Name of Course : Design of Farm Power and Machinery Systems

Dept. Course No : TMP - 522

Credit Hours : 3 (2-1-1)

I. SYLLABUS

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. Analytical design considerations of linkages/ components in farm machinery and its application. Design of selected farm equipments: - tillage, seeding, planting, interculture, plant protection, harvesting and threshing. Design of rotary, vibrating and oscillating machines. Design and selection of matching power unit. Safety devices for tractors & farm implements.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Modern trends, principles, procedures, fundamentals and economic considerations for design and development of farm power and machinery systems. Factors affecting the farm machinery design.	1-2
2.	Analytical design considerations of linkages/ components in farm machinery and its application. Types of links, kinematics pairs and their classifications, kinematics chain, its joints and mechanisms. Application of plane and four bar mechanism.	3-5
3.	Design considerations, procedure and their applications in agricultural tractors & typical machines such as ploughs, harrows and cultivators	6-9
4.	Reliability criteria in design and its application	10
5.	Design of mould board plough, theoretical furrow slice inversion, design of frontal plan. Considerations and procedure of designing cylindrical, cylindroidal, semi helical and helical type mould board bottom, standard dimension of shares and land side.	11-14
6.	Disc implement and their design consideration, design of disc for different disc tools, spacing of disc in multi-disc tools. Force analysis of vertical and inclined disc. Determination of load for standard design and bearing selection.	15-17
7.	Cultivators and their application, design of soil engaging tools and shank.	18-19
8.	Introduction of rotary equipment and their types, kinematics of working elements, speed and angle of cutting, analysis of forces of cutting soil slices, arrangement of working elements, specific works of rotary machine, specific and dynamic forces. Calculation of rotary machines in reference to main parameters.	20-22

9.	Design parameters of sowing and planting equipment, design of seed metering mechanism, design consideration of seed and fertilizer box and frame, design of seed metering mechanism of planters. Fertilizers handling equipment and their design consideration. Design of centrifugal broad caster.	23-25
10.	Design consideration of threshing and harvesting equipment in reference to types of cylinder and safety measure.	26-27
11.	Design and selection of matching power unit. Safety devices for tractors & farm implements.	28
	Pre-Final Exam	**2**
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	To compare engine and system design specifications in agricultural tractors	1-2
2.	To study three point linkages and different hitch systems of a tractor	3-4
3.	To study working of tractors PTO operated equipment	5
4.	To study graphical representation of different tillage implements: mould board plough, disc Plough, cultivator and rotary implement	6-8
5.	To study the mechanisms of seeding and planting equipment for seed metering, seed placement and power transmission	9-10
6.	To study working principle of manually and power operated plant protection equipment	11
7.	To study design considerations in different inter culture and weed control equipment	12
8.	To compare design criteria for different harvesting machines	13
9.	To compare design considerations in different types of power threshers	14-15
	Lab. Final Exam	01
	TOTAL	**16**

References

1. Arther W Judge 1967. *High Speed Diesel Engines.* Chapman & Hall.
2. Barger EL, Liljedahl JB & McKibben EC 1967. *Tractors and their Power Units.* Wiley Eastern.
3. Bernacki C, Haman J & Kanafajski CZ.1972. *Agricultural Machines* Oxford & IBH.
4. Bindra OS & Singh Harcharan 1971. *Pesticides Application Equipments.* Oxford & IBH.
5. Bosoi ES, Verniaev OV & Sultan-Shakh EG. 1990. *Theory, Construction and Calculations of Agricultural Machinery* Vol. I. Oxonian Press.
6. Klenin NI, Popov IF & Sakoon VA. 1987. *Agricultural Machines. Theory of Operations. Computing and Controlling Parameters and the Condition of Operation.* Amrind Publ.
7. Lal R & Dutra AC. 1979. *Agricultural Engineering* (through solved examples). Saroj Parkashan.

8. Maleev VL. 1945. *Internal Combustion Engines.* McGraw Hill.
9. Mathur ML & Sharma RP. 1988. *A Course in Internal Combustion Engines.* Dhanpat Rai & Sons.
10. Ralph Alcock.1986. *Tractor Implements System.* AVI Publ.
11. Raymond N, Yong Ezzat A & Nicolas Skiadas 1984. *Vehicle Traction Mechanics.* Elsevier.
12. Sharma PC & Aggarwal DK. 1989. *A Text Book of Machine Design.* Katson Publishing House.
13. *Theory and Construction.* Vol. 1. U.S. Dept. of Commerce, National Technical Information Service, Springfield, Virginia.
14. Thornhill EW & Matthews GA. 1995. *Pesticide Application Equipment for Use in Agriculture.* Vol. II. *Mechanically Powered Equipment.* FAO Rome.
15. William. R Gill & Glen E Vanden Berg. 1968. *Soil Dynamics in Tillage and Traction.* US Govt. Printing Office, Washington, D.C.
16. Yatsuk EP.1981. *Rotary Soil Working Machines Construction, Calculation and Design.* American Publ.Co.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Design of Farm Power and Machinery Systems
	b) Number of course	TMP - 522
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech students of FMPE
6.	Credits	3 (2-1-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students about the Design of Farm Power and Machinery Systems.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course	**:**	**Soil Dynamics in Tillage and Traction**
Dept. Course No	**:**	**TMP - 666**
Credit Hours	**:**	**3 (2-1-1)**

I. SYLLABUS

Dynamic properties of soil and their measurement, stress-strain relationships, theory of soil failure. Mechanics of tillage tools and geometry of soil tool system, design parameters and performance of tillage tools. 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. 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, design of traction and transport devices. Soil compaction by agricultural vehicles and machines.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Dynamic properties of soil: Cohesion, adhesion, soil/soil and soil/metal friction. Shear strength of soil, construction of Mohr's circle diagram, laboratory methods of determining shear strength of soil using translational shear box and tri-axial shear test apparatus.	**1-3**
2.	Theory of soil failure: Boundary stress and strain-conditions, Mohr-coulomb criteria of soil failure, Relationship between the principle stresses, cohesion and angle of shearing resistance at the point of incipient soil failure.	**4-7**
3.	Mechanics of tillage tools and geometry of soil tool system, design parameters and performance of tillage tools. Dimensional analysis of different variables related to soil-tyre system; soil vehicle models.	**8-11**
4.	Mechanics of steering of farm tractor; Selection of pneumatic tyres for different operations, effect of tyre design parameters on traction, special problems of wet land traction and floatation.	**12-15**
5.	Introduction of traction devices, tyres-types, function & size, their selection; mechanics of traction devices.	**16-18**
6.	Deflection between traction devices and soil, slippage and sinkage of wheels.	**19-20**
7.	Evaluation and prediction of traction performance.	**21-22**
8.	Factors affecting traction, traction theory Design of traction and	**23-25**

	transport devices.	
9.	Soil compaction by agricultural vehicles and machines: Soil physical properties associated with compaction-their expression and measurement; dry bulk density, porosity, permeability and diffusivity, cone index, shear strength, surface bearing strength, clod and aggregate characteristics etc. Wheel parameters associated with compaction and their measurement.	**26-28**
	Pre-Final Exam	**2**
	TOTAL	**30**

B. Practical

Sl. No.	**Topics**	**No. of Lab.**
1.	Determination of soil moisture, bulk density, cone index and other soil parameters.	1
2.	Direct and Triaxial shear test for measurement of soil strength	2-3
3.	Determination of atternberg limits and analysis of field soils	4-5
4.	Determination of clod mean-weight diameter and pulverization modulus of soil in a seedbed	6-7
5.	Mohr- circle	8
6.	To study different traction aids	9-10
7.	To study mechanics of soil failure under powered wheels	11-12
8.	To study traction through single, dual and tandem wheels	13-14
9.	Determination of wheel slippage under different conditions	15
10.	**Lab. Final Exam**	1
	TOTAL	**16**

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.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Soil Dynamics in Tillage and Traction
	b) Number of course	TMP - 666
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech students of FMPE
6.	Credits	3 (2-0-1)
7.	Is this is a new course	No
8.	Curricular purpose of the course	To acquaint the students about the Soil Dynamics in Tillage and Traction.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course : TRACTOR DESIGN

Dept. Course No : TMP - 526

Credit Hour : 3 (2-1-1)

I. SYLLABUS

Technical specifications of tractors available in India, modern trends in tractor design and development, special design features of tractors in relation to Indian agriculture. Parameters affecting design of tractor engine and their selection, Design of fuel efficient engine components and tractor systems like transmission, steering, front suspension, hydraulic system & hitching, chassis, driver's seat, work-place area and controls. Tire selection, Mechanics of tractor, Computer aided design and its application in agricultural tractors.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lecture
1.	Technical specification of various makes of tractors available in India	1-2
2.	Modern trends in tractor design and developments	3-4
3.	Special design features of indigenous tractors	5
4.	Parameters affecting design of tractor engine and their selection criterion	6
5.	Design of fuel efficient engine components : piston, piston ring, piston pin, connecting rod, crankshaft	7-10
6.	Design of transmission system : gear box and its arrangement, differential, final drive, speed selection for tractor, planetary gear drive	11-13
7.	Design of steering : various types of steerings, steering geometry and their design criterion, kinematics of tractor steering, tractor chasis, tractor stability	14-16
8.	Design of hydraulic system : types of hydraulic system, common type of hydraulic system used in Indian tractor and their components, types of hitches, three-point hitch system	17-19
9.	Driver's seat, work-place area and tractor controls	20-21
10.	Tractor tires- types of tires, tire nomenclature, ply rating and load bearing capacity, selection of tractor tires	22
11.	Mechanics of tractor – Forces acting on tractor body, stability of tractor, weight transfer	23-25
12.	Computer aided design and its application in designing various components of a tractor	26-28
	Pre-Final Exam	2
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	To study design features of special and general purpose tractors.	1-2
2.	To study design features of tractor engine w.r.t. to automobile engines.	3
3.	To study modern fuel injection system as used in tractors and I.C. engines.	4
4.	To study design features of piston, piston rings, connecting rod and crankshaft of different tractor sizes.	5
5.	To study design features of single, dual and multiplate clutch systems.	6
6.	To study different types of gears transmission system used in tractors.	7
7.	To study working of a fluid coupling and torque converter.	8
8.	To study a planatery gear system and its application in agricultural tractor.	9
9.	To study different steering mechanism and their geometry.	10
10.	To study working of different types of valves, cylinders and other controls in tractor hydraulic system.	11-12
11.	To study position and draft control using tractor implement combination in a field.	13
12.	To study ROPS and safety signs for a tractor.	14
	Lab final	1
	TOTAL	**15**

References

1. Arther W Judge 1967. *High Speed Diesel Engines.* Chapman & Hall.
2. Barger EL, Liljedahl JB & McKibben EC. 1967. *Tractors and their Power Units.* Wiley Eastern.
3. Macmillan RH. *The Mechanics of Tractor - Implement Performance. Theory and Worked Example.* University of Melbourne.
4. Maleev VL. 1945. *Internal Combustion Engines.* McGraw Hill.
5. Ralph Alcock 1986. *Tractor Implements System.* AVI Publ. Co.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and Power Engineering
3.	a) Title of the course	Tractor Design
	b) Number of course	TMP - 526
	c) Pre-requisite	Nil
4.	Catalogue description	Attached
5.	To be offered	M. Tech. student of FMPE
6.	Credits	3 (2-1-1)
7.	Is this is a new course	No, Modified as per recommendations of IVth Dean's committee
8.	Curricular purpose of the course	To acquaint the students about the various distinct features of a tractor, their designing and selection criterion.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Modified as per the recent needs
10.	Relation to other courses	
	a) Pre-requisite	Nil
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	Yes
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	No
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	Already offered but modified as per the recommendations of 4th Dean's committee
12.	Is the course intended to replace an existing course or courses	No
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of M. Tech. Agril. Engg. (Farm Machinery and Power Engineering
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the department
20.	Prepared/ modified by	Dr. T. P. Singh
21.	Approved by	Course Curriculum Committee

Name of Course : Agro-Energy Audit and Management

Dept. Course No : TMP - 642

Credit Hours : 3 (2-1-0)

I. SYLLABUS

Energy resources on the farm: conventional and non-conventional forms of energy and their use. Heat equivalents and energy coefficients for different agricultural inputs and products. Pattern of energy consumption and their constraints in production of agriculture. Direct and indirect energy. Energy audit of production agriculture, and rural living and scope of conservation. 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. Energy conservation planning and practices. Energy forecasting, Energy economics, Energy pricing and incentives for energy conservation, factors effecting energy economics. Energy modelling.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Energy resources on the farm: conventional and non-conventional forms of energy and their use Direct and indirect energy	2
2.	Heat equivalents and energy coefficients for different agricultural inputs and products	3
3.	Pattern of energy consumption and their constraints in production of agriculture.	2
4.	Energy audit of production agriculture, and rural living and scope of conservation	4
5.	Identification of energy efficient machinery systems, energy losses and their management	3
6.	Energy analysis techniques and methods: energy balance, output and input ratio, resource utilization, conservation of energy sources	4
7.	Energy conservation planning and practices	2
8.	Energy forecasting	2
9.	Energy economics, factors effecting energy economics	2
10.	Energy pricing and incentives for energy conservation	2
11.	Energy modeling	2
	Pre-Final Exam	2
	TOTAL	**32**

References

1. Kennedy WJ Jr. & Wayne C Turner. 1984. *Energy Management.* Prentice Hall.
2. Pimental D. 1980. *Handbook of Energy Utilization in Agriculture.* CRC Fluck RC & Baird CD.1984. *Agricultural Energetics.* A VI Publ.
3. Rai G.D. 1998. *Non-conventional Sources of Energy.* Khanna Publ.
4. Twindal JW & Anthony 0 Wier 1986. *Renwable Energy Sources.* E & F.N. Spon Ltd.
5. Verma SR, Mittal JP & Surendra Singh 1994. *Energy Management and Conservation in Agricultural Production and Food Processing.* USG Publ. & Distr., Ludhiana.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery & Power Engineering
3.	a) Title of the course	Agro-Energy Audit and Management
	b) Number of course	TMP 642
	c) Pre-requisite	Nil
4.	Catalogue description	Attached
5.	To be offered	M.Tech. Student of FMPE
6.	Credits	3 (2-1-0)
7.	Is this is a new course	No Modified as per the recommendations of IV Dean's Committee
8.	Curricular purpose of the course	To acquaint the students about Agro-Energy Audit and Management
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Modified as per ICAR guidelines recent needs
10.	Relation to other courses	
	a) Pre-requisite	Nil
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	Yes
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	No
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	Already being offered but modified as per the recommendations
12.	Is the course intended to replace an existing course or courses	Yes
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of M. Tech. in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached with course outline
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Content of course discussed in the Department

20.	Prepared/ modified by	Dr. R.P. Singh
21.	Approved by	Course Curriculum Committee

Name of course : **Applied Instrumentation in Farm Machinery and Stress Analysis**

Dept. Course No : **TMP - 604**

Credit Hours : **3 (2-0-1)**

I. SYLLABUS

Strain and stress, strain relationship, strain gauges. Mechanical, optical, electrical acoustical and pneumatic etc. and their use. Various methods of. determining strain/stresses experimentally. Measuring devices for displacement (linear and rotational), velocity, force, torque and shaft power. Strain gauges: types and their application in two and three dimensional force measurement. Design and analysis of strain gauges. Introduction to functional elements of instruments. Active and passive transducers, Analog and digital modes, Null and deflection methods. Performance characteristics of instruments including static and dynamic characteristics. Devices for measurement of temperature, relative humidity, pressure, sound, vibration, flow etc. Recording devices and their type. Measuring instruments for calorific value of solid, liquid, and gaseous fuels. Measurement of gas composition using GLC. Basic signal conditioning devices - data acquisition system - micro computers for measurement and data acquisition. Data storage and their application.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Introduction about the applied instrumentation in farm machinery and their stress analysis, Strain and stress, strain relationship.	1-2
2.	strain gauges. Mechanical, optical, electrical acoustical and pneumatic etc. and their use. Various methods of. determining strain/stresses experimentally.	3-5
3.	Measuring devices for displacement (linear and rotational), velocity, force, torque and shaft power	6-9
4.	Strain gauges: types and their application in two and three dimensional force measurement	10
5.	Design and analysis of strain gauges. Introduction to functional elements of instruments. Active and passive transducers	11-14
6.	Analog and digital modes, Null and deflection methods	15-17
7.	Performance characteristics of instruments including static and dynamic characteristics	18-19
8.	Devices for measurement of temperature, relative humidity, pressure, sound, vibration, flow etc	20-22
9.	Recording devices and their type. Measuring instruments for calorific value of solid, liquid, and gaseous fuels	23-25
10.	Measurement of gas composition using GLC Basic signal conditioning devices - data acquisition system - micro computers	26-27

	for measurement and data acquisition.	

11.	Data storage and their application	28
	Pre-Final Exam	**2**
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1	Familiarization with static and dynamic characteristics of measuring devices	1
2	Identification of different strain gauges and strain measuring devices	2-3
3	To study straingage based load, force and torque sensors	4-5
4	To study measurement of velocity, displacement and acceleration	6-7
5	To study noise and vibration in tractors and power operated agricultural equipment and their control.	8
6	To study different types of sensors for measurement of temperature, pressure, relative humidity, flow of fluids etc.	9-10
7	To analyze constituents of exhaust gases of IC engines	11
8	To study equipment for determining the colorific value of solid, liquid and gaseous fuels	12-13
9	To familiarize with the data acquisition and storage systems	14
	Lab final	1
	TOTAL	**15**

References

1. Ambrosius EE. 1966. *Mechanical Measurement and Instruments.* The Ronald Press.
2. BeckwithTG. 1996. *Mechanical Measurements.* Addison- Wesley.
3. Doeblin EO. 1966. *Measurement System - Application and Design.* McGraw Hill.
4. Ernest O Doebelin. 1995. *Measurement Systems - Application and Design.* McGraw Hill.
5. Holman P 1996. *Experimental Methods for Engineers.* McGraw Hill.
6. Nachtigal CL. 1990. *Instrumentation and Control. Fundamentals and Application.* John Wiley & Sons.
7. Oliver F J. 1971. Practical; Instrumentation Transducers. Hayden Book Co.
8. Perry CC & Lissner HR.1962. *The Strain Gauge Primer.* McGraw Hill.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Applied Instrumentation in Farm Machinery and Stress Analysis
	b) Number of course	TMP - 604
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech students of FMPE
6.	Credits	3 (2-0-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students about the Applied Instrumentation in Farm Machinery and Stress Analysis .
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course : Testing and Evaluation of Tractors and Farm Equipment

Dept. Course No : TMP - 622

Credit Hours : 2 (1-0-1)

I. SYLLABUS

Types of tests; test procedure, national and international codes. Test equipment; usage and limitations. Power losses in dynamometers and hydraulic test equipment. Prototype feasibility testing and field evaluation. Laboratory and field testing of selected farm equipment. Non-destructive testing techniques. Tractor performance testing, evaluation and interpretation of results. Review and interpretation of test reports. Case studies.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Importance of testing, concept, biasness and unbiasness in testing. Difference between testing and evaluation.	**1**
2.	Different types of test codes such as Nabraska, RNAM and BIS etc. used for testing of agricultural implements.	**2**
3.	Types of tests; test procedure, national and international codes	**3**
4.	Test equipment; usage and limitations. Different types of dynamometers and their uses, power losses in dynamometers and hydraulic test equipment	**4-5**
5.	Prototype feasibility testing and field evaluation	**6**
6.	Laboratory and field testing of selected primary tillage equipment	**7-8**
7.	Laboratory and field testing of selected sowing equipment	**9-10**
8.	Laboratory and field testing of selected inter culture equipment	**11-12**
9.	Laboratory and field testing of selected harvesting and threshing equipment	**13-14**
10.	Non-destructive testing techniques. Tractor performance testing, evaluation and interpretation of results.	**15-16**
11.	Review and interpretation of test reports. Case studies.	**17**
	Pre-Final Exam	**1**
	TOTAL	**18**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	To determine specification of a given tractor and measure its different dimensions	**1**
2.	To find out the visibility from drivers seat of a given tractor	**1**
3.	To find out the turning space and turning circle of a given tractor	**1**
4.	Measurement of wheel slip of a tractor	**1**
5.	Tractor drawbar test at variable loads	**1**
6.	To conduct field test of a mouldboards plough	**1**
7.	To measure width covered by different types of harrow and verify it by the theoretical relationship	**1**
8.	To measure hardness, disc angle, gang angle, eccentricity etc. of disc tools	**1**
9.	To perform testing of a ferti-seed drill	**1**
10.	To perform testing of a given hand and power operated sprayers	**1**
11.	To perform the testing of a given hand and power operated sprayers	**1**
12.	To perform testing of a given hand/power operated duster	**1**
13.	To perform testing of a power thresher	**1**
14.	To perform testing of a combine harvester	**1**
	Lab. Final Exam	**1**
	TOTAL	**15**

References

1. Anonymous. 1983. *RNAM Test Code & Procedures for Farm Machinery.* Technical Series 12.
2. Barger EL, Liljedahl JB & McKibben EC. 1967. *Tractors and their Power Units.* Wiley Eastern.
3. *Indian Standard Codes for Agril. Implements.* Published by ISl, New Delhi.
4. Inns FM. 1986. *Selection, Testing and Evaluation of Agricultural Machines and Equipment.* F AO Service Bull. No. 115.
5. Lal R & Dutta Pc. 1979. *Agricultural Engineering* (through solve examples). Saroj Parkashan,
6. Metha ML, Verma SR, Mishra SK & Sharma VK. 1995. *Testing and Evaluation of Agricultural Machinery.* National Agricultural Technology Information Centre, Ludhiana.
7. Nebraska Tractor Test Code for Testing Tractor, Nebraska, USA.
8. Smith DW, Sims BG & O'Neill D H. 2001. *Testing and Evaluation of Agricultural Machinery and Equipment - Principle and Practice.* FAO Agricultural Services Bull. 110.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	**Testing and Evaluation of Tractors and Farm Equipment**
	b) Number of course	TMP - 622
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech students of FMPE
6.	Credits	2 (1-0-1)
7.	Is this is a new course	No
8.	Curricular purpose of the course	To acquaint the students about the **Testing and Evaluation of Tractors and Farm Equipment.**
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course : Ergonomics and Safety in Farm Operations

Dept. Course No : TMP - 636

Credit Hours : 2 (1-0-1)

References

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

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	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.	**1-2**
2.	Concept of indirect calorimeter, work physiology in various agricultural tasks.	**3-4**
3.	Physiological stress indices and their methods of measurement: Mechanical efficiency of work, fatigue and shift work.	**5-7**
4.	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.	**8-9**
5.	Human limitations in relation to stresses and demands of working environments.	**10**
6.	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	**11-12**
7.	Safety standards at work place during various farm operations and natural hazards on the farm.	**13**
8.	Farm safety legislation. Man-machine system concept. Human factors in adjustment of man and his work	**14**

9.	Design aspects of foot and hand controls on tractors and farm equipment.	**15**
10.	Design of operator's seat for tractors and agricultural equipment. Operator's seat and cabs for agricultural equipment : Operating task analysis, work-space envelope, science of seating dimensioning set, cushion functional requirement static and dynamic compatibility of operator-seat-machine.	**16**
	Pre-Final Exam	**2**
	TOTAL	**18**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	Measurement and analysis of anthropometric data of subjects and determination of different anthropometric-indices	1-2
2.	To study physiological response of humans at different work loads and speeds.	3-4
3.	To study controls of tractors, and power tillers of various sizes	5-7
4.	To study ergonomic design considerations of tractor operator seat	8
5.	To study ergonomic considerations of hand tools and implements	9-10
6.	To study ergonomic considerations in yokes, harnesses and animal drawn implements	11
7.	Identification of the common machine hazards and their remedial measures	12
8.	To study different types of safety devices in agricultural equipment	13
9.	To study different types safety signs in agricultural prime movers and implements.	14
10.	Lab. Final	1
	TOTAL	**15**

References

1. Bridger RS. 1995. *Introduction to Ergonomics.* McGraw Hill.
2. Charles D Reese. 200 I. *Accident /lncident Prevention Techniques.* Taylor & Francis.
3. Gavriel Salvendy. 1997. *Hand Book of Human Factors and Ergonomics.* Jhon Wiley & Sons.
4. Kromer KHE. 2001. *Ergonomics.* Prentice Hall.
5. Mathews 1 & Knight AA.1971. *Ergonomics in Agricultural Design.* National Institute of Agric. Engineering, Wrest Park Silsoe, Bedford.

6. Mathews J. Sanders, Cormicks MS & MCEj. 1976. *Human Factors in Engineering and Design.* 4th Ed. McGraw Hill.
7. William D McArdle. 1991. *Exercise Physiology.* 1991. Lea & Febiger.
8. Zander J. 1972. *Principles of Ergonomics.* Elsevier.
9. Zander J.1972. *Ergonomics in Machine Design.* Elsevier.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Ergonomics and Safety in Farm Operations
	b) Number of course	TMP - 636
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech & Ph.D. students of FMPE
6.	Credits	2 (1-0-1)
7.	Is this is a new course	No
8.	Curricular purpose of the course	To acquaint the students about the Ergonomics and Safety in Farm Operations.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	No
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course : **Design and Analysis of Renewable Energy Conversion Systems**

Dept. Course No : **TMP - 646**

Credit Hours : **3 (2-0-1)**

I. SYLLABUS

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. Thermodynamics of energy conversion; conversion of solar energy, wind energy, water flows, heat, biomass, etc.; other conversion processes.' 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. Design of bio-fuel production units: design of gasifiers, gas flow rates, biogas plants. Establishment of esterification plant, fuel blending.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Energy cycle of the earth; water flow and storage	2
2.	Ocean currents and tides	1
3.	Energy heat flow and energy storage	2
4.	Photosynthesis and biomass	2
5.	Renewable energy sources	4
6.	Thermodynamics of energy conversion, conversion of solar energy, wind energy, water flows, heat, biomass, etc.; other conversion processes	4
7.	Development and use of biogas, alcohols and plant oils, plant oil esters in I.C. engines.	6
8.	Study of various parameters for measuring the performance of an engine.	2
9.	Design of bio-fuel production units: design of gasifiers, gas flow rates, biogas plants	5
10.	Establishment of esterification plant, fuel blending.	2
	Pre-Final Exam	2
	TOTAL	**32**

B. Practical

Sl. No.	Topics	No. of Lab.
1	To study working of different designs of biogas plant	1
2	To determine TS, VS, COD, BOD, ash content etc of different biomass and organic wastes	3
3	To study trans esterification process for production of bio diesel	1
4	To determine fuel properties of bio diesel	3
5	To study working of solar thermal gadgets	1
6	To study solar photovoltaic systems and their application in agriculture	1
7	To analyze design considerations in a modern wind mill	1
8	To study performance of an I.C. engine on different alternate fuels	2
9	To study working of different type of gasifiers	1
	Lab Final	1
	TOTAL	**15**

References

1. Boyle Godfrey. 1996. *Renewable Energy Power for Sustainable Future.* Oxford Univ. Press.
2. Culp A W. 1991. *Principles of Energy Conservation.* Tata McGraw Hill.
3. Duffle JA & Beckman WA. 1991. *Solar Engineering of Thermal Processes.* John Wiley.
4. Garg HP & Prakash J .1997. *Solar· Energy - Fundamental and Application.* Tata McGraw Hill.
5. Grewal NS, Ahluwalia S, Singh S & Singh G. 1997. *Hand Book of Biogas Technology. Solar Energy Fundamentals and Applications.* TMH New Delhi.
6. Mittal KM. 1985. *Biomass Systems Principles & Applications.* New Age International.
7. Odum HT & Odum EC. 1976. *Energy Basis for Man and Nature.* Tata McGraw Hill.
8. Rao SS & Parulekar BB.1999.· *Non-conventional, Renewable and Conventional.* Khanna Publ.
9. Sukhatme SP.1997. *Solar Energy - Principles of Thermal Collection and Storage.* 2nd Ed. Tata McGraw Hill.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery & Power Engineering
3.	a) Title of the course	Design and Analysis of Renewable Energy Conversion Systems
	b) Number of course	TMP 646
	c) Pre-requisite	Nil
4.	Catalogue description	Attached
5.	To be offered	
6.	Credits	3 (2-0-1)
7.	Is this is a new course	No. modified as per recommendations of IVth Dean's Committee
8.	Curricular purpose of the course	To acquaint the students about Design and Analysis of Renewable Energy Conversion Systems
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Modified as per ICAR guidelines recent needs
10.	Relation to other courses	
	a) Pre-requisite	Nil
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of field knowledge represented by the Department	Yes
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	No
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	Already being offered but modified as per the recommendations
12.	Is the course intended to replace an existing course or courses	Yes
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of M.Tech in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached with course outline
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Content of course discussed in the Department
20.	Prepared/ modified by	Dr.R.P.Singh
21.	Approved by	

Name of Course : Farm Machinery Dynamics, Noise & Vibrations

Dept. Course No : TMP-712

Credit Hours : 3 (2-1-1)

I. SYLLABUS

Principles of soil working tools: shares, discs, shovels, sweeps and blades, rota-tillers and puddlers. 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. 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 harvester, power requirement of various components of field machines. 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. 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.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Introduction to Farm Machinery system, links, mechanisms and their application in agricultural machines.	1-2
2.	Principles of soil working tools: shares, discs, shovels, sweeps and blades, rota-tillers and puddlers	3-5
3.	Metering of seeds and granular fertilizers with various mechanism.	6-7
4.	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.	8-10
5.	Kinematics of transplanters. Kinematics of reapers/harvesting machines.	11-14
6.	Theory of atomization, specific energy for atomization, electrostatic spraying and dusting, spray distribution patterns.	15-17
7.	Theory of mechanical separation of grains from ear heads/pods.	18-19
8.	Parameters affecting performance of threshers.	20-22
9.	Noise and vibration theory – Definition, units and parameters of measurement and their importance.	23-24

10.	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.	25-26
11.	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.	27
12.	Complete balancing of reciprocating parts of engine.	**28**
	Pre-Final Exam	**2**
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	To study analysis of forces on a soil working tool in a soil bin	1-3
2.	To study different mechanism used in seeding and planting equipment	4-5
3.	To study different mechanism in fertilizer application equipment	6
4.	To study kinematics of mechanism as used in transplanting equipment	7-9
5.	To study working of power sprayers and atomizers	10-11
6.	To measure noise level in different agricultural equipment and identification of their source	12-13
7.	To study modes of horizontal and vertical vibration and their measurement	14
8.	To study balancing of cylinders, drums etc. in power operated agricultural equipments	15
9.	**Lab. Final**	1
	TOTAL	**16**

References

1. Ballaney PL. 1974. *Theory of Machines.* Khanna Publ.
2. Bosoi ESO, Verniaev V, Smirnov & Sultan-Shakh EG. 1990. *Theory, Construction and Calculations of Agricultural Machinery.* Vol. I. Oxonian Press Pvt. Ltd. No.56.
3. Getzlaff GE. 1993. *Comparative Studies on Standard Plough Body. Engineering Principles of Agricultural Machines.* ASAE Text Book No.6.
4. Grover GK. 1996. *Mechanical Vibrations.* New Chand & Bros., Roorkee.
5. Harris CM & Crede CEo 1976. *Shock and Vibration Hand Book.* McGraw Hill.

6. Holowenko AR. 1967. *Dynamics of Machinery.* McGraw Hill.
7. Kelly SG. 2000. *Fundamental of Mechanical Vibration.* 2nd Ed. McGraw Hill.
8. Kepner RA, Bainer R & Berger EL. 1978. *Principles of Farm Machinery.* AVI Pub I. Co.
9. Klenin NI, Popov IF & Salmon VA. 1987. *Agricultural Machines Theory of Operations, Computing and Controlling Parameters and the Condition of Operation.* Amrind Publ. Co.
10. Marples. 1969. *Dynamics of Machines.* McGraw Hill.
11. Meirovitch L. 1986. *Elements of Vibration Analysis.* 2nd Ed. McGraw Hill.
12. Nartov PS. 1985. *Disc Soil Working Implements.* A. Balkema, Rotterdam
13. Srivastav AC. 2001. *Elements of Farm Machinery.* Oxford & IBH.
14. Steidal. 1986. *Introduction to Mechanical Vibrations.* Wiley International & ELBS Ed.
15. William T Thomson. 1993. *Theory of Vibration with Application.* Prentice Hall.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Farm Machinery Dynamics, Noise & Vibrations
	b) Number of course	TMP – 712
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech. & Ph.D. students of FMPE
6.	Credits	3 (2-1-1)
7.	Is this is a new course	No
8.	Curricular purpose of the course	To acquaint the students about the Farm Machinery Dynamics, Noise & Vibrations.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of Ph. D. in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. T.K. Bhattacharya
21.	Approved by	Course Curriculum Committee

Name of Course : **Machinery for Natural Resource Management and Precision Farming**

Dept. Course No : **TMP- 711**

Credit Hours : **3(2-1-1)**

I. SYLLABUS

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

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	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.	1-6
2.	Ag GPS parallel swathing option, data base management, functional systems documentation. Application of relevant software.	7-8
3.	An introduction to precision farming. GIS/GPS positioning system for precision farming, yield monitoring and mapping, soil sampling and analysis.	10-12
4.	Computers and Geographic information systems.	13-14
5.	Precision farming- Issues and conditions.	15
6.	Role of electronics in farm machinery for precision farming.	16
7.	Engineering fundamentals related to earth moving machinery: swell, shrinkage and compaction measurements.	17-18
8.	Use of tractors & Crawlers and effects of altitude & temperature on their performance. Grade resistance and gradability.	19-20
9.	Land cleaning and reclamation equipment. Land leveling equipment.	21

10.	Working of Power shovels, drag lines, cam shells.	22-23
11.	Types of Rubber tires for earth moving machinery.	24
12.	Trenching machineries and wagons.	25
13.	Economic analysis of land development machinery.	26
14.	Application of PERT and CPM to the problems related to land development.	27-28
	Pre-Final Exam	2
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1.	Familiarization with different conservation equipment used in production agriculture.	1-2
2.	To study management practices using conventional and precision tillage machineries	3-4
3.	To study management practices using conventional and precision sowing and planting equipments	5-6
4.	To Study working of a laser leveller	7
5.	To study different equipment for management of crop residues	8-9
6.	Familiarization with GPS and GIS and study its working and applications	10-11
7.	To study working of a front end loader cum back hoe, excavators, deag lines and motor gradess	12-14
8.	Lab. Final	1
	TOTAL	**15**

References

1. De Mess M. N. Fundamental of Geographic Information System. John Willy and Sons, New York.
2. Dutta SK. 1987. Soil conservation and land management. International distributors, Dehradun.
3. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. Lori J. Dhaba1t, USA.
4. Lille Sand, T and Kaiffer, R. Remote Sensing and Image Interpretation, John Willy and Sons, London.
5. Nichols HL& Day DH.1998. Moving the emih. The work book of excavation. Mcgraw Hill.

6. Peurifoy RL 1956.Construction, planning, equipment and methods. Mcgraw Hill
7. Sabbins, F. Remote Sensing Principle and Interpretation. Freeman, New York
8. Singh G.1991. Manual of soil and water conservation engineering. Oxford and IBH, Co.
9. Sigma & Jagmohan.1976. Earth moving machinery. Oxford & IBH
10. Wood & Stumi. 1977. Earth moving machinery. Prentice Hall.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery & Power Engineering
3.	a) Title of the course	Machinery for Natural resource and Management and Precision Farming
	b) Number of course	TMP 611
	c) Pre-requisite	Nil
4.	Catalogue description	Attached
5.	To be offered	Ph.D
6.	Credits	3 (2-1-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students with the farm machinery used for natural resources management and machinery for precision farming. Use of GIS and GPS in farm machinery
9.	General education purpose	Yes
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Modified as per recent needs.
10.	Relation to other courses	
	a) Pre-requisite	Nil
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	Yes
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No

11.	What are the urgent reasons why this course be offered at this present time	Modified
12.	Is the course intended to replace an existing course or courses	No
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of Ph.D in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached with course outline
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Course content discussed in the Department
20.	Prepared/ modified by	Dr. Aurn Kumar
21.	Approved by	Course Curriculum Committee

Name of Course : Simulation Modelling in Farm Machinery and Power Engineering

Dept. Course No : TMP – 722

Credit Hours : 3 (2-0-1)

I. SYLLABUS

System performance and 36odeling methodologies – transformation of units of measurement – dimensional homogeneity. Buckingham's Pi Theorem. Simulation for system 36odeling, Formulations of simulation model, validation and testing of the simulation model. Experimentation with physical models and their application in farm machinery design. Sensitivity of models, scale effects, scale factors. Use of models. Complete similarity, kinematics and dynamic similarity. Model laws, empirical methods in model engineering. Principle of similarity in mathematical investigations. Mathematical 36odeling and its limitations, etc. Mathematical 36odeling through ordinary differential equation of first order, second order, partial differential equations. Similarity conditions and abstract parameters determining characteristics of engines. Similitude in tillage tool studies, prediction models for traction devices.

II. COURSE OUTLINE:

J. Lectures

Sl. No.	Topics	No. of Lectures
1.	System performance and 36odeling methodologies	1-2
2.	Transformation of units of measurement – dimensional	3-5

	homogeneity	
3.	Buckingham's Pi Theorem	6-8
4.	Simulation for system 37odeling, Formulations of simulation model, validation and testing of the simulation model	10-14
5.	Experimentation with physical models and their application in farm machinery design	15-17
6.	Sensitivity of models, scale effects, scale factors	
7.	Use of models	18-19
8.	Complete similarity, kinematics and dynamic similarity	20-21
9.	Model laws, empirical methods in model engineering	22
10.	Mathematical Modeling and its limitations, etc	23
11.	Mathematical Modeling through ordinary differential equation of first order, second order, partial differential equations	24-25
12.	Similarity conditions and abstract parameters determining characteristics of engines	26
13.	Similitude in tillage tool studies, prediction models for traction devices.	27-28
	Pre-Final Exam	2
	TOTAL	**30**

K. Practical

Sl. No.	Topics	No. of Lab.
1.	To determine the form of relationship for freely falling body	1
2.	To study effect of amplitude on period of a pendulum	2
3.	Application of the Buckingham Pi theorm in solving the problems	3-4
4.	Determination of vibration period of a spring mass system through dimensional analysis.	5-6
5.	To analyse period of vibration of a uniform cantilever beam	7
6	To study spring mass lever system and to develop an equation for the period of vibration of a rod pointed at one end	8
7.	To solve problems related to loaded rectangular beams	9
8.	To solve problems related to spring mass system	10
9.	Solution to the problems related to structural models	11
10.	Solution to the problems related to soil tillage and traction	12
11.	Solution to the problems related to threshing and winnowing	13
12.	Solution to the problems of heat conduction	14
13.	Lab. Final	1
	TOTAL	**15**

References:

1. Langhaar HL.1954. *Dimensional Analysis and Similitude.* McGraw Hill.
2. Sedov LI. 1991. *Similarity and Dimensional Methods in Mechanics.* Mir Publ Moscow.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and Power Engineering
3.	a) Title of the course	Simulation Modelling in Farm Machinery and Power Engineering
	b) Number of course	TMP - 722
	c) Pre-requisite	Yes
4.	Catalogue description	To enhance the knowledge in Management
5.	To be offered	Ph. D. Students of FMPE
6.	Credits	3(2-0-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	Yes
9.	General education purpose	Yes
	a) General education	Development as per recent & Industry demand
	b) Opportunity for students research	
	c) Departmental specification	No
	d) Outgrowth of instructor research programme	No
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Yes
10.	Relation to other courses	Yes
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	No
	e) A further development of course described under c & d	
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	
11.	What are the urgent reasons why this course be offered at this present time	Attached
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	Attached
14.	What is the exact place of this course in the development of education programme of your department	Core course of Ph.D. in FMPE
15.	Topics outlined	Discussed and approved by the Department
16.	Practical	
17.	Basic text books for the proposed course	Attached with course outline
18.	Do class room, lab and other facilities exists	Yes

19.	Sequence of action	Course Content discussed in the Department
20.	Prepared/ modified by	Dr. Jayant Singh
21.	Approved by	Course Curriculum Committee

Name of Course : Advances in Hydraulics and Electro Pneumatic Controls

Dept. Course No : TMP- 732

Credit Hours : 2(1-1-1)

I. SYLLABUS

Fluid power, its advantages, properties of hydraulic fluids, viscosity, bulk modulus, density. Concepts of energy of hydraulic systems, laws of fluid flow. Distribution system, pressure rating of tubing and hoses, couplings. Basics of hydraulic flow and hydraulic circuit analysis - pumps, types and theory of operation. Pressure intensifiers. Fluid power actuators, hydraulic rams, gear motors, piston motors and their performance characteristics, electro hydraulic motors and hydrostatic transmissions, control components. Directional pressure safety and servo valves. Hydraulic circuit design. Regenerative pump unloading, pressure intensifier circuits. Speed control of hydraulic motors, mechanical hydraulic servo systems for tractors. Pneumatic circuits - properties of air. Compressors, control elements. Design of pneumatic circuits. Electrical control for fluid power circuits. Electronic sensors/ circuits used as controls in modern farm equipment. Maintenance of hydraulic and pneumatic circuits and devices. Trouble shooting.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Fluid power, its advantages, properties of hydraulic fluids, viscosity, bulk modulus, density.	1-2
2.	Concepts of energy of hydraulic systems, laws of fluid flow. Distribution system, pressure rating of tubing and hoses, couplings.	3-5
3.	Basics of hydraulic flow and hydraulic circuit analysis - pumps, types and theory of operation.	6-8
4.	Pressure intensifiers. Fluid power actuators, hydraulic rams, gear motors, piston motors and their performance characteristics.	9-11
5.	Electro hydraulic motors and hydrostatic transmissions, control components. Directional pressure safety and servo valves.	12-14
6.	Hydraulic circuit design. Regenerative pump unloading, pressure intensifier circuits. Speed control of hydraulic motors.	15-17
7.	Mechanical hydraulic servo systems for tractors. Pneumatic circuits - properties of air. Compressors, control elements.	18-20
8.	Design of pneumatic circuits. Electrical control for fluid power circuits.	21-23
9.	Electronic sensors/ circuits used as controls in modern farm equipment.	24-26
10.	Maintenance of hydraulic and pneumatic circuits and devices. Trouble shooting.	27-28
	Pre-Final Exam	**2**

	TOTAL	**30**

B. Practical

Sl. No.	**Topics**	**No. of Lab.**
1	To study working principles of modern hydraulic system of a tractor and identification of different component.	**1**
2	To measure different properties of a fluid.	**1**
3	To study design specifications of pipes, hoses, couplers and joints etc. in a hydraulic system.	**1**
4	To study different types of hydraulic pumps and measurement of flow through different pumps.	**1**
5	To study working of hydraulic motors	**1**
6	To study working of hydrostatic transmission system	**1**
7	To study working of hydraulic cylinders.	**1**
8	To study working of different types of hydraulic valves and accumulators	**1**
9	To study working of hydraulic ram cylinder	**1**
10	To study working of close and open centre valves as used in tractor hydraulic system.	**1**
11	To study working of tractor rear lift system and sensing	**1**
12	To study different types of air compressor and measurement of compressor characteristics.	**1**
13	Familiarization with different types of sensors used in modern farm equipment	**1**
14	Familiarization with different circuits used in pneumatic and hydraulic system	**1**
15	Lab. Final	**1**
		15

Books

1. Anthony Esposito. 2003. *Fluid Power with Applications.* Pearsons Edu.
2. Krutz G.1984. *Design of Agricultural Machines.* John Wiley & Sons.
3. Merritt HE. 1991. *Hydraulic Control System.* John Wiley & Sons.
4. Majumdar SR. 2003. *Oil Hydraulic System.* Tata McGraw Hill.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Advances in Hydraulics and Electro Pneumatic Controls
	b) Number of course	TMP - 732
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	Ph.D. students of FMPE
6.	Credits	2 (1-1-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students about the Advances in Hydraulics and Electro Pneumatic Controls .
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course of Ph.D. in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. T.K. Bhattacharya
21.	Approved by	Course Curriculum Committee

Name of Course : **Energy Conservation and Management in Farm Power and Machinery**

Dept. course No : **TMP-723**

Credit Hours : **2 (2-1-0)**

I. SYLLABUS

Energy requirement of different operations in agricultural production systems viz. crop, livestock and aquaculture. Energy conservation through proper management and maintenance of farm machinery, planning and management of agricultural production systems for energy conservation and energy returns assessment. Development of computer program for efficient energy management in a given agricultural production system. Energy use planning and forecasting for a given system.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Energy resources on the farm conventional and non-conventional, Direct and indirect energy forms of energy and their use on the farms.	1-2
2.	Patterns of energy consumption and their constraints in production agriculture..	3-5
3.	Energy requirement of different operations in agricultural production systems viz. crop, livestock and aquaculture.	6-9
4.	Energy conservation through proper management and maintenance of farm machinery.	10-13
5.	Planning and management of agricultural production systems for energy conservation and energy returns assessment.	14-19
6.	Development of computer program for efficient energy management in a given agricultural production system.	20-26
7.	Energy use planning and forecasting for a given system.	27-28
	Pre-Final Exam	**2**
	TOTAL	**30**

References

1. Mittal JP, Panesar BS, Singh S, Singh CP & Mannan KD. 1987. *Energy in Production Agriculture and Food Processing.* ISAE and School of Energy Studies, Ludhiana. ISAE Publ.
2. Pimental D. 1980. *Handbook of Energy Utilization in Agriculture.* CRC Press.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	Energy Conservation and Management in Farm Power and Machinery
	b) Number of course	TMP - 723
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech. & Ph.D. students of FMPE
6.	Credits	2 (2-1-0)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students about the Energy Conservation and Management in Farm Power and Machinery.
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of Ph.D. in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.N. Pateriya
21.	Approved by	Course Curriculum Committee

Name of Course : Computer Aided Analysis and Design of Farm Machinery

Dept. Course No : TMP-610

Credit Hours : 2(1-0-1)

A. SYLLABUS

Introduction to CAD – the design process – Modeling using CAD architecture of CAD system. Geometric Modeling – requirements geometric construction methods – representation of curve –desirable modeling facilities. – CAD standards – Graphical Standard system – Exchange of modeling data. System analysis – Relevance of system approach to biological systems and engineering systems. Role of a system analyst ‘in design of a system and development of computer systems. Characteristics of Agricultural systems. Tools of structured analysis.-The data flow model. Object oriented approach. Feasibility study-Steps in feasibility analysis-cost analysis. System design process – structured design. Application to farm machinery scheduling problem. Application to farm factory co-ordination – case study. Design of farm machinery with the help of CAD.

II. COURSE OUTLINE:

B. Lectures

Sl. No.	Topics	No. of Lectures
1.	Introduction to CAD – the design process	1
2.	Modelling using CAD architecture of CAD system.	2-3
3.	Geometric 47odeling – requirements geometric construction methods – representation of curve –desirable modeling facilities.	3-4
4.	-CAD standards – Graphical Standard system.	5-6
5.	Exchange of modeling data. System analysis – Relevance of system approach to biological systems and engineering systems.	7-8
6.	Role of a system analyst ‘in design of a system and development of computer systems.	9
7.	Characteristics of Agricultural systems.	10
8.	Tools of structured analysis.	11
9.	The data flow model. Object oriented approach. Feasibility study-Steps in feasibility analysis-cost analysis.	12
10.	System design process – structured design.	13
11.	Application to farm machinery scheduling problem. Application to farm factory co-ordination – case study.	14
12.	Design of farm machinery with the help of CAD.	15

	Pre-Final Exam	2
	TOTAL	**17**

C. Practical

Sl. No.	Topics	No. of Lab.
1.	Familiarization with different CAD softwares	1
2.	Drawing of different geometrical shapes using CAD softwares	2-6
3.	Development of isometric view, plan and elevation of tillage implements	7-8
4.	Development of isometric view, plan and elevation of sowing equipment	9-10
5.	Development of isometric view, plan and elevation of plant protection equipment	11
6.	Development of isometric view, plan and elevation of harvesting equipment	12-13
7.	Development of isometric view, plan and elevation of threshing equipment	14
8.	Lab. Final	1
	TOTAL	**15**

References

1. Chris McMahon & Jimmie Browne. 2000. *CAD /CAM/ Principles. Practice and Manufacturing Management.* Pearson Edu.
2. Grover Mikell P. 2003. *Automation, Production Systems and Computer Integrated Manufacturing.*Prentice-Hall of lndia.
3. Radhakrishnan P, Subramanyan S & Raju V. 2003. *CAD/CAM/CIM.* New Age International.
4. Rao PN. 2002. *CAD/CAM Principles and Applications.* Tata McGraw Hill.
5. Zeid Ibrahim.1998. *CAD/CAM Theory and Practice.* Tata McGraw Hill.

PROPOSAL FOR MODIFIED COURSE

1.	College	P.G.S.
2.	Department	Farm Machinery & Power Engineering
3.	a) Title of the course	Computer Aided Analysis and Design of Farm Machinery
	b) Number of course	TMP 610
	c) Pre-requisite	Nil
4.	Catalogue description	Attached
5.	To be offered	Ph.D student of FMPE
6.	Credits	2 (1-0-1)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To acquaint the students with the computer aided design, analysis and manufacturing of farm machinery with the help of CAD
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Modified as per recent needs.
10.	Relation to other courses	
	a) Pre-requisite	Nil
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	Yes
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	No
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	Modified

12.	Is the course intended to replace an existing course or courses	No
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course of Ph.D in FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached with course outline
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Course content discussed in the Department
20.	Prepared/ modified by	Dr. Aurn Kumar
21.	Approved by	Course Curriculum Committee

Name of Course : System Simulation and Computer Aided Problem Solving in Engineering

Dept. Course No : TMP - 609

Credit Hours : 2 (2-1-0)

I. SYLLABUS

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. Mathematical modeling and engineering problem solving. Computers and softwares - software development process - Algorithm design, - program composition- quality control- documentation and maintenance - software strategy. 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 of algorithm. Solving differential equation on computers- modeling engineering systems with ordinary differential equations- solution techniques using computers.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Concept, advantages and limitation of dimensional analysis, dimensions and units	1-2
2.	Fundamental and derived units, systems of units	3-4
3.	Conversion of units of measurement	5
4.	Conversion of equations in different units, complete set of dimensionless products and their formulation methods	6-7
5.	The Rayleigh's method, Buckingham's Pi theorem and other methods	8-12
6.	Mathematical modeling and engineering problem solving.	13-15
7.	Computers and softwares - software development process	16-17
8.	Algorithm design	18
9.	Program composition- quality control- documentation and maintenance - software strategy.	19
10.	Approximation- round off errors- truncation errors	20

11.	Nature of simulation systems models and simulation- discreet event	21
12.	Simulation- time advance mechanisms	22
13.	Components of discreet event simulation model	23
14.	Simulation of singular server que- programme organization and logic- development of algorithm	24-25
15.	Solving differential equation on computers- modeling engineering systems with ordinary differential equations- solution techniques using computers	26-28
	Pre-Final Exam	2
	TOTAL	**30**

References

1. Averill M. Law & W David Kelton.2000. *Simulation Modeling and Analysis.* Mc Graw 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.
6. Robert J Schilling & Sandra L Harries. 2002. *Applied Numerical Methods for Engineers Using MATLAB and* C. Thomson Asia.
7. Simpson OJ. 2000. *Basic Statistics.* Oxford & ISH.
8. Singh RP. 2000. *Computer Application in Food Technology.* Academic Press.
9. Steven Chopra & Raywond Canale. 1989. *Introduction to Computing for Engineers.* McGraw Hill.
10. Veerarajan T & Ramachnadran T. 2004. *Numerical Methods with Programmes in* C *and C+ +.* Tata McGraw Hill.
11. Wilks SS. 1962. *Mathematical Statistics.* John Wiley & Sons.

PROPOSAL FOR MODIFIED COURSE

1.	College	PGS
2.	Department	Farm Machinery and power Engineering
3.	a) Title of the course	**System Simulation and Computer Aided Problem**
	b) Number of course	TMP - 609
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	To M. Tech and Ph.D students of FMPE
6.	Credits	2 (2-1-0)
7.	Is this is a new course	Yes
8.	Curricular purpose of the course	To enhance the knowledge in the Farm Machinery Management
9.	General education purpose	
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Core course for M. Tech. students of FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. Jayant Singh
21.	Approved by	Course Curriculum Committee

Name of Course : Advances in Land Development Machinery
Dept. Course No : TMP-515

Credit Hours : 3 (2-1-1)

I. SYLLABUS

Engg. fundamentals related to earth moving machinery, swell, shinkage and compaction measurements. Use of tractors and crawlers and effect of altitude and temperature on their performance grade resistance and their gradability. Land clearing and reclamation equipment and machines. Land leveling equipment, power shovel, dragline clamshells. Rubber tyres for earthmoving machinery, trenching machinery, trucks and wagons. Economic analysis of Land Development Machinery, Application of PERT and CPM to the problem related to land development.

II. COURSE OUTLINE:

A. Lectures

Sl. No.	Topics	No. of Lectures
1.	Engg. fundamentals related to earth moving Rolling resistance, effect of grade on required tractive effort, coefficient of traction effect of altitude on the performance of I.C. engine. Effect of temp. the performance of I.C. Engg., combined effect of pressure temp. on the performance of I.C. engine. Drawbar pull rimpull and related numerical problem.	1-3
2.	Soil stabilization and compaction-glossary of terms, properties of soil, swell, shrinkage. Swell factor, types of soil, compaction and type of compacting equipments. Such as Tamping roller smooth wheel rollers, pneumatic tired rollers vibrating roller, self propelled vibrating plates.	4-6
3.	Tractors and related equipments, type of tractors. Crawler tractors crawler tractors with direct drive crawler tractor with torque converter. Performance data for wheel and crawler tractors and related numerical problem.	7-8
4.	Gradability-Gradability for wheel and crawler tractors and related numerical problems.	9-10
5.	Land cleaning machines-Bulldozer-General information-Crawler-wheel tractors relative merits and demerit. Moving earth with bulldozer. Outpur of bull dozer. Types of equipments used in land clearing. Tractor mounted special blades, bulldozer rakes, steel cables root ploughs, disposal of bush; production rates.	11-12
6.	Land leveling equipments a scrapers-general information-Performance chart, cycle time, operating efficiency, Push loading method, production rates, ripping, prewetting, loading down the grade, load growth curve of scraper loading. Effect of rolling resistance on the production of scrapers. Numerical problems	13-15

	related to above.	
7.	Power shovel-General information, size, basic parts and operation, selecting the type and size of power shovel. Shovel dimensions, optimum depth of cut, output of power shovel. Effect of depth of cut on the output of power shovel. Effect of angle of swing on output, Job and management condition, Numerical Problems.	16-17
8.	Drag line – General information, Types, size working Principle, Optimum depth of cut, output, effect of depth of cut and angle swing on output, Job and management condition, size of bucket and length of boom affecting output. Related numerical problems.	18-20
9.	Clamshells-General Information, Clamshell bucket, production rates and related, numerical problems.	21-23
10.	Hoes – General information, basic parts, working ranges of hoes, output of hoes.	24
11.	Trenching machines – General information-wheel type tranching machines, ladder type trenching machine, selection of trenching machines production rates.	25-26
12.	Trucks and wagons-General information, Rear dump trucks, bottom dump wagons.	27
13.	Numerical problem related to Land Development Machines application of PERT and CPM.	28
	Pre-Final Exam	2
	TOTAL	**30**

B. Practical

Sl. No.	Topics	No. of Lab.
1	Study of land leveling equipment –Bull dozer with special reference to blade and output.	1-2
2	Study of land leveling equipment-scraper-production rates and vakes & load growth curve.	3-5
3	Study of land escavating machine- dragline, size of bucket, angle of swing, boom length and working.	6-8
4	Study of various types of land leveling equipment such as levellers, floats etc.	9-12
5	Study of various land grading machines, output, working etc.	13-14
	Lab final Exam	1
	TOTAL	**15**

References

1. Peurifoy, R.L. & Ladbeter WB. Construction Planning Equipment and Methods.
2. Moving the Earth – H. Nichols.

PROPOSAL FOR MODIFIED COURSE

1.	College	Technology
2.	Department	Farm Machinery & Power Engineering
3.	a) Title of the course	Advances in Land Development Machinery
	b) Number of course	TMP-515
	c) Pre-requisite	Nil
4.	Catalogue description	Enclosed
5.	To be offered	M. Tech. & Ph.D. student of FMPE.
6.	Credits	3 (2-1-1)
7.	Is this is a new course	No
8.	Curricular purpose of the course	To enhance the knowledge in the Farm Machinery Management
9.	General education purpose	To acquaint the student about knowledge of Advances in Land Development Machinery
	a) General education	Yes
	b) Opportunity for students research	Yes
	c) Departmental specification	Yes
	d) Outgrowth of instructor research programme	Yes
	e) Why could the educational purpose of this course not be achieved by modification of the course now being given	Development as per recent requirement
10.	Relation to other courses	
	a) Pre-requisite	No
	b) Is the course a pre-requisite to any course	No
	c) An introductory survey of special area of knowledge	No
	d) An introductory survey of special area of knowledge	Yes
	e) A further development of course described under c & d	Yes
	f) An application of departmental field and area of knowledge: represented by the department	No
	g) A summarizing of integrated course	No
	h) In your opinion does this course overlap to considerable extent of other course	No
11.	What are the urgent reasons why this course be offered at this present time	No
12.	Is the course intended to replace an existing course or courses	
13.	Would the introduction of this course require staff over and above the sanctioned strength of the department	No
14.	What is the exact place of this course in the development of education programme of your department	Optional course for M. Tech. & Ph.D students of FMPE
15.	Topics outlined	Attached
16.	Practical	Attached
17.	Basic text books for the proposed course	Attached
18.	Do class room, lab and other facilities exists	Yes
19.	Sequence of action	Discussed and approved by the Department
20.	Prepared/ modified by	Dr. R.P. Singh
21.	Approved by	Course Curriculum Committee

Name of the Department : **Farm Machinery & Power Engineering**

Post Graduate programme(s) : 1. **M. Tech. Agricultural Engineering (Farm Machinery & Power Engineering)**
in the department

1. Programme of study for Masters

Sl. No.	Course No. & Name of the Course	Credits Hrs.
Core Courses		**15**
TMP-522	Design of Farm Power and Machinery Systems	3(2-1-1)
TMP-666	Soil Dynamics in Tillage and Traction	3(2-1-1)
TMP-609	System Simulation and Computer Aided Problem Solving in Engineering	2(2-1-0)
TMP-526	Tractor Design	3(2-1-1)
TMP-642	Agro Energy Audit and Management	3(2-1-0)
TMP-600	Seminar	1
Basic Supporting Courses		**06**
TME-634	Advanced Machine Design	3(3-1-0)
BPS – 561	Statistical Methods	3(2-0-1)
Credits for Optional/Minor Courses		**9**
TMP-604	Applied Instrumentation in Farm Machinery and Stress Analysis	3(2-0-1)
TMP-622	Testing and Evaluation of Tractors and Farm Equipment	2(1-0-1)
TMP-636	Ergonomics and Safety in Farm Operations	2(1-0-1)
TMP-646	Design and Analysis of Renewable Energy Conversion Systems	3(2-0-1)
TMP-690	Thesis Research	**20**
	Total	**50**

`Name of the Department : **Farm Machinery & Power Engineering**

Post Graduate programme(s) : Ph.D. (Farm Machinery and Power Engineering)

2. Programme of study for Ph.D.

Sl. No.	Course No. & Name of the Course	Credits Hrs.
Core Courses*		**11**
TMP-712	Farm Machinery Dynamics Noise and Vibration	3(2-1-1)
TMP-722	Simulation Modelling in Farm Machinery and Power Engineering	3(2-0-1)
TMP-	Machinery for Natural Resource Management and	3(2-1-1)

711	Precision Farming	
TMP-788	Doctoral Seminar-I	1
TMP-789	Doctoral Seminar-II	1
Basic Supporting Courses		**04**
BHS-652	Research Methodology-I	1(1-0-0)
BPS-653	Research Methodology-II	3(2-0-1)
Credits for Optional Courses		**05**
TMP-723	Energy Conservation and Management in Farm Power Machinery	2(2-1-0)
TMP-610	Computer Aided Analysis and Design of Farm Machinery	2(1-0-1)
TMP-732	Advances in Hydraulics and Electro Pneumatic Controls	2(1-1-1)
Credit for Minor Package		**10**
TMP-790	Thesis Research	**45**
	Total	**75**