

UTTAR PRADESH TECHNICAL UNIVERSITY LUCKNOW



SYLLABUS

Bachelor of Agricultural Engineering

3rd Year (V & VI Semester)

(Effective from Session 2015-2016)

Study and Evaluation Scheme
B. Tech. (Agricultural Engineering)
 [Effective from Session 2015-16]
 Third Year, Semester V

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit	
			L	T	P	Sessional Exam			ESE			
						CA	TA	Total				
Theory Subjects												
1	NAG 501	Machine Design	3	1	0	30	20	50	100	150	4	
2	NAG 502	Soil & Water Conservation	3	1	0	30	20	50	100	150	4	
3	NAG 503	Refrigeration and Air-condition	3	1	0	30	20	50	100	150	4	
4	NAG 504	Farm power	3	1	0	30	20	50	100	150	4	
5	NAG 505	EPBM	2	1	0	15	10	25	50	75	3	
6	NHU 501	Engineering Economics	2	0	0	15	10	25	50	75	2	
Practical												
7	NAG 551	Soil & Water Conservation	0	0	3	10	10	20	30	50	1	
8	NAG 552	Refrigeration and Air-condition	0	0	3	10	10	20	30	50	1	
9	NAG 553	Farm power	0	0	3	10	10	20	30	50	1	
10	NAG 554	EPBM	0	0	3	10	10	20	30	50	1	
11	NGP 501	GP							50		50	
		Total	16	5	12					1000	25	

Study and Evaluation Scheme
 B. Tech. (Agricultural Engineering)
 [Effective from Session 2015-16]
 Third Year, Semester VI

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
Theory Subject											
1	NAG 601	Irrigation & Drainage Engg	3	1	0	30	20	50	100	150	4
2	NAG 602	Dairy & Food Engg	3	1	0	30	20	50	100	150	4
3	NAG 603	Tractor System Control	3	1	0	30	20	50	100	150	4
4	NAG 011-015	Elective-I	3	1	0	30	20	50	100	150	4
5	NAG 021-024	Elective-II	2	1	0	15	10	25	50	75	3
6	NHU 601	Industrial Management	2	0	0	15	10	25	50	75	2
Practical											
7	NAG 651	Irrigation & Drainage Engg.	0	0	3	10	10	20	30	50	1
8	NAG 652	Dairy & Food Engg.	0	0	3	10	10	20	30	50	1
9	NAG 653	Tractor System Control	0	0	3	10	10	20	30	50	1
10	NAG 654	Seminar	0	0	3	10	10	20	30	50	1
11	NGP 601	GP				50				50	
Total			16	5	12					1000	25

*The teaching load of Environment camp will be counted as equivalent to 0-0-3. Field study of any environmental issue and report for remedy will be prepared during winter break of one week. Evaluation will be done by the group activity presentation.

Departmental Elective Papers

AG -I

[3-1-0]

NAG-011 Watershed Planning & Management
NAG-012 Food Processing Plant Design & Layout
NAG-013 Land Development Machinery

AG II

[2-1-0]

NAG-021 Minor Irrigation and Command area Development
NAG-022 Development of Processed Products and Equipments
NAG-023 Production Technology and Agricultural Machineries

Vth SEM

MACHINE DESIGN

NAG-501

4(3+1)

Unit-I

Principle of design, Phases of design, design considerations. Common engineering Materials and their mechanical properties.

Unit-II

Types of loads and stresses, theories of failure, factor of safety, selection of allowable Stress. Stress concentration. Elementary fatigue and creep aspects.

Unit-III

Design of Cotter joints, knuckle joint and Design of welded subjected to static loads, Design of shafts under torsion and combined bending and torsion, Design of keys, Design of muff, sleeve, and rigid flange couplings.

Unit-IV

Design of helical and leaf springs, Design of flat belt and V-belt drives and pulleys, Design of spur and helical gears

Unit-V

Design of gears, Design of screw motion mechanism like screw jack, lead screw. Antifriction bearing.

Text Books:

1. Machine Design by Dr. Sadhu Singh
2. Machine Design by Sharma & Agarwal
3. Machine Design by J.E. Shigley
4. Design of Machine. Elements by M.F. Spotts
5. Elements of Machine. Design by Pandya & Shah

SOIL AND WATER CONSERVATION ENGINEERING

NAG-502

4(3+1)

Unit I

Introduction; soil erosion - causes, types and agents of soil erosion; water erosion – forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; characteristics of contours and preparation of contour maps.

Unit II

Erosion control measures – agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces – level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design; gully and ravine reclamation – principles of gully control - vegetative and temporary structures.

Unit III

Wind erosion - factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks & shelter belts, sand dunes stabilization.

Unit IV

Soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters. Sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency.

Unit V

Design principle of channel; Most Economical trapezoidal, Triangular channel and grassed water ways and their design; introduction to water harvesting techniques; introduction to stream water quality and pollution.

Text Books:

1. Principles of Agricultural Engineering Vol. II By Michael and Ojha
2. Soil & Water Conservation Engineering by R. Suresh
3. Hydrology and Soil Conservation Engineering by Gahanshyam Das
4. Land and Water Management Engineering V.V.N. Murthy

SOIL AND WATER CONSERVATION ENGINEERING Lab

- 1-Study of wind break
- 2- Study of Shelter belt
- 3-Study of USLE/MUSLE parameter
- 4-Computation of soil erosion by USLE/MUSLE
- 5-Study of erosion checked by row cropping pattern
- 6-Study of contour cropping effect on soil erosion
- 7-Study of bund /graded/contour bund

- 8-Design of grassed water ways
- 9-Design of Trapezoidal water ways
- 10-Design of Triangular water ways

REFRIGERATION AND AIR CONDITIONING

NAG-503

4(3+1)

Unit-I

Principles of refrigeration, second law of thermodynamics applied to refrigeration, Carnot cycle, reversed Carnot cycle, coefficient of performance, unit of refrigeration. Refrigeration in food industry, types of refrigeration system.

Unit-II

Refrigerant, desirable properties of ideal refrigerant, cold storages, insulation material, design of cold storages, defrosting.

Unit-III

Mechanical vapour compression, vapour absorption system, components of mechanical refrigeration, Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems, ultra low temperature refrigeration.

Unit-IV

Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychrometric chart, Psychrometric processes and its use.

Unit-V

Air conditioning principles, type and functions of air conditioning system, air distribution and duct design methods, Psychrometric processes, types of air conditioners & applications.

Text Books:

1. Refrigeration and Air conditioning by C.P. Arora
2. Thermal Environmental Engineering by J.L. Threlkald
3. Refrigeration and Air Conditioning by W.F. Stoecker

Refrigeration and Air Conditioning Lab (NAG-552)

2(0+2)

1. Study of vapour compression and vapour absorption systems
2. Solving problems on refrigeration on vapour absorption system
3. Experiments with the refrigeration tutor to study various components of refrigeration
4. Determination of the coefficient of performance of the refrigeration tutor
5. Experiment on humidifier for the determination of humidifying efficiency
6. Experiment on dehumidifier for the determination of dehumidifying efficiency
7. Experiment on the cooling efficiency of a domestic refrigerator
8. Experiments on working details of a cold storage plant and air conditioning unit
9. Experiments with air conditioning tutor to study various components
10. Determination of the coefficient of performance of air conditioning tutor

11. Estimation of refrigeration load; Estimation of cooling load for air conditioner
12. Design of complete cold storage system.

FARM POWER

NAG -504

4(3+1)

Unit-1

Sources of farm power -conventional & non-conventional energy sources and their utilization. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle.

Unit-2

Engine & their components, their construction, operating principles and functions. Valves & valve mechanism. Firing order and diagram, criteria for selection.

Unit-3

Study of constructional details, adjustments & operating principles of fuel & air supply, cooling, lubricating, ignition, governing and electrical systems.

Unit-4

IC engine fuels - their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines. Properties of coolants, anti freeze and anti-corrosion materials, lubricant types & study of their properties.

Unit-5

Transmission systems of wheel and track type tractors: clutch, gear box, differential and final drive mechanism PTO system, type, standardization, belt and pulley on tractor and their standardization. Preventive maintenance of various systems

Text Book

Tractors and their Power Units, John B. Lijedahal, Paul K. Turnquist :CBS Publication

Farm Tractor maintenance and repair, S.C.Jain; Standard Publishers Distributors

Farm Power Lab

- 1 Introduction to different systems of an CI engine;
- 2 Engine parts and functions, working principles etc;
- 3 Valve systems – study, construction and adjustments;
- 4 Oil & Fuel - determination of physical properties;
- 5 Air cleaning system;
- 6 Fuel supply system of SI & CI engine;
- 7 Diesel injection system & timing;
- 8 Study Cooling system;
- 9 Performance evaluation of lubricating system.
- 10 Engine starting and study of electrical system and Ignition system;
- 11 Visit to engine manufacturer/ assembler/ spare parts agency;
- 12 Servicing of tractor;

ENGINEERING PROPERTIES OF BIOLOGICAL MATERIAL

NAG -505

3(2+1)

Unit-1

Importance of engineering properties of biological materials, Physical properties like shape, size, volume, density, roundness, sphericity, surface area.

Unit-2

Thermal properties like thermal conductivity, specific heat & thermal diffusivity. measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

Unit-3

Rheological characteristics like stress, strain time effects, rheological models and their equations.

Unit-4

Aerodynamic characteristics and fractional properties. Application of engineering properties in handling processing machines and storage structure.

Text books:

1. Physical properties of plant and animal materials by N.N. Mohenensin
2. Engineering properties of foods by Rao, M.A and Rizvi.,S.S.H

EPBM Lab**2(0+2)**

1. Determination of shape & size of agricultural Products.
2. Determination of volume and density.
3. Measurement of roundness.
4. Measurement of sphericity.
5. Determination of surface area of leaf.
6. Determination of thermal conductivity & thermal diffusivity.
7. Measurement of viscosity of jam and jelly.
8. Measurement of texture of biscuits & confectionary.
9. Measurement of angle of repose & internal friction.

Vith Sem**IRRIGATION AND DRAINAGE ENGINEERING****NAG-601****4 (3+1)****Unit I**

Purpose of irrigation, sources of irrigation water, present status of development and utilization of different water resources of the country; common irrigation terminology water distribution pattern and system of levying irrigation charges.

Unit II

Measurement of irrigation water, weir, notches, flumes and orifices and other methods; water conveyance, design of irrigation field channels, Lacey's and Kennedy's theory, underground pipe conveyance system, irrigation structures, channel lining; land grading, different design methods and estimation of earth work and cost.

Unit III

Soil water plant relationship, soil water movement, infiltration, evapo-transpiration, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies.

Unit IV

Surface irrigation methods of water application, border, check basin, furrow and contour irrigation; sprinkler and drip irrigation method, merits, demerits, selection and design. Surface drainage, drainage coefficient, types of surface drainage, design of open channel.

Unit V

Sub-surface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types of use of subsurface drainage system, steady and unsteady state methods for drain depth and spacing, installation and cost estimation, drainage of salt affected soils and leaching requirement inter-relation of irrigation and drainage, canal command area, development programmes.

IRRIGATION AND DRAINAGE ENGINEERING Lab

2(0+2)

1. Measurement of soil moisture by different soil moisture measuring instruments
2. Measurement of infiltration rate, computation of evaporation and transpiration.
3. Design of underground pipe line system.
4. Measurement of advance and recession in border irrigation and estimation of irrigation efficiency.
5. Measurement of uniformity coefficient of sprinkler irrigation method.
6. Measurement of uniformity coefficient of drip irrigation method.
7. In-situ measurement of hydraulic conductivity.
8. Determination of drainage coefficients.
9. Installation of piezometer and observation well.
10. Preparation of iso-bath and isobar maps.
11. Measurement of hydraulic conductivity and drainable porosity.
12. Design of surface drainage systems and subsurface drainage systems.
13. Determination of chemical properties of soil and water.
14. Fabrication of drainage tiles and testing of drainage tiles.
15. Determination of gypsum requirement for land reclamation;
16. Installation of sub-surface drainage system;
17. Cost analysis of surface and sub-surface drainage system.

DAIRY AND FOOD ENGINEERING

NAG-602

4 (3+1)

Unit I

Milk; Definition and composition Physical, thermal and chemical properties of milk and milk products.

Unit II

unit operation of various dairy and food processing systems, process flow charts for product manufacture

Unit III

Working principles of equipment for receiving, pasteurization, sterilization, homogenization, filling & packaging(Production of butter , Pannier & Cheese) dairy plant design and layout.

Unit IV

Composition and proximate analysis of food products. Deterioration in products and their controls.

Unit V

Physical, chemical and biological methods of food preservation, changes during processing, evaporation, drying, freezing juice extraction, filtration, membrane separation, thermal processing, plant utilities requirement.

Books:

1. Brennan, J.G., Butters, J.r. Cowell, N.D. and Lilly, A.E.V. 1976. Food Engineering Operations Applied Science Publishers
2. Farrall, A.W. 1967. Engineering for Dairy and Food Products Wiley Eastern Pvt. Ltd. New Delhi.
3. Kessler, H.G. 1981. Food Engineering and Dairy Technology Verlag A. Kessler, Freising, F.R. Germany

DAIRY AND FOOD ENGINEERING Lab 2 (0+2)

- 1 Determination of the composition of milk and its properties (fat content, total solids, specific gravity, acidity, pH, viscosity etc.)
- 2 . Study of milk plant
4. Study of plate heat exchanger and tubular heat exchanger
5. HTST pasteurization of milk
6. Centrifugal separation of milk
7. Study of vacuum pan and rising film evaporators
8. Visit to milk food factory.
9. Spray drying of milk
10. Study of drum dryer
11. Study of soya milk process and related equipments
12. Design of food processing plant and preparation of layout

TRACTOR SYSTEM & CONTROLS

NAG-603

4 (3+1)

Unit I

Performance characteristics of tractor engines. Tractor transmission and final drive: Clutches & their types, Tractor power train; selection gear hydrostatic transmission, differential and final drives.

Unit II

Tractor steering mechanisms: Their types, control on crawler and wheel tractors, mechanical steering, caster, camber, toe-in & toe-out on tractors, kingpin inclination, tie-rod locking. Auxiliary power transmission power outlets, braking system in tractor:

Unit III

Tractor hydraulic circuit symbols, response adjustments, loading capacity, category, classification and standardization, position and draft controls Traction Theory: Definition of related terms, rolling resistance, travel reduction, coefficient of traction, tractive efficiency, tractive effort, rim pull, drawbar pull. Traction parameters, traction aids

Unit IV

Tractor hitching: Terminology, types, single and two axes hitches, automatic hitching. Mechanics of tractor chassis: Location of c.g., forces acting on tractor and dynamic equilibrium, analysis of force equilibrium with and without implement farm type & design.

Unit V

Ergonomic applications in man-machine and animal system: Human factors in tractor design with reference to comfort, convenience and safety, effects of noise, vibration and thermal stresses on human performance. Economics of tractor utilization

Books:

1. Jones, F.R. Farm Gas Engines and Tractors
2. Barger, E.L.; Lijedehl, J.B; Carleton, W.B. and Mc Kibben, E.G. Tractors and their Power Units.
3. Moses and Frost. Farm Power.
4. Radhey Lal and Dutta. Agricultural Engineering through solved examples.
5. Frazeee, Irving and Philip, V.E. Tractors and Crawlers.

Tractor Systems and Controls

2(0+2)

1. Introduction to transmission systems and components
2. Study of clutch functioning, parts and design problem on clutch system
3. Study of different types of gear box,
4. Calculation of speed ratios, design problems on gear box;
5. Study on differential and final drive and planetary gears;
6. Study of brake systems and some design problems;
7. Steering geometry and adjustments;
8. Study of hydraulic systems in a tractor,
9. Hydraulic trailer and some design problems;
- 10 Traction performance of a tractor wheel;
11. Finding C.G. of a tractor by weighing technique;
12. Finding CG of a tractor using suspension/balancing techniques;

13. Finding moment of Inertia of a tractor;
14. Appraisal of various controls in different makes tractors in relation to anthropometric measurements.

Departmental Elective Papers

AG -I

[3-1-0]

- NAG-011 Watershed Planning & Management
- NAG-012 Food Processing Plant Design & Layout
- NAG-013 Land Development Machinery

AG II

[2-1-0]

- NAG-021 Minor Irrigation and Command area Development
- NAG-022 Development of Processed Products and Equipments
- NAG-023 Production Technology and Agricultural Machineries

NAG-011 Watershed Planning and Management

4(3+1)

UNIT- I

Watershed management - problems and prospects; watershed based land use planning, watershed characteristics – physical and geomorphologic, factors affecting watershed management, hydrologic data for watershed planning,

UNIT- II

Watershed delineation, delineation of priority watershed, water yield assessment and measurement from a watershed; hydrologic and hydraulic design of earthen embankments and diversion structures;

UNIT- III

Sediment yield estimation and measurement from a watershed and sediment yield models; rainwater conservation technologies - in-situ and storage, design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system,

UNIT- IV

Land management and cultural practices on watershed hydrology; evaluation and monitoring of watershed programmes; people's participation in watershed management programmes;

UNIT- V

Planning and formulation of project proposal; cost benefits analysis of watershed programmes; optimal land use models; case studies.

NAG-012 Food Processing Plant Design & Layout 4(3+1)

UNIT- I

Meaning and definition of plant layout. Objectives and principles of layout. Types of layout.

UNIT- II

Salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products.

UNIT- III

Location selection criteria, selection of processes, plant capacity, project design, flow diagrams,

UNIT- IV

Selection of equipments, process and controls, handling equipments, plant layout, Plant elevation, requirement of plant building and its components, labour requirement,

UNIT- V

Plant installation, power and power transmission, sanitation. Cost analysis, preparation of feasibility report.

NAG-013 Land Development Machinery 4(3+1)

UNIT- I

Engineering fundamentals related to earth moving machinery; terminology and nomenclature, swell, shrinkage, rolling resistance, reactive effort, rim pull etc. Grade resistance and gradability. Soil strength parameters, soil stabilization and compaction equipment. Tractors and crawlers; classification, working principle and capacity determination, motorgrader and land levelling equipment: levellers and land plane.

UNIT- II

Land clearing equipment; types and application. Front end loaders; Land excavating equipment; scrapers, power shovel, drag line, clamshell, hoe and trenching machinery: Trucks and wagons; types, capacities and performance. Engg. Fundamentals of moving the earth-rolling, resistance. The effect of grade on required tractive effort, coefficient of traction. Effect of altitude on performance of I.C.engine. Effect of temperature on the performance of I.C. engines. Combined effect of pressure and temperature on the performance of I.C.engines. Drawbar pull.

UNIT- III

Tractors and Related Equipment: Tractor uses, types of tractor crawler tractors; Bulldozers: General information, Crawler mounted versus wheel mounted bulldozers, Moving earth with bulldozers, output of bulldozers. Land Clearing Operations: Types of equipment used.Scrapers: General information, types and sizes, Performance of wheel type scrapers. Excavating Equipment: Power shovel; general information, size of power shovel, basic parts, working principle.

UNIT- IV

Draglines-General Information, types of draglines, size, basic parts, optimum depth, output, effect of depth of cut and angle of swing on output. Clamshell: Types of bucket, sizes, production rates for clamshells. Hoes: General information, basic parts of cable operated hoe. Working ranges of hoes, output of hoes. Trenching Machines: General Information, wheel type trenching machine. Ladder type trenching machine. Trucks and Wagons: Trucks, classification and utilization.

UNIT- V

Types, output performance capabilities of trucks and wagons. Balancing capacities of hauling units with the size of excavator. Effect of the size of truck on the cost of hauling unit. Front end loaders output; levellers, output and operation.

NAG-021 Minor Irrigation and Command area Development

3(2+1)

UNIT- I

Major, medium and minor irrigation projects – their comparative performance; development and utilization of water resources through different minor irrigation schemes.

UNIT- II

Basic concepts of command area – definition, need, scope, and development approaches: historical perspective, command area development authorities;

UNIT- III

Interaction/collaboration of irrigation water use efficiency and agricultural production. Planning and execution of on farm development activities with in the scope of command area development;

UNIT- IV

Use of remote sensing techniques for command area development; Case studies of some selected commands; Farmers participation in command area development

NAG-022 Development of Processed Products and Equipments 3(2+1)

UNIT- I

Applications of unit operations to the food industry, analytical processing concepts with regards to mass and energy balances, equipment involved in the commercially important food processing methods and unit operations; value addition to cereals like rice, wheat etc.

UNIT- II

Parboiling of rice, quality of processed products of rice & wheat. Processing of pulses, spices and condiments; extruded food product, fermented food product, frozen and dried product, technology of meat, fish and poultry products,

UNIT- III

Technology of milk and milk products. Technology of oilseeds and fat products, snack foods, Fruits and vegetables product: candy, nutraceuticals, food product development trends, food additives and labeling.

UNIT- IV

Process equipment for thermal processing-evaporation, dehydration, drying, blanching, pasteurization, distillation; mechanical separation-filtration, sieving, centrifugation, sedimentation; Mechanical handling-conveying and elevation; size reduction and classification-mixing; kneading, blending.

NAG-023 Production Technology and Agricultural Machineries 3(2+1)

UNIT- I

Critical appraisal in production of Agricultural Machinery; Modelling and stress analysis of Machinery parts by using standard software;

UNIT- II

Advances in material used for tractor & Agril. Machinery. Cutting tools including CNC tools and finishing tools. Advanced manufacturing techniques like powder metallurgy, EDM (Electro-Discharge Machining),

UNIT- III

Heat Treatment of steels including pack carburizing, shot pining process, chemical vapour deposition (CVD) etc. Limits, Fits & Tolerances, Jigs & Fixtures, Microstructure Analysis.

UNIT- IV

Industrial lay-out planning, Quality management,. Economics of process selection. Techno-Economic feasibility of Project Report. Selection of Standard/ critical components. Case studies of manufacturing of agril. machinery. CNC controllers for machine tools. CNC programming.