आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

MASTER OF TECHNOLOGY

AGRICULTURAL ENGINEERING

(PROCESS AND FOOD ENGINEERING)

[*w.e.f.* ACADEMIC SESSION 2018 – 19]

IFTM UNIVERSITY

N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244102
Website: www.iftmuniversity.ac.in

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SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

Study and Evaluation Scheme

of

Master of Technology

Agricultural Engineering

(Process and Food Engineering)

[*w.e.f.* Academic Session 2018 – 19]

Summary

Programme:	**Master of Technology** **Agricultural Engineering** **(Process and Food Engineering)**
Programme Level:	**Degree (Post Graduation)**
Duration:	**Two Years (Four semesters) Full time**
Medium of Instruction:	**English**
Minimum Required Attendance:	**75%**
Maximum Credits:	**66**

IFTM UNIVERSITY
MORADABAD

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N.H-24 Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244102

www.iftmuniversity.ac.in

Effective from 2018-2019

Programme:

M. Tech. Agricultural Engineering (Farm Machinery and Power Engineering)

Programme Outcomes (POs):
Students completing this course will be able to:

1. Understand and application of the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve the complex engineering problems.
2. Use and implement of recourses which will be economically feasible, agro and energy technologies for sustainable agriculture
3. Synthesizing and analyzing of farm machinery and power and management system in the field of agriculture.
4. Conduct demonstrates; develop ability to Design and Conduct Experiments, Interpret and Analyzes Data and Report Results. Deeply elaborate various fundamental concepts learned at graduation level.
5. Demonstrate an Understanding of their Professional Ethical Responsibilities.
6. Develop to conduct demonstrate ability to Function Effectively Individually and also as a Team Member in Multidisciplinary activities.
7. Understand the importance & role of government all over the world to promote use of the renewable energy sources
8. Communicate Effectively in both Verbal and Written Forms.

School of Agricultural Sciences & Engineering, IFTMU

STUDY & EVALUATION SCHEME

M. Tech–Agricultural Engineering (Farm Machinery and Power Engineering)

YEAR - I, SEMESTER - I

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	**MFM101**	**Design of Farm Power and Machinery Systems**	3	0	0	20	10	30	70	100	3
2.	**MFM 102**	**Testing and Evaluation of Tractors and Farm Equipment**	3	0	0	20	10	30	70	100	3
3.	**MFM 103**	**Soil Dynamics in Tillage and Traction**	3	0	0	20	10	30	70	100	3
4.	**MFM104 A**	**Elective Course**	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT											
						IA	AT				
5.	**MFM 151**	**Farm Power and Machinery Systems Lab**	0	0	2	40	10	50	50	100	1
6.	**MFM 152**	**Testing and Evaluation of Tractors and Farm Equipment Lab**	0	0	2	40	40	50	50	100	1
.		**TOTAL**	**12**	**00**	**04**					**600**	**14**

School of Agricultural Sciences & Engineering, IFTMU

STUDY & EVALUATION SCHEME

M. Tech–Agricultural Engineering (Farm Machinery and Power Engineering)

YEAR - I, SEMESTER - II

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	**MFM 201**	**System Simulation and Computer Aided Problem Solving in Engineering**	3	0	0	20	10	30	70	100	3
2.	**MFM202**	**Advances in Farm Machinery and Power Engineering**	3	0	0	20	10	30	70	100	3
3.	**MFM203 (B)**	**Elective Course**	3	0	0	20	10	30	70	100	3
4.	**MMAG204**	**Agricultural Statistics and Experimental Designs**	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT											
						IA	AT				
5	**MFM 251**	**Computer Aided Design Lab**	0	0	2	40	10	50	50	100	1
6	**MMAG254**	**Agricultural Statistics and Experimental Designs Lab**	0	0	2	40	40	50	50	100	1
		TOTAL	**12**	**00**	**04**					**600**	**14**

School of Agricultural Sciences & Engineering, IFTMU

STUDY & EVALUATION SCHEME

M. Tech–Agricultural Engineering (Farm Machinery and Power Engineering)

YEAR - II, SEMESTER - III

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
THEORY											
1.	**MFM301**	**Tractor Design**	3	0	0	20	10	30	70	100	3
2.	**MFM 302**	**Applied Instrumentation in Farm Machines and Stress Analysis**	3	0	0	20	10	30	70	100	3
3.	**MFM303 C**	**Elective Course**	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT											
						IA	AT				
4.	**MFM351**	**Tractor Design Lab**	0	0	2	40	10	50	50	100	1
5.	**MFM352**	**Seminar**	0	0	4	-	100	100	-	100	4
6.	**MAE353**	**Pre-Dissertation**	0	0	4	-	50	50	50	100	4
		Total	**09**	**00**	**10**					**600**	**18**

YEAR - II, SEMESTER - IV

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
PRACTICALS / PROJECT											
1.	**MAE451**	**Dissertation Work**	**-**	**-**	20		300	300	300	600	20
		Total	**-**	**-**	**20**					**600**	**20**

School of Agricultural Sciences & Engineering, IFTMU

STUDY & EVALUATION SCHEME

M. Tech–Agricultural Engineering (Farm Machinery and Power Engineering)

List of Electives

Group A

Elective I

S.N.	CODE	Name of Elective
1.	MFM 104 (I)	Agro-Energy Audit and Management
2.	MFM104 (II)	Machinery for Natural Resources Management and Precision Farming

Group B

Elective II

S.N.	CODE	Name of Elective
1.	MFM 203 (I)	Ergonomics and Safety in Farm Operations
2.	MFM203 (II)	Farm Machinery Dynamics Noise and Vibrations

Group C

Elective III

S.N.	CODE	Name of Elective
1.	MFM303 (I)	Energy Conservation and Management in Farm Power and Machinery
2.	MFM303 (II)	Designs & Analysis of Renewable Energy Conservation System

MFM101 Design of Farm Power and Machinery Systems L:T:P 3:0:0

Objective: To acquaint and equip with the latest design procedures of farm power and machinery systems.

UNIT I

Modern trends, principles, procedures, fundamentals and economic considerations for design and development of farm power and machinery systems. Design considerations, procedure and their applications in agricultural tractors & typical machines. Reliability criteria in design and its application.

UNIT II

Analytical design considerations of linkages/ components in farm machinery and its application.

UNIT III

Design of selected farm equipments–tillage, seeding, planting, interculture, plant protection, harvesting and threshing. Design of rotary vibrating and oscillating machines.

UNIT IV

Design and selection of matching power unit.

UNIT V

Safety devices for tractors and farm implements. Studies on land development machineries.

Course Outcomes:

Students completing this course will be able to:

- Able to design the agricultural machines for tillage, planting/ sowing, threshing and combine harvesting etc.
- Able to testing of agricultural machines for tillage, planting/ sowing, threshing and combine harvesting etc.
- Mastering the methods and processes of design.
- Having fundamental knowledge of theories of agricultural machinery and equipment.
- Having knowledge and transfer of new technologies in the field of design and

construction of agricultural machines and equipment.

- Monitoring and implementation of new and contemporary solutions

Suggested Readings:

1. Anonymous.1983. RNAM Test Code and Procedures for Farm Machinery. Technical series 12.
2. Barger EL, Liljedahl JB & Mc Kibben EC. 1967. Tractors and their Power Units. Wiley Eastern.
3. Lal R & Dutta PC. Agricultural Engineering (through solved examples). Saroj Parkashan, Allahabad.
4. Metha ML, Verma SR, Mishra SK & Sharma VK. 1995. Testing and Evaluation of Agricultural Machinery. National Agricultural Technology Information Centre, Ludhiana

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM151 Farm Power and Machinery Systems Lab L:T:P 0:0:1

List of Experiments: Minimum 08 experiments out of the following:

1. Statement and formulation of design problems.
2. Design of farm power systems
3. Design of mechanisms & prototypes in farm machinery.
4. Introduction to various farm machines,
5. Visit to implements shed and research hall;
6. Field capacity and field efficiency measurement for at least two machines/implements;
7. Draft & fuel consumption measurement for different implements under different soil conditions;
8. Construction details, adjustments and working of M.B. plow,
9. Construction details, adjustments and working Disc plow, disc harrow and secondary tillage tools;
10. Introduction, construction and working of earth moving equipment.

MFM102 Testing and Evaluation of Tractors and Farm Equipment L:T:P 3:0:0

Objective: To acquaint and equip with the test procedures of agricultural machinery and tractors

UNIT I

Types of tests; test procedure, national and international codes.

UNIT II

Test equipment; usage and limitations. Power losses in dynamometers and hydraulic test equipment.

UNIT III

Prototype feasibility testing and field evaluation. Laboratory and field testing of selected farm equipment. Non-destructive testing techniques.

UNIT IV

Tractor performance testing, evaluation and interpretation of results.

UNIT V

Review and interpretation of test reports. Case studies.

Course Outcomes:

Upon completion of this course, students will be able to:

- Understand the standard testing procedures and rules.
- Familiarize with different instruments used in testing of agricultural machinery.
- Understand different test codes of ISO, RNAM, ASTM, ASABE etc.
- Carry out performance evaluation of different agricultural implements

Suggested Readings:

1. Barger EL, Liljedahl JB & McKibben EC. 1967. Tractors and their Power Units. Wiley Eastern.
2. Selection, Testing and Evaluation of Agricultural Machines and Equipment. FAO Service Bulletin No. 115. Lal R & Dutta PC. Agricultural Engineering (through solved examples). Saroj Parkashan, Allahabad.

3. Metha ML, Verma SR, Mishra SK & Sharma VK. 1995. Testing and Evaluation of Agricultural Machinery. National Agricultural Technology Information Centre, Ludhiana

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM152 Testing and Evaluation of Tractors and Farm Equipment Lab L:T:P 0:0:1

List of Experiments: Minimum 08 experiments out of the following:

1 . Laboratory and field testing of selected farm equipment.
2 . Interpretation and reporting of test results.
3 . Material testing and its chemical composition.
4. Accelerated testing of fast wearing components.
5. Study of Non-destructive testing techniques.
6. Field capacity and field efficiency measurement for at least two machines/implements;
7. Draft & fuel consumption measurement for different implements under different soil conditions;
8. Introduction to various Testing farm machines,
9. Study of calibration of seed drill and seed-cum fertilizer drill
10. Study of different machinery (testing BIS test codes).

MFM103 Soil Dynamics in Tillage and Traction L:T:P 3:0:0

Objective: To acquaint and equip with the dynamic properties of soil, soil failure and design of tillage tools, prediction of traction performance and dimensional analysis of different variables related to soil- tire system.

UNIT I

Dynamic properties of soil and their measurement, stress-strain relationships, theory of soil failure.

UNIT II

Mechanics of tillage tools and geometry of soil tool system, design parameters and performance of tillage tools.

UNIT III

Dimensional analysis of different variables related to soil-tyre system; soil vehicle models; mechanics of steering of farm tractor; special problems of wet land traction and floatation.

UNIT IV

Introduction of traction devices, tyres-types, function & size, their selection; mechanics of traction devices. Deflection between traction devices and soil, slippage and sinkage of wheels, evaluation and prediction of traction performance,

UNIT V

Design of traction and transport devices. Soil compaction by agricultural vehicles and machines.

Course Outcomes:

Upon completion of this course, students will:

- be able to measure and utilize physical and mechanical properties of soil in order to interpret and predict soil stress-strain behavior.
- be able to design and implement safe and cost-effective mechanical soil tillage systems for producing desired physical states
- be able to design and implement and cost-effective mechanical traction/transport systems which produce specified performance and acceptable alteration of affected soil profiles

- Understand the need to learn and apply improved methodologies through continuing education.

References:

1. Daniel Hill. 1962. Fundamentals of Soil Physics. Academic Press.
2. Gill & Vandenberg.1968. Soil Dynamics in Tillage and Traction. Supdt. of Documents, U.S. Govt. Printing Office, Washington, D.C.
3. Sineokov GN. 1965. Design of Soil Tillage Machines. INSDOC, New Delhi.
4. Terzaghi K & Peck Ralph B.1967. Soil Mechanics in Engineering Practices. John Wiley & Sons.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM 201 System Simulation and Computer Aided Problem Solving in Engineering L:T:P 3:0:0

Objective: To acquaint and equip with the concept of dimensional analysis, mathematical modeling, software development process and the use of CAD software and in solving the engineering problems related to design of farm machinery.

UNIT I

Concept, advantages and limitation of dimensional analysis, dimensions and units, fundamental and derived units, systems of units, conversion of units of measurement, conversion of dimensional constants, conversion of equations in different units, complete set of dimensionless products and their formulation methods- the Rayleigh's method, Buckingham's Pi theorem and other methods.

UNIT II

Mathematical modeling and engineering problem solving.

UNIT III

Computers and softwares – software development process – Algorithm design, – program composition- quality control- documentation and maintenance – software strategy.

UNIT IV

Approximation- round off errors- truncation errors. Nature of simulation- systems models and simulation- discreet event simulation- time advance mechanisms- components of discreet event simulation model. Simulation of singular server que-programme organization and logic-development

UNIT V

Solving differential equation on computers- modeling engineering systems with ordinary differential equations- solution techniques using computers.

Course outcomes:

- Computer graphics and tools for designing and drafting. & Mathematical modeling and engineering problem solving.

- Develop a good knowledge about construction of numerical control systems and machines.
- Develop a good knowledge about operation of numerical control systems and machines.
- Process planning and Part programming & software development process

References:

1. Averill M. Law & W David Kelton.2000. Simulation Modeling and Analysis. McGraw Hill.
2. Balagurusamy E. 2000. Numerical Methods. Tata McGraw Hill.
3. Buckingham E. 1914. On Physical Similar System. Physical Reviews 4: 345.
4. Langhar H. 1951. Dimensional Analysis and Theory of Models. John Wiley & Sons.
5. Murphy J. 1950. Similitude in Engineering. The Roland Press Co.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM 251 **Computer Aided Design Lab** **L:T:P 0:0:1**

List of Experiments: Minimum 08 experiments out of the following:

1. Study CAD Fundamental concept
2. Mathematical modeling and engineering problem solving.
3. Study software development process – Algorithm design,
4. Study Simulation of singular server que- programme organization and logic-development2
5. Extensive practice on Software development process, modeling techniques, use of CAD
6. Study of Software in solving engineering problems related to design of farm machinery
7. Study acquaint and equip with the concept of dimensional analysis,
8. Study Basic Fundamental concept of mathematical modeling,
9. Design of Farm equipment (minimum 2or3)
10. Study of Computers aided design softwares.

MFM 202 Advances in Farm Machinery and Power Engineering L:T:P 3:0:0

Objective: To acquaint and equip with the latest design procedures of farm power and machinery systems.

UNIT I

Farm machinery system, its characteristics and evaluation. Identification of dynamic characteristics of related components of engine and agricultural machines. Mechanism of dynamic elements and analysis of forces, displacement and their equilibrium in machines.

UNIT II

Statement and formulation of design problems. Computer-aided design of mechanical power transmission systems. Half interval search method.

UNIT III

Analysis of forces in tractor implement combinations under two and three dimensional conditions. Vibrations, transmissibility and effect of damping on various agricultural machine systems like engine, cutter-bar, straw walker, threshing cylinder and reaper-binder.

UNIT IV

Application of various vibration analysis methods. Tractor dynamics; development of the model. Checking, interpretation and statistical analysis of results.

UNIT V

Single and double-tie-rod steering systems, development of mathematical models and its computer-aided solutions.

Course outcomes:

- Getting knowledge of Farm Mechanization scenario and report writing.
- Learning selection of farm machinery on the basis of various requirements, their costing and replacement
- Develop a good knowledge about Statement and formulation of design problems

References:

1. DK & Newwell IC. 2001. Modelling and Analysis of Dynamic System. John Wiley & Sons.
2. Franklin GF & Powell JD. 1980. Digital Control of Dynamic System. Addison Wesley Publ.
3. Kepner R A, Bainer R & Berger EL. 1978. Principles of Farm Machinery. AVI Publ.
4. Mabie H H & Ocrirk FW.1987. Mechanism and Dynamics of Machinery. John Wiley &Sons.
5. Shigley J E & Uicker JJ .1980. Theory of Machinery and Mechanism. McGraw Hill.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MMAG 204 Agricultural Statistics and Experimental Design L:T:P : 3:0:0

Objective: The main aims of this course are to provide comprehensive knowledge of the basic information of agriculture statistics and experimental design.

Unit I

Presentation of Data: Frequency distributions; graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves Measures of Locations and Dispersion: Mean, median, mode and their simple properties (with-out derivation) and calculations of median by graphs; range, mean deviation, standard deviation, standard error, coefficient of variation.

Unit II

Probability and Distributions: Random distributions; events exhaustive, mutually exclusive and equally likely; definition of probability (with simple exercises); definitions of binomial, Poisson's and normal distributions; and simple properties of the above distributions (without derivation)

Unit III

Correlation and Regression: Bivariate data-simple correlation and regression coefficients and their relation; Spearman rank correlation; limits of correlation coefficient; effect of change of origin and scale on correlation coefficient; linear regression and equations of line of regression; association and independence of attributes.

Unit IV

Sampling: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test.

Unit V

Experimental Designs**:** Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs; augmented block

design; simple factorial experiments including split and strip plot design (mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD).

Course Outcomes:

The student is able to

- Understand basic theoretical and applied principles of agricultural statistics needed to enter in agriculture.
- Demonstrate an understanding of the basic concepts of probability and random variables.
- Understand and interpret the concepts of descriptive statistics from the obtained data.
- Utilize and apply regression and other statistical methods to analyze commodity markets and economic data.
- Gain proficiency in using statistical software for data analysis.

References:

1. J, Medhi: Statistical Methods, New age International (P) Ltd.
2. J.K. Goyal & J.N. Sharma, Mathematical Statistics.
3. J.K. Ghosh, Mathematical Statistics, John Wiley & Sons, New York.
4. S.C. Gupta & V.K. Kapoor .Advanced Statistics, S. Chand.
5. M. Ray, Mathematical Statistics, R.P & Sons, Agra.
6. Goulden, C.H. (1952). Methods of Statistical Analysis, 2/e, John Wiley, New York
7. Kempton RA and Fox PN (1997). Statistical Methods for Plant Variety Evaluation.
8. Chapman and Hall.
9. Panse, V.C. and Sukhatme, P.V. (1967). Statistical Methods for Agricultural Workers,
10. I.C.A.R., New Delhi.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- www.onlinecourses.nptel.ac.in
- www.en.wikipedia.org

MMAG 254 Agricultural Statistics and Experimental Design Lab L:T:P 0:0:1

List of Experiments:

1. Measurement of central tendency and dispersion
2. Standard deviation and standard error
3. Principle uses of χ^2 , F and T- test.
4. Correlation Coefficient, Regression coefficient and Regression equation.
5. Analysis of data generated from completely randomized design, randomized block design.
6. Analysis of data generated from Latin square design, factorial experiments in 2^2, 2^3 Split plot designs
7. Missing plot techniques.
8. Analysis of covariance.
9. Sampling in field experiments.
10. Analysis of variance (ANOVA).

MFM301 Tractor Design L:T:P 3:0:0

Objective: To acquaint and equip with the latest design procedures of tractor and its systems.

UNIT I

Technical specifications of tractors available in India, modern trends in tractor design and development

UNIT II

Special design features of tractors in relation to Indian agriculture.

UNIT II

Parameters affecting design of tractor engine and their selection.

UNIT III

Design of fuel efficient engine components and tractor systems like transmission, steering, front suspension,

UNIT IV

Design of hydraulic system & hitching, chassis, driver's seat, work-place area and controls. Tire selection.

UNIT V

Mechanics of tractor. Computer aided design and its application in agricultural tractors.

Course outcomes:

- Design parameters of tractor engine components and power transmission system.
- Stability during operation and different tests conducted on tractor
- Demonstrate of hydraulic system & hitching
- Design of fuel efficient engine components and tractor systems

References:

1. Arther W Judge 1967. High Speed Diesel Engines. Chapman & Hall.
2. Barger E L, Liljedahl JB & Mc Kibben EC. 1967. Tractors and their Power Units. Wiley Eastern.

3. Macmillan R H. The Mechanics of Tractor - Implement Performance, Theory and Worked Example. University of Melbourne.
4. Maleev V L. 1945. Internal Combustion Engines. McGraw Hill.
5. Ralph Alcock 1986. Tractor Implements System. AVI Publ. Co.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM351 **Tractor Design Lab** **L:T:P 0:0:1**

List of Experiments: Minimum 08 experiments out of the following:

1. Extensive practices on the design of tractor engine
2. Study hydraulic system, driver seat, place area and control.
3. Study of Fuel supply system of SI engine;
4. Diesel injection system & timing;
5. Cooling system, and fan performance, thermostat and radiator 9 performance evaluation;
6. Study of Part load efficiencies & governing; lubricating system.
7. Study of adjustments; Starting and electrical system; Ignition system;
8. Study of Tractor engine heat balance and engine performance
9. Visit to engine manufacturer/assembler/spare parts agency.
10. Visit to Tractor manufacturer and assembler.

MFM -302 Applied Instrumentation in Farm Machines and Stress Analysis L:T:P 3:0:0

Objective: To acquaint and equip with the concept of instrumentation used in farm power & machinery and measuring devices for force, torque and other parameters.

UNIT I

Basic instrumentation systems and transducer principles. Displacement Transducers Potentiometer, LVDT, Piezoelectric and capacitive transducers. Digital Transducers. Velocity transducers – Analog and Digital

UNIT II

Acceleration and absolute motion measurement. Force transducer _ Strain Gauge, Hydraulic load cell, Cantilever type and Probing ring. Method of separation of force – Torque, Power and Energy measuring techniques.

UNIT III

Temperature measurement using Bi-metals, PTRs, Thermistors, Thermocouples, Electronic IC sensors and Pyrometers. Heat flux measurement. Humidity measurement – Dry and Wet bulb, Hair hygrometer and Humister. Soil and Grain moisture transducers, pressure measurement – Manometers, Bourdon Tube, Diaphragm type transducer. High pressure and vacuum sensing techniques.

UNIT IV

Flow transducers, Positive displacement, venturimeter, Rota meter, Drag force, Ultrasonic, Electromagnetic, Hot wire anemometers. Time and frequency measurement.

UNIT V

Level measurement, OD and pH measurement, PCO2 and grain quality measurement. Biomedical measurement – BP, ECG etc., Ultrasonic flaw detection, Spectroscopy.

Course outcomes:

- To help understand students the basics of Instrumentation, control and automation emphasizing on measurement principles, transducers and their types with applications
- Demonstrate an awareness of the Basic instrumentation systems and transducer principles
- Understand what are the high pressure and vacuum sensing techniques.

- Understand the Flow transducers, Positive displacement, venturimeter, Rota meter and Drag force,
- Demonstrate an awareness of the Level measurement, OD and pH measurement, PCO2 and grain quality measurement. BP, ECG etc.

References:

1. Doebelin EO.1990. Measurement Systems Applications and Design. Tata McGraw Hill.
2. Nakra BC & Chaudhary KK. 2004. Instrumentation Measurement and Analysis. Tata McGraw Hill.
3. Sawhney AK. 2008. Electrical and Electronics Measurement and Instrumentation. Dhanpat Rai & Sons.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM104 I Agro-Energy Audit and Management L:T:P 3:0:0

Objective: To acquaint and equip about the sources of energy, conservation of energy and its management. Energy use scenario in agricultural production system, agro-based industry. Study of energy efficiency, energy planning, forecasting and energy economics.

UNIT I

Energy resources on the farm Direct and indirect energy. conventional and non-conventional forms of energy and their use. Heat equivalents and energy coefficients for different agricultural inputs and products.

UNIT II

Energy audit of production agriculture, and rural living and scope of conservation. Energy use scenario in agricultural production system, agro-based industry.

UNIT III

Identification of energy efficient machinery systems, energy losses and their management. Energy analysis techniques and methods energy balance, output and input ratio, resource utilization, conservation of energy sources.

UNIT IV

Energy conservation planning and practices. Energy forecasting, Energy economics, Energy pricing and incentives for energy conservation, factors effecting energy economics. Energy modelling.

UNIT V

Study of energy efficiency, energy planning, forecasting and energy economics. pattern of energy consumption and their constraints in production of agriculture.

Course outcomes:

- Understand need to differentiate between conventional, non-conventional & renewable energy sources.
- Reason out why the non-conventional energy sources need to be used as replacement to conventional form of energy.

- To know the importance & role of government all over the world to promote use of the renewable energy sources
- Recognizing of energy sources and types of energy used in agricultural production and agro-industry
- Collecting of necessary data for pre-energy audit in an agricultural enterprise or agroindustry 6. Performing of organization and planning of necessary infrastructure studies for establishing of energy management system
- Understanding of relationship between energy consumption and production as for energy efficiency and savings
- Determining of potential of energy efficiency and energy savings

References:

1. Kennedy WJ Jr. & Wayne C Turner.1984. Energy Management. Prentice Hall.
2. CRC Fluck RC & Baird CD.1984. Agricultural Energetics. AVI Publ.
3. Rai GD. 1998. Non-conventional Sources of Energy. Khanna Publ.
4. Twindal JW & Anthony D Wier 1986. Renwable Energy Sources. E & F.N. Spon Ltd.

Website Sources:

- https://ecourses.icar.gov.in/
- www.agrimoon.com

MFM 104 II Machinery for Natural Resources Management and Precision Farming
L:T:P 3:0:0

Objective: To Acquaint and equip with the farm Machinery used for natural recourses management and machinery for precision farming use of GIS and GPS in farm Machinery **:**

UNIT I

Functional design, specifications, requirements and working of farm machinery needed for natural resources management like rotavator, Precision sowing and planting machines, laser guided leveller, power sprayer ,straw chopper cum spreader, straw bailer , combine harvester etc.

UNIT II

Ag GPS parallel swathing option, data base management, functional systems documentation. Application of relevant software.

UNIT III

An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming.

UNIT IV

Engineering fundamentals related to earth moving machinery: Swell, shrinkage and compaction measurements. Use of tractors & Crawlers and effects of altitude & temperature on their performance. Grade resistance and gradability

UNIT V

Land cleaning and reclamation equipment. Land leveling equipment. Power shovels, drag lines, cam shells. Rubber tire for earth moving machinery. Trenching machineries and wagons. Economic analysis of land development machinery. Application of PERT and CPM to the problems related to land development.

Course outcomes:

- Students interested in technology will learn how satellite based guidance systems and other related technologies can be utilized to track and manage agricultural inputs (i.e. seed, fertilizer, fuel) and better manage their farming operation
- Take this knowledge directly to industry working for agricultural consults and manufacturers
- Understanding how to set up an auto guidance system is only a small piece of the puzzle.
- Students master precision agriculture technologies like soil and crop health sensors, yield monitors, GNSS, GIS and mapping, variable rate controllers, and automated guidance.
- Graduates of this program are challenged to understand management and troubleshooting of the entire agricultural system

References:

1. Dutta SK. 1987. Soil conservation and land management. International distributors, Dehradun.
2. Kuhar, John. E. 1977. The precision farmimg guide for agriculturalist. Lori J. Dhabalt, USA.
3. Lille Sand, T and Kaiffer, R. Remote Sensing and Image Interpretation, John Willy and Sons, London.
4. Nichols HL& Day DH.1998. Moving the earth. The work book of excavation. Mcgraw Hill.
5. Peurifoy RL 1956.Construction, planning, equipment and methods. Mcgraw Hill

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MFM 203 I Ergonomics and Safety in Farm Operations L:T:P 3:0:0

Objective: To acquaint and equip with the ergonomic aspects in the design of farm machinery for safety of human beings

UNIT I

Concept and design criteria for optimum mutual adjustment of man and his work Importance of ergonomics and its application in agriculture, liberation and transfer of energy in human body, concept of indirect calorimeter, work physiology in various agricultural tasks.

UNIT II

Physiological stress indices and their methods of measurement Mechanical efficiency of work, fatigue and shift work.

UNIT III

Anthropometry and Biomechanics Anthropometric data and measurement techniques, joint movement and method of measurement, analysis and application of anthropometric data, measurement of physical and mental capacities.

UNIT IV

Human limitations in relation to stresses and demands of working environments. Mechanical environment; noise and vibration and their physiological effects, thermal environment; heat stress, thermal comfort, effect on performance and behavior, field of vision, color discrimination, general guidelines for designing visual display, safety standards at work place during various farm operations and natural hazards on the farm. Farm safety legislation.

UNIT V

Man-machine system concept. Human factors in adjustment of man and his work. Design aspects of foot and hand controls on tractors and farm equipment. Design of operator's seat for tractors and agricultural equipment.

Course outcomes:

- Demonstrate an awareness of the unique attributes involved with farm work and planning for safety on a farm

- Understand the impact of near misses, injuries and fatalities on the farm, including the daily workings, business finances, the wide range of people affected, etc.
- Understand what hazards are, how they manifest, and how they impact business efficiency
- Understand the elements involved in creating a farm safe plan
- Understand how developing a farm safe plan can be valuable tool for business management, risk

References:

1. Bridger R S. 1995. Introduction to Ergonomics. McGraw Hill.
2. Charles D Reese. 2001. Accident / Incident Prevention Techniques. Taylor & Francis.
3. Gavriel Salvendy. 1997. Hand Book of Human Factors and Ergonomics. John Wiley & Sons.
4. Kromer KHE. 2001. Ergonomics. Prentice Hall.
5. Mathews J & Knight AA.1971. Ergonomics in Agricultural Design. National Institute of Agric. Engineering, Wrest Park Silsoe, Bedford.

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MFM 203 II Farm Machinery Dynamics Noise and Vibrations L:T:P 3:0:0

Objective: To acquaint and equip with the theoretical aspects of farm machinery used on the farm

UNIT I

Principles of soil working tools: shares, discs, shovels, sweeps and blades, rota-tillers and puddlers.

UNIT II

Metering of seeds and granular fertilizers with various mechanism, effect of various parameters on distribution of seed and fertilizer in seed cum fertilizer drills and planters, flow of seeds and fertilizers through tubes and boots. Kinematics of transplanters.

UNIT III

Theory of atomization, specific energy for atomization, electrostatic spraying and dusting, spray distribution patterns. Kinematics of reapers/harvesting machines. Theory of mechanical separation of grains from ear heads/pods. Parameters affecting performance of threshers, aerodynamic properties of straw and grain mixture, theory of root crop harvesters, power requirement of various components of field machines.

UNIT IV

Noise and vibration theory- Definition, units and parameters of measurement and their importance. Types of vibrations- free and forced, in damped and without damped analysis of one , two and multiple degree of freedom systems and their solution using Newton's motion, energy method, longitudinal, transverse and torsional vibrations, Raleigh's methods, Lagrange equation.

UNIT V

Introduction of transient vibration in systems, vibration of continuous media. Balancing of single rotating weight and number of weights in same plane and different planes. Complete balancing of reciprocating parts of engine

Course outcomes:

- Demonstrate of all type of soil working tools.

- Understand Metering of seeds and granular fertilizers with various mechanisms & distribution of seed and fertilizer in seed cum fertilizer drills and planters etc.
- Understand Theory of atomization, specific energy for atomization, electrostatic spraying and dusting, spray distribution patterns. Kinematics of reapers/harvesting machines
- Understand the theory of root crop harvesters, power requirement of various components of field machines.

References:

1. Ballaney P L. 1974. Theory of Machines. Khanna Publ.
2. Harris C M & Crede CE. 1976. Shock and Vibration Hand Book. McGraw Hill.
3. Holowenko AR. 1967. Dynamics of Machinery. McGraw Hill. Kelly SG. 2000. Fundamental of Mechanical Vibration. 2nd Ed. McGraw Hill.

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MFM 303 I Energy Conservation and Management in Farm Power and Machinery L:T:P 3:0:0

Objective: To acquaint and equip with the energy use pattern in agriculture production systems, conservation of energy, energy planning and economics.

UNIT I

Energy requirement of different operations in agricultural production systems viz. crop, livestock and aquaculture.

UNIT II

Energy conservation through proper management and maintenance of farm machinery, planning and management of agricultural production systems for energy conservation and energy returns assessment.

UNIT III

Development of computer program for efficient energy management in a given agricultural production system. Energy use planning and forecasting for a given system.

UNIT IV

Computer aided design and its application in agricultural tractors. IC engine fuels - their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines,

UNIT V

Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types & study of their properties.

Course outcomes:

- Determine what farm practices use the most energy for producing a crop.
- Describe farm equipment options for reducing energy use.
- Describe management options for reducing energy use

References:

1. Mittal J P, Panesar BS, Singh S, Singh CP & Mannan K D. 1987. Energy in agriculture

2. Production Agriculture and Food Processing. ISAE and School of Energy Studies, Ludhiana. ISAE Publ.
3. Pimental D. 1980. Handbook of Energy Utilization in Agriculture. CRC Press.

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MFM 303 II Designs and Analysis of Renewable Energy Conversion Systems L:T:P 3:0:0

Objective: To acquaint and equip with the conventional and non-conventional energy sources. Energy from biomass, conversion of energy from biomass. Development of biogas and biofuels.

UNIT I

Energy cycle of the earth; water flow and storage; ocean currents and tides. Energy heat flow and energy storage; photosynthesis and biomass; renewable energy sources.

UNIT II

Thermodynamics of energy conversion; conversion of solar energy, wind energy, water flows, heat, biomass, etc.; other conversion processes.

UNIT III

Development and use of biogas, alcohols and plant oils, plant oil esters in I.C.engines. Study of various parameters for measuring the performance of the output.

UNIT IV

Design of bio-fuel production units: design of gasifiers, gas flow rates, bio-gasplants. Establishment of esterification plant, fuel blending.

UNIT V

Exhaustible and inexhaustible energy sources. Commercial, non commercial energy

Course outcomes:

On completion of this course, the students will be able to

- Learn about the Indian and World Energy Scenario and world energy use resources, Energy cycle on earth etc
- Understand the types of energy, energy storage and energy conversion systems.
- Development and use of biogas, alcohols and plant oils, plant oil esters in I.C.engines.
- Design of bio-fuel production units
- Learn about the Exhaustible and inexhaustible energy sources. Commercial and non commercial energy

References:

1. Boyle Godfrey. 1996. Renewable Energy: Power for Sustainable Future. Oxford Univ. Press.
2. Culp AW. 1991. Principles of Energy Conservation. Tata McGraw Hill.
3. Duffle J A & Beckman WA. 1991. Solar Engineering of Thermal Processes. John Wiley.
4. Garg H P & Prakash J.1997. Solar Energy - Fundamental and Application. Tata McGrawHill.
5. Grewal N S, Ahluwalia S, Singh S & Singh G. 1997. Hand Book of Biogas Technology
6. Rai GD. 1998. Non-conventional Sources of Energy. Khanna Publ.

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