RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AT501- Unit Operation in Post Harvest Management

Unit I Introduction
Post-harvest management introduction –objectives –post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content –measurement –direct and indirect methods – moisture meters – equilibrium moisture content.

Unit II Psychrometry and Drying
Psychrometry – importance – Psychometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers

Unit III Cleaning and grading
Principles - air screen cleaners – adjustments - cylinder separator-spiral separator – magnetic separator-colour sorter-inclined belt separator – length separators - effectiveness of separation and performance index.

Unit IV Shelling and handling
Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling –belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.

Unit V Paddy and crop processing
Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing.

Practicals:
Determination of moisture content – determination of engineering properties of grain- testing of paddy thresher-paddy winnower. Testing of groundnut decorticator-maize Sheller - evaluation of thin layer drier- study of LSU drier. Determination of oil content of oilseeds Determining the efficiency of bucket elevator and screw conveyor-study of paddy parboiling drum-evaluation of shelling efficiency of rubber roll sheller-study of cone polisher-visit to modern rice mill – visit to pulse milling industry.

Learning Outcome:
On completion of this chapter the students will understand different post harvest losses of agricultural and horticultural crops, their prevention and different unit operations involved after harvest for value addition to the produce.

Suggested Reading:

- Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi
- Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.
- Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana

- Mohsenin, N.N.1970. Physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana
- Chakraborty, S.K. 2013. Fundamental Food Engineering, Narosa Publishing House Pvt. Ltd., New Delhi, ISBN:978-81-8487-334-4.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AT502- Farm Machinery -II

Unit I- Tractor and tractor systems

Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Types of tractors – functional requirement and constructional details. Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements.

Unit II – Traction and tractor-implement system

Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids-ballasting the tractor. Tractor-implement hitching system, single point hitch, three point hitch system, different categories of three point hitch system, Study of tractor mechanics – forces acting on the tractor-implement combination. Determination of CG of a tractor and tractor-implement combination. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system.

Unit III- Power tiller and other farm power sources

Power tiller as source of power, engine and transmission system in power tiller- types, construction, major functional requirement, hitching system in power tillers. Implements suitable for power tiller hitching.

Unit IVTesting and safety with tractor and power sources

Introduction to tractor and power tiller testing. Deciphering the engine test codes.Ergonomical considerations and operational safety in operating the tractor controls.

Practical

Introduction to transmission systems and components; Study of clutch functioning, parts and design problem on clutch system; Study of different types of gear box, calculation of speed ratios, design problems on gear box; Study on differential and final drive and planetary gears; Study of brake systems and some design problems; Steering geometry and adjustments; Study of hydraulic systems in a tractor, hydraulic trainer and some design problems; Appraisal of various controls in different makes tractors in relation to Operators seat and body dimensions of the operators. Determination of location of CG of a tractor, Moment of Inertia of a tractor. Traction performance of a traction wheel.

Learning Outcome:

This Chapter helps the students in understanding the tractor and power systems, selection of matching implements, hitching mechanisms, safety standards of different power unit operations.

Suggested Reading:

- Liljedahl J B and Others. Tractors and Their Power Units.
- Rodichev V and G Rodicheva. Tractors and Automobiles.
- Singh Kirpal. Automobile Engineering – Vol I.
- Heitner Joseph. Automotive Mechanics: Principles and Practices.
- C.B.Richey. Agricultural Engineering Handbook.
- John Deere. Fundamentals of Service Hydraulics.
- Relevant BIS Test Codes for Tractors.

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Agriculture Engineering, V-Semester

Departmental Elective AT- 503 (A) OPERATIONS RESEARCH

Unit-I

Linear programming –Introduction- Problem Formulation - Graphical method –Limitations. General Linear programming problem-Canonical and Standard forms of LPP-Simplex Method. Computational Procedure –Artificial variable technique - Big M- Method.

Unit-II

Transportation Problem –Mathematical form of TPP-Methods of finding initial basic feasible solutions- North West - Corner Rule. Row Minimum - Column Minimum- Matrix Minimum - Vogel's Approximation Method (VAM)- Optimal Solution – Modified distribution Method (MODI Method). Assignment Problem –Mathematical form- Hungarian Method.

Unit-III

Integer Programming Problems-definitions –General form- Gomory's Algorithm –All Integer Cutting Plane Algorithm- Gomory's mixed integer method.

Unit-IV

Introduction –Network and basic components –construction and time calculation in network. Critical path method (CPM). Programme Evaluation and Review Technique (PERT) calculation – advantages in network

Unit-V

Inventory control - selective control techniques – economic lot size problems – problem of EOQ with and without shortage- EOQ problems with price Breaks. Inventory control techniques – uncertain demand and stochastic problems.

Suggested Reading:

- KantiSwarup, P.K Gupta, Man Mohan (2005)-Operations Research - Sultan Chand and Sons educational publisher, New Delhi.
- G.V. Shenoy, U.K.Srivastava& S.C. Sharma(2002)-Operations Research for Management-New Age International (P) Ltd., publishers, New Delhi.
- V.K.Kapoor and SumantKapoor(2003)- Operations Research Technique for Management-S. Chand and Sons, New Delhi
- Hamdy A. Taha (2000) -Operations Research -Prentice Hall of India Publisher, New Delhi
- Ravindran, Don.T.Phillips and James .J.Solberg(2001)-Operations Research-John Willey and Sons, Singapore.
- S.J.Venkatesan(1999)-Operations Research- JS Publishers, Cheyyar.
- Prem Kumar Gupta & D.S. Hira (2001)-Operations Research- Sultan Chand and Sons educational publisher, New Delhi.

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Agriculture Engineering, V-Semester

Departmental Elective AT- 503 (B) AGRICULTURE ECONOMICS

Unit-I: Nature and scope of economics

Importance – Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits - Definitions of Economics: Wealth, welfare, scarcity and growth definitions - Divisions of Economics – Micro and Macro economics - Agricultural Economics: definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth, Welfare - Wants: Characteristics and classification.

Unit-II :Theory of consumption utility

definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – Assumptions - Limitations and Applications - Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and Contraction Vs Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand - Engel's law of family expenditure - Consumer's surplus: Definition – Importance.

Unit-III: Theory of Production Concept of production

Factors of production – Land and its characteristics - Labour – Division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur - Supply definition – law of supply – factors influencing supply - elasticity of supply.

Unit-IV :Theory of Distribution

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage - Interest – liquidity preference theory – profit – Risk bearing theory of profit.

Unit-IV :Macroeconomic Concepts

National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income-Measurement of National Income - Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - service tax - Cannons of taxation, public expenditure: principles - Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, Pareto's optimality – Millennium Development Goals (MDG). Practical Law of Diminishing Marginal Utility - Law of Equi Marginal Utility - Individual and market demand - Indifference curve analysis and consumer equilibrium - Measurement of arc elasticity and point elasticity of demand - own price elasticity, income and cross elasticity of demand - consumer surplus - law of diminishing marginal returns – relationship between TPP, APP and MPP - Cost concepts and graphical derivation of cost curves - Population growth and food grain production - Supply elasticity - Causes of inflation and control measures – Consumer price index and wholesale price index - Types and functions of money - Computation ofNational Income - Study of structural changes in the economy - welfare indicators.

Learning Outcome:

On completion of this the students will understand the basics of agricultural economics demand-supply chain, production, consumption and distribution patterns of agricultural commodities and the terminology associated with national income.

Suggested Reading:

- Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
- Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi.
- Koutsoyiannis,A. 1983.Modern Microeconomics, The Macmillan Press Ltd., Hongkong
- Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi
- Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi

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Agriculture Engineering, V-Semester

Departmental Elective AT- 503 (C) Engineering Properties of Soil & Agriculture Materials

Engineering properties of soil such as stress strain relationships, permeability, shear strength, liquid limit, plastic limit etc. Determination of Field Density by Core cutter and Sand Replacement methods-Mechanical analysis of Soil Sieving-Hydrometer analysis for Grain Size Distribution-Determination of Atterberg's Limits of Soil Consistency. Experiments for the determination of physical properties like, length, breadth, thickness, surface area, bulk density, porosity, true density, coefficient of friction, angle of repose and colour for various food grains, fruits, vegetables, spices and processed foods, aerodynamic properties like terminal velocity, lift and drag force for food grains, firmness and hardness of grain, fruits and stalk.

Learning Outcome:
The students will learn about the different engineering properties of soil and agricultural materials which will be useful for design of soil engaging tools and also in the design of storage & value addition tools and equipment.

Suggested Reading:

- Mohsenin, N.N. 1970. Physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana
- Singhal, O.P. and Samuel, D.V.K. 2011. Engineering properties of biological materials. Saroj Prakashan, Allahabad. ISBN: 8170976253.
- Kachra, R.P., Gupta, R.K. and Alam, A. 1994. Physico- chemical constituents and engineering properties of food crops. Scientific publishers, Jodhpur. ISBN: 9788172330835.
- Rao, M. A. and Rizvi, S.S.H. 1986. Engineering properties of foods. Marcel deker, New York. ISBN: 9780824775261
- Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.
- Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
    - Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.

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Agriculture Engineering, V-Semester

Open Elective AT- 504 (A) Modelling and Simulation

Scope of dimensional analysis and simulation modelling, transformation of units of measurement.Dimensional homogeneity, Buckingham's Pi theorem, simulation for system modelling, simulation models-formulation and testing. Simulation modelling as applied to problems of stress analysis, fluid mechanics, and heat transfer. Mathematical modelling through ordinary differential equation of first order, second order andpartial differential equation.Application of simulation modelling to problems of agricultural engineering.

Suggested Readings:

- Langhaar HL. Dimensional Analysis and Similitude. McGraw Hill.
- Sedov LI. Similarity and Dimensional Methods in Mechanics. Mir Publ., Moscow.

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Agriculture Engineering, V-Semester

Open Elective AT- 504 (B) IC ENGINES

Introduction to SI and DI engines, Engine operating characteristics, Ideal cycle analysis, Disassembly and assembly of engines, Combustion and thermochemistry, Kinetics, equilibrium and dissociation, Gas properties and fuel - air cycle; cycle simulation

Mixture preparation in SI engines, Intake and exhaust processes, SI engine combustion, knocking, SI engine emissions, Engine performance and emissions measurements, SI engine emissions control

Diesel engine characteristics, Diesel engine: injection, ignition and combustion, Diesel engine emissions and control, Engine heat transfer, Engine friction and tribology, Turbocharging

Hydrogen, fuel cell and battery, Bio fuels and hybrids

Suggested Readings:

- Mathus, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
- Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
- Kepner, R. A., Bainer Roy, and Barges, E.C. (1978). Principles of Farm Machinery. CBS Publishers and Distributors, Delhi-17.
- Heywood, J. B. Internal Combustion Engine Fundamentals. New York, NY: McGraw-Hill, 1988. ISBN: 9780070286375.

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Agriculture Engineering, V-Semester

Open Elective AT- 504 (C) Soil Mechanics & Foundation

Stresses: effective and neutral stress, elementary concept of Boussinesq and Wester guards analysis, new mark influence chart. Shear strength, Mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear test, triangle test & vane shear test. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction test field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure: plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.

Suggested Reading:

- Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.
- Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
- Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.

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Agriculture Engineering, V-Semester

AT505-On Field Farm Machinery Operations

- Operation and maintenance of tractors, power tiller and self-propelled units
- Operation of primary and secondary tillage equipment – MB Plough, Cultivator, Rotavator, Harrow, etc.
- Operation, calibration and adjustment of seeding and planting equipment– manual, animal drawn, self propelled and tractor operated.
- Operation, calibration and adjustment of spraying and dusting equipment
- Operation and maintenance of different types of weeders – manual, animal drawn, self propelled and tractor operated.
- Operation and maintenance of different types of harvesters – Sickle, vertical conveyor reaper, combine harvesters, other harvesting machines, etc.
- Operation and maintenance of different types of threshers and shellers – manual, animal drawn, engine/ motor operated and tractor operated.
- Operation and maintenance of different types of cleaners & graders.

Suggested Reading:

- Jain SC. & Rai CR. 2012. Farm Tractor: Maintenance and Repair. Standard Publishers.
- Jain SC. & Rai CR. 2018. Farm Tractor Power Tiller: Maintenance and Repair. Standard Publishers.
- HansenSteve&HansenAnnlarken Hansen. 2011. Maintaining small farm equipment. ISBN-13: 978-1612125275. ISBN-10: 1612125271
- Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair, .SathyaPrakashan and Tech India Publications, New Delhi.
- Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, John Wiley & Sons, New-York.
- Ghosh, P.K, and Swain, S. (1993). Practical Agricultural Engineering. NayaProkash, Calcutta.

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Agriculture Engineering, V-Semester

AT506-Measurements Systems

Sensing Elements: Resistance Thermometers and Thermistors. Metal and Semiconductor Resistance strain Gauges.Resistance temperature Characteristics of a thermistor, Strain Gauge transducer, Linear variable differential Transformer, Capacitive Transducer, Temperature – emf characteristics of thermocouple. Piezoelectric Transducer and their characteristics, Hall –effect transducer, Photodiode – Measurement of characters, Instrumentation Amplifier, Analogue to Digital Conversion, Digital to Analogue Conversion.

Suggested Reading:

- W. Bolton Industrial Control and Instrumentation.
- D. Patranabis. Sensors and Transducers. Wheeler publishing.
- John Bantly. Principles of Measurement Systems – 3rd Edition.