# FIRST YEAR COURSE STRUCTURE FOR M. TECH. IN FARM MACHINERY AND POWER ENGINEERING

### FIRST SEMESTER

A. Theory							
Sl.	Paper	Nome of Donor	Contact Periods/Week				Credita
No	Code	Name of Paper	L	Т	Р	Total	Creans
1	FMP101	Advanced Farm Machinery	4	2	-	6	6
2	FMP102	Agricultural Automation and Precision Agriculture	3	2	-	5	5
3	FMP103	Design and Graphics	3	2	-	5	5
4	FMP104	Elective I	3	2	-	5	5
Total Theory						21	21
B. Practical							
4	FMP105	Advanced Farm Machinery Lab	-	-	3	3	2
3	FMP106	Agricultural Automation and Precision Agriculture Lab	-	-	3	3	2
Total Practical					6	4	
Total of Semester:					27	25	

## SECOND SEMESTER

A. Theory							
Sl.	Paper	Nome of Deper	Contact Periods/Week				Cara liter
No	Code	Name of Faper	L	Т	Р	Total	Creatis
1	FMP201	Design of Farm Machinery and	3	2	-	5	5
		Tractors					
2	FMP202	Renewable Energy	3	1	-	4	4
3	FMP203	Elective -II	3	2	-	5	5
4	FMP204	Elective-III	3	2	-	5	5
Total Theory						19	19
B. Practical							
5	FMP205	Renewable Energy Lab	-	-	3	3	2
6	FMP206	Seminar	-	-	-	6	4
Total Practical					9	6	
Total of Semester:				28	25		

# SECOND YEAR COURSE STRUCTURE FOR M. TECH. IN FARM MACHINERY AND POWER ENGINEERING

# THIRD SEMESTER

Practical							
1	FMP301	Thesis Part-I	-	-	-	-	15
2	FMP302	Comprehensive Viva Voce	-	-	-	-	10
Total Practical					-	25	
Total of Semester:					-	25	

#### FOURTH SEMESTER

Practical							
2	FMP401	Thesis Part-II	-	-	-	-	25
Total Practical					-	25	
Total of Semester:					-	25	

# <u>List of Elective Papers (Elective I/II/III): M.Tech. – Farm Machinery and Power</u> Engineering

- 1. Ergonomics
- 2. GIS and GPS principles and application in Agriculture
- 3. Image Processing in Agriculture
- 4. Biofuel Production
- 5. Remote Sensing for agricultural application
- 6. Sensor Technology
- 7. Farm Planning, Economics & Management
- 8. Agricultural Statistics
- 9. Agricultural Soil Mechanics
- 10. Agricultural Extension
- 11. Computer Programming and Data Management

## **Detailed Syllabus: M. Tech. (Farm Machinery and Power Engineering)**

#### FMP101: Advanced Farm Machinery Unit I

Mechanics of rigid, rotary and oscillating tillage tools, design and performance of various tillage tools, Tyre size, load and pressure relationship, mechanics and design of traction and transport devices.

### Unit II

Advanced farm machinery equipments such as: disk harrow, seed drill, rice transplanter, combine harvester, tractor and earth moving vehicles.

### Unit III

Hydraulics system design, system maintenance, servo control, grading and boring machines, different methods of boring.

### Unit IV

Single and three point hitch, drawbar performance, hydraulic controls and systems, design of mechanical & power steering.

#### Unit V

Traction improvement, Handling charateristics of offroad vehicles, Human factors in designing farm machinery.

#### Suggested reading:

- 1. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units.
- 2. R.A. Kepner, R. Bainer, E.L Barger, Principles of Farm Machinery, CBS Publishers and Distributors.
- 3. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.
- 4. Donald M. Johnson, J. Harper, David E. Lawer, Mechanical Technology in Agriculture, Interstate Publishers.

# **FMP102:** Agricultural Automation and Precision Agriculture

#### Unit I:

Information and data collection, interpretation of data, management of information system

## Unit II:

Global positioning system, geographical information system, remote sensing, sensor technology

## Unit III:

Soil sample collection, Soil mapping, yield monitor and yield mapping, site-specific management, real-time data collection and mapping, variable rate technology.

#### Unit IV:

Advanced agriculture technology, precision controlling system, image acquisition and processing, modeling and programming with C/C++ for Windows and Linux system.

# Unit V:

Real-time field monitoring system, agricultural robotics, pilot projects, bill of materials.

### Suggested reading:

- 1. J. V. Safford, Precision Agriculture' 05, Oxford Press.
- 2. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units.
- 3. R.A. Kepner, R. Bainer, E.L Barger, Principles of Farm Machinery, CBS Publishers and Distributors.
- 4. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.
- 5. Donald M. Johnson, J. Harper, David E. Lawer, Mechanical Technology in Agriculture, Interstate Publishers.

### **FMP 103: Design and Graphics**

### Unit I

Computer-aided design, Geometric modelling and interactive graphics, computer-aided analysis and synthesis of common mechanical components, Computer-aided selection of standard mechanical components, Introduction to FEM

### Unit II

Application of numerical methods and optimal techniques to machine design problems, Preparation of engineering drawings of machine/implement components, design of plough share/furrow openers/plough discs, and other components of farm machinery

#### Unit III

Forms of screw threads: BSW-square-metric, representations of threads, bolts, headed counter sunk-stud, nuts-hexagonal-square, keys-type, taper, saddle, round-gib head feather and woodruff keys etc.Design of different tractor components and systems, such as: fuel supply system, exhus, piston-cylinder engines etc.

#### Unit IV

3-D Design, computer aided design with additional commercials software such as: Mechanical desktop and SoildWorks etc.

## Unit V

Design of few agricultural equipments, preparation of bill of materials and cost analysis.

## Suggested reading:

- 1. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units.
- 2. R.A. Kepner, R. Bainer, E.L Barger, Principles of Farm Machinery, CBS Publishers and Distributors.
- 3. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.
- 4. Donald M. Johnson, J. Harper, David E. Lawer, Mechanical Technology in Agriculture, Interstate Publishers.

## FMP105: Advanced Farm Machinery Lab

Soil tool interaction, Advanced tillage tools, 3-point Hitching, PTO and power transmission system.

Design and testing of farm machinery equipments such as: transplanter, combine harvester etc.

Pilot project on agricultural tractors and power tillers.

# Suggested reading:

- 1. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units.
- 2. R.A. Kepner, R. Bainer, E.L Barger, Principles of Farm Machinery, CBS Publishers and Distributors.
- 3. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.
- 4. Donald M. Johnson, J. Harper, David E. Lawer, Mechanical Technology in Agriculture, Interstate Publishers.

## FMP106: Agricultural Automation and Precision Agriculture Lab.

GPS receivers and field data collection, Introduction to ArcView GIS software, Soil and Yield mapping, Yield monitor, Real time crop scouting, Variable rate Technology, On-the-go nutrient estimation.

## Suggested reading:

- 1. S. Srivastav, Precision Agriculture, International Publishers
- 2. J. V. Stafford, Precision Agriculture 05, Oxford Press.
- 3. Terry Brase, Precision Agriculture, Oxford Press.
- 4. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units.
- 5. R.A. Kepner, R. Bainer, E.L Barger, Principles of Farm Machinery, CBS Publishers and Distributors.

# FMP 201: Design of Farm Machinery and Tractors

## Unit I:

Materials of construction of farm machinery and their properties, locally available materials and requirements.

## Unit II:

Design of transmission of power components and systems in agricultural machines and tractors, fits and tolerances.

## Unit III:

Design parameters of agricultural implements, force analysis of primary and secondary tillage tools and their hitching systems.

## Unit IV:

Design consideration of seed drill and planters, reapers, mowers harvesters and threshing equipments.

# Unit V:

Application of design methods to the system of selected farm machinery, bill of materials and construction cost in project design.

### Suggested reading:

- 1. H. P. Smith and Pearson. Farm Machinery and Equipment. McGraw Hill.
- 2. Richey. Handbook of Agricultural Engineering
- 3. C.P. Nakra. Farm Machines and Equipments.
- 4. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.

### FMP 202: Renewable Energy

### Unit I:

Biomass Resources, Modes of Biomass Utilization for Energy, Biomass Conversion Processes, Chracteristics of Biomass Fuels such as: Composition, Ultimate and Proximate Analyses, Heating Value.

### Unit II:

Pyrolysis: Slow and Fast Pyrolysis, Charcoal Production, Gasification: Updraft, Downdraft and Fluidized Bed Gasification, Equilibrium and Kinetic Considerations, Combustion

### Unit III:

Fluidized Bed Conversion: General Behaviour of Fluidized Beds, 2-Phase Theory, Methanol Production, Biogas Production: Types of Substrates, Digester Design, Operational Problems, Kinetic Considerations.

## Unit IV:

Ethanol Production: Basic Production Processes, Distillation; Types of Densification Devices, Properties of Densified Fuels.

## Unit V:

Main challenge to renewable energy integration, Cost effectively connecting renewable projects - Testing, Legal & compliance bottlenecks.

#### Suggested readings

- 1. C. Y. WereKo Brobby and E. B. Hagan: Biomass Conversion and Technology, John Wiley and Sons, 1996.
- 2. T. B. Reed: Biomass Gasification, Noyes Data Corporation, 1981.
- 3. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.

#### FMP 205: Renewable Energy Lab

Sources of Reneable energy, Windmill, Solar cell, Biogas plant and accessories, Machnical Gasification. Biofuel and Biodisel, Renewable energy cost estimation

#### Suggested readings

1. C. Y. WereKo - Brobby and E. B. Hagan: Biomass Conversion and Technology, John

Wiley and Sons, 1996.

- 2. T. B. Reed: Biomass Gasification, Noyes Data Corporation, 1981.
- 3. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.

# **Elective I**

# **Ergonomics**

# Unit I:

Introduction, importance of Ergonomics, agricultural ergonomics, characteristics of local farming environment.

# Unit II:

Anthropometry-body measurements, operator's posture, classification of farm workers, workspace layout, national and international standards, thermal environment of agricultural workers.

## Unit III:

Operator's perception, sight, hearing, system vibration action, physical load, physical process, mental load, mental process.

## Unit IV:

Applications in design of equipment and process in tropical climates such as tractor seat, steering and braking, lighting system, power tiller handles, brakes, hand tools etc. laboratory and field testing.

# Unit V:

Operator's safety and comfort, bill of materials, design consideration and cost estimation. **Suggested reading:** 

- 1. H. P. Smith and Pearson. Farm Machinery and Equipment. McGraw Hill.
- 2. Richey. Handbook of Agricultural Engineering
- 3. C.P. Nakra. Farm Machines and Equipments.
- 4. D.N. Sharma, S. Mukesh, Design of Agricultural Tractors (Principles and Problems), Join Brother Publishers.