Working Machines Construction, Calculation and Design*. American Publishing Co. Pvt. Ltd, New Delhi.

I. Course Title : Design of Farm Machinery-II

II. Course Code : FMPE 506

III. Credit Hours : 1+1

IV. Aim of the course

To learn the engineering principles behind application of pesticides and the systems that implements the same. To learn the concepts behind design of crop harvesting and threshing equipment.



V. Theory

Unit I

Pesticide calculation examples. Multidisciplinary nature of pesticide application. Overview of chemical control integrated pest management. Targets for pesticide deposition. Formulation of pesticides.

Unit II

Spray droplets. Hydraulic nozzles. Power operated hydraulic sprayer design principles. Air assisted hydraulic sprayer design principles. Controlled droplet application. Electrostatically charged sprayers. Spray drift and its mitigation. Aerial spraying systems. Use of drones for spraying: Design of spray generation and application issues.

Unit III

Introduction to combine harvesters: Construction, equipment subsystems, power sub systems. Crop harvesting: Plant properties, physical and mechanical properties of plant stem, plant bending modelling. Properties of plant grain: Physical, mechanical, grain damage. Properties of MOG; Mechanical and aerodynamic.

Unit IV

Design of grain header; Orienting and supporting reel. Plant cutting cutter bar: Working process, cutter bar drive. Knife cutting speed pattern area. Design of auger for plant collection. Corn header: Working elements, snapping roll design, stalk grasping and drawing process. Corn ear detachment: Stalk cutting and chopping.

Unit V

Cereal threshing and separation; Design of tangential and axial threshing units. Performance indices of threshing units. Modelling material kinematics in different threshing units. Factors influencing the threshing process and power requirement. Separation process and design of straw walker. Cleaning Unit process and operation. Grain pan; Chaffer and bottom sieve. Blower design and flow orientation. Design of conveying system for grain. Straw choppers and shredders.

VI. Practical

Measurement of spray characters for different nozzles. Problems on sizing of sprayer components. Design of sprayer for special purpose: Orchard and tall trees. Harvesting machine. Problems on design of cutterbars, reels, platform auger, conveyors. Design of threshing drum: Radial and axial flow type. Design of cleaning and grading systems. Design of blowers.

VII. Learning outcome

The student will know the principles behind the design of crop spraying equipments and harvesting and threshing machinery.

VIII. Lecture Schedule

S.No.	Topic	No of Lectures
1.	Overview of chemical control integrated pest management.	1
2.	Targets for pesticide deposition. Formulation of pesticides.	1
3.	Multidisciplinary nature of pesticide application.	1
4.	Pesticide calculation examples.	2



S.No.	Topic	No of Lectures
5.	Spray droplets. Hydraulic nozzles. Power operated hydraulic sprayer design principles.	2
6.	Controlled droplet application. Spray drift and its mitigation.	1
7.	Air assisted hydraulic sprayer design principles. Electrostatically charged sprayers.	2
8.	Aerial spraying systems. Use of drones for spraying:	1
9.	Design of spray generation and application issues.	1
10.	Introduction to combine harvesters; Construction, equipment subsystems, power sub systems.	1
11.	Crop harvesting: Plant properties, physical and mechanical properties of plant stem, plant bending modelling.	1
12.	Properties of plant grain: Physical, mechanical, grain damage.	2
13.	Properties of MOG; Mechanical and aerodynamic.	2
14.	Design of grain header; Orienting and supporting reel. Plant cutting cutter bar.	2
15.	Working process, cutter bar drive. Knife cutting speed pattern area.	1
16.	Design of auger for plant collection.	1
17.	Corn header: Working elements, snapping roll design, stalk grasping and drawing process. Corn ear detachment: Stalk cutting and chopping.	2
18.	Cereal threshing and separation, Design of tangential and axial threshing units. Performance indices of threshing units.	2
19.	Modelling material kinematics in different threshing units. Factors influencing the threshing process and power requirement.	1
20.	Separation process and design of straw walker.	1
21.	Cleaning Unit process and operation. Grain pan: Chaffer and bottom sieve. Blower design and flow orientation.	2
22.	Design of conveying system for grain. Straw choppers and shredders.	2
	Total	32

IX. List of Practicals

S.No.	Practical	No of Practicals
1.	Measurement of spray characters for different nozzles.	1
2.	Problems on sizing of sprayer components.	1
3.	Design of spraying units – manual	1
4.	Design of spraying units – powered	1
5.	Design of sprayer for special purpose: Orchard and tall trees.	1
6.	Design of agitation units – mechanical and hydraulic	1
7.	Harvesting machines: Problems on design of shear type cutting mechanism	1
8.	Harvesting machines: Problems on design of impact type harvesting mechanism	1
9.	Harvesting machines: Problems on design of platform auger and conveyors.	1
10.	Harvesting machines: Problems on design of reels	1
11.	Design of threshing drum: Radial flow type.	1
12.	Design of threshing drum: Axial flow type.	1
13.	Design of cleaning systems.	1
14.	Design of grading systems.	1
15.	Design of blowers.	1
	Total	15



X. Suggested Reading

- Bernacki C, Haman J and Kanafajski Cz 1972. *Agricultural Machines Theory and Construction*. Vol-I. U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22151.
- Bindra, OS and Singh H. 1971. *Pesticides Application Equipments*. Oxford & IBH Publishing Co., New Delhi.
- Bosoi ES, Verniaev OV, Smirnov II and Sultan-Shakh EG. 1987. *Construction and Calculations of Agricultural Machinery - Vol.II*. Oxonian Press Pvt. Ltd. New Delhi.
- Miu P. 2016. *Combine Harvesters Modeling and Design*. CRC Press, Boca Raton, USA ISBN 13:978-1-4822-8237-5
- Thornhill EW and Matthews GA. 1995. *Pesticide Application Equipment for Use in Agriculture Vol II*. Mechanically powered equipment FAO Rome.

- I. Course Title : Management of Farm Power and Machinery System**
II. Course Code : FMPE 507
III. Credit Hours : 2+1

IV. Aim of the course

To understand how principles of management are applied to farm machinery systems to make them more effective and profitable.

V. Theory

Unit I

Importance and objectives of farm mechanization in Indian agriculture, its impact, strategies, myths and future needs. Estimation of operating cost of tractors and farm machinery. Management and performance of power, operator, labour. Economic performance of machinery, field capacity, field efficiency and factors affecting field efficiency.

Unit II

Tractor power performance in terms of PTO, drawbar and fuel consumption. Power requirement problems to PTO, DBHP.

Unit III

Selection of farm machinery, size selection, timeliness of operation, optimum width and problem related to its power selection. Reliability of agricultural machinery. Replacement of farm machinery and inventory control of spare parts.

Unit IV

Systems approach to farm machinery management and application of programming techniques to farm machinery selection and scheduling. Network Analysis: Transportation, CPM and PERT, dynamic programming, Markov chain.

VI. Practical

Study of latest development of different agricultural equipment and implements in India and other developing countries. Size selection of agricultural machinery. Experimental determination of field capacity of different farm machines. Study of farm mechanization in relation to crop yield. Determination of optimum machinery system for field crop and machine constraints. To develop computer program for the selection of power and machinery.