

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Technology, VI-Semester

AT601- Agriculture Structures

Unit I

Planning and layout of farmstead. Scope, importance and need for environmental control, physiological reaction of livestock environmental factors, environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods, Livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures.

Unit II

Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.

Unit III:

Storage of grains, Causes of spoilage, Water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins; Traditional storage structures and their improvements, Improved storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Design consideration for grain storage godowns, Bag storage structures, Shallow and Deep bin, Calculation of pressure in bins, Storage of seeds.

Unit IV:

Rural living and development, rural roads, their construction cost and repair and maintenance. Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. Site and orientation of building in regard to sanitation, community sanitation system; sewage system and its design, cost and maintenance, design of septic tank for small family.

Unit V:

Estimation of domestic power requirement, source of power supply and electrification of rural housing.

Practical

- Measurements for environmental parameters and cooling load of a farm building,
- Design and layout of a dairy farm,
- Design and layout of a poultry house,
- Design and layout of a goat house/ sheep house,
- Design of a farm fencing system,
- Design of a feed/fodder storage structures,
- Design of grain storage structures,
- Design and layout of commercial bag and bulk storage facilities,
- Study and performance evaluation of different domestic storage structure,
- Cost estimation of a Farm building.

Learning Outcome:

Understanding the requirements of different types of structures used at farm/ rural level. Knowledge about their standards and available literature/ sources for design.

Reference Books

- Pandey, P.H. Principles and practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
- Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.
- Nathanson, J.A. Basic Environmental Technology, Prentice Hall of India, New Delhi.
- Venugopal Rao, P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.
- Garg, S.K. Water Supply Engineering, Khanna Publishers, New Delhi-6.
- Dutta, B.N. Estimating and Costing in Civil Engineering, Duttta & CO, Lucknow. Khanna, P.N. Indian Practical Civil Engineer's Hand Book, Engineer's Publishers, New Delhi.
- Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas publishing pvt. Ltd, Noida.
- Banerjee, G.C. A Text Book of Animal Husbandry, Oxford IBH Publishing Co, New Delhi.

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Agriculture Technology, VI-Semester

AT602- Soil & Water Conservation Engineering

Unit I

Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development.

Unit II

Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE²5 and EI₃₀ methods. Soil erodibility - topography, crop management and conservation practice factors.

Unit III

Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures– Bunds and terraces. Bunds - contour and graded bunds - design. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching.

Unit IV

Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design.

Unit V

Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

Practical

- Study of different types and forms of water erosion.
- Exercises on computation of rainfall erosivity index.
- Exercises on soil loss estimation/measuring techniques.
- Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor.
- Determination of sediment concentration through oven dry method.
- Design and layout of contour bunds.
- Design and layout of graded bunds.
- Design and layout of broad base terraces.
- Design and layout of bench terraces.
- Design of vegetative waterways.
- Exercises on rate of sedimentation and storage loss in tanks.
- Computation of soil loss by wind erosion.
- Design of shelterbelts and wind breaks for wind erosion control.
- Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.

Learning Outcome:

Understanding the Soil and Water conservation processes including agronomical and engineering measures.

Reference Books

- Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
- Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
- Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
- Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
- Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.
- Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Technology, VI-Semester

Departmental Elective AT- 603 (A) Watershed Management

Theory

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors. Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed. Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated watershed management - concept, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

Suggested Reading:

- Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
- Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
- Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
- Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
- Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
- Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur. Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
- Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi

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Agriculture Technology, VI-Semester

Departmental Elective AT- 603 (B) Protected Cultivation Technology

Protected cultivation: Introduction, History, origin, development, National and International Scenario, plant environment interactions – principles of limiting factors, solar radiation and transpiration, light, temperature, relative humidity, carbondioxide enrichment, Components of green house , perspective, types of green houses, shade nets, Cladding materials, Design and construction of green house-site selection, orientation, construction, design for ventilation requirement using exhaust fan system, selection of equipment, Greenhouse cooling system - necessity, methods – ventilation with roof and side ventilators, evaporative cooling, different shading material, fogging, combined fogging and fanpad cooling system. Planting techniques in green house cultivation. Root media – types – soil and soil less media, composition, estimation, preparation and disinfection, bed preparation. Irrigation in greenhouse and net house – water quality, types of irrigation system, components, design, installation and material requirement.

Practical

Estimation of material requirement for construction of greenhouse ; Estimation of material requirement for preparation of root media; Root media preparation, bed preparation and disinfections; Design and installation of irrigation system; Study of different greenhouse environment control instruments; Economic analysis of greenhouses and net houses; Visit to shadenet houses, greenhouses.

References:

Singh Brahma and Balraj Singh. 2014. Advances in protected cultivation, New India Publishing Company
Sharma P. 2007. Precision Farming. Daya Publishing House New Delhi.
Ramana Rao KV, Gangwar S, A Bajpai, Chourasia, L, Soni K 2016. Snrakshit Kheti ke Antargath Satat Phasal Prabandhan. Scientific Publishers, Jodhpur

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Agriculture Technology, VI-Semester

Departmental Elective AT- 603 (C) Precision Farming

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc. Introduction to GIS based precision agriculture and its applications.

Introduction to sensors and application of sensors for data generation. Database management. System concept. GPS – Concept and its application in agriculture. Site- specific management of inputs, On the go systems, map based systems. Application of different type of system for detection, Spectrophotometry Image analysis- approach, methods, software. Yield monitoring system, Yield monitors.

System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations. Application to PERT and CPM for machinery system management

Practical

Familiarization with precision agriculture problems and issues. Familiarization with various machines for resource conservation. Practical use of spectrophotometer, spad meter, green seeker, etc. for field variability analysis. Solving problems related to image analysis. Problems related to cost analysis and inflation and problems related to selection of equipment, replacement, break-even analysis, time value of money etc.

References:

Kuhar J E. The Precision Farming Guide for Agriculturist.
Dutta SK. Soil Conservation and land management.
Sigma and Jagmohan. Earth Moving Machinery.
Wood and Stuart. Earth Moving Machinery.
DeMess MN. Fundamentals of Geographic Information System.
Hunt Donnell. Farm Power and Machinery Management.
Sharma DN and S Mukesh. Farm Power and Machinery Management Vol I.

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Agriculture Technology, VI-Semester

Departmental Elective AT- 603 (D) Fundamental of Agriculture Extension

Unit I Communication and Programme Planning

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

Unit II Extension Teaching Methods

Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

Unit III Modern Communication Gadgets Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

Unit IV Diffusion and Adoption

Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.

Unit V Capacity building Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.

Practicals

Communication pattern in TOT organizations – ongoing agricultural and rural development/TOT programmes, ATMA and SHGs – preparation of visual aids – extension literature – news stories, feature stories – interview articles – photo journalism – activities of Directorate of ODL / Educational Media Centre – activities of Community Radio Centre – writing script for radio and television – spread and acceptance of farm technologies at village level.

References:

- Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
- Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork
- Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi
- Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

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Agriculture Technology, VI-Semester

Open Elective AT- 604 (A) Fluid Mechanics

Unit I

Fundamental Fluid Properties: – Engineering units of measurement – Mass, density – specific weight, specific volume – specific surface tension – capillarity. Viscosity, bulk modulus of elasticity, pressure and vapour pressure. Fluid Statics: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on Gravity Dams and Tainter Gates), buoyant force, stability of floating and submerged bodies, relative equilibrium.

Unit II

Kinematics and Dynamics of flow: Introduction to basic lines – Streamlines, Streak lines, pathlines various types of fluid flow. Velocity potential function, Stream function, Vorticity and Circulation Flow net. Basic equations of fluid flow like Energy equation, continuity equation and momentum equation. Bernoulli's equation and its applications.

Unit III

Laminar Flow and Turbulent Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number. Velocity distribution, Laminar and turbulent boundary layers and laminar sublayer, boundary layer concept, aging of pipes. Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes, concept of water Hammer transmission of power.

Unit IV

Open channels: Channel geometry and elements of channel selection, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, determinations of normal depth and velocity, normal and critical slopes, economical sections. Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing.

Practical

Problems on properties of fluid - Pressure measurement - hydrostatic forces - kinematics of flow - continuity equation - tank emptying - Measurement of head loss in pipe lines and pipe fittings - Flow measurement in pipes with venturi meter & orifice meter - Flow measurement in channels - most economical channel section - Design of channel.

Learning Outcome

Knowledge of the basic concept and principles of fluid mechanics. Ability to analyze fluid flow problems with the application of momentum and energy equations. Ability to distinguish between various types of fluid flow. Ability to find solutions to typical pipe flow problems,

References

Bansal, R.K., 2002. A text book of fluid mechanics and hydraulic machinery, Laxmi publications (P) Ltd., New Delhi

Grade, R.J., 2002. Fluid mechanics through problems. Wiley eastern Ltd., Madras

Jagadish Lal, 2000. Hydraulic machines. Metropolitan book house, New Delhi.

Donald, Pritchard Fluid Mechanics-Wiley India, New Delhi.

John F. Douglas, J.M. Gasoriek, John Swaffield, Lynne Jack, Fluid Mechanics, Pearson Edu.

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Agriculture Technology, VI-Semester

Open Elective AT- 604 (B) Theory of Machines & Machine Design

Unit I

Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions. Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers.

Unit II

Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc.

Unit III

Determining velocity ratio by tabular method. Turning moment diagrams, coefficient of fluctuation of speed and energy, weight of flywheel, flywheel applications. Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Design of flat belt and V-belt drives and pulleys. Effect of centrifugal tension, creep and slip on power transmission, Chain drives. Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings. Types of governors. Constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness, stability, hunting, iso-chronism, power and effort of a governor. Static and dynamic balancing. Balancing of rotating masses in one and different planes.

Unit IV

Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading. Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs. Selection of anti-friction bearings.

Practical

Find out gyroscopic couple, Find out velocity & acceleration of slider crank mechanism, Find out velocity ratio of various gear trains, Study various types of belt drives and find out the velocity ratio of the drive, Draw the cam profile, Draw involute profile of a gear by generating method

Learning Outcome:

Understanding principles involved in design of a functional machine to knowing about different standard mechanisms.

References:

- Bevan Thomas. 1984. Theory of Machines. CBS Publishers and Distributors, Delhi.
- Ballaney P L. 1985. Theory of Machines. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
- Rao J S and Dukupatti R V. 1990. Mechanisms and Machine Theory. Wiley astern Ltd., New Delhi.
- Lal Jagdish. 1991. Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 Netaji Subash Marg, New Delhi..
- Rattan S B. 1993. Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.
- Khurmi R S and Gupta J K. 1994. Theory of Machines. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi
- Jain R K. 2013. Machine Design. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
- Khurmi R S and Gupta J K. 2014. A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi

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Agriculture Technology, VI-Semester

Open Elective AT- 604 (C) IPR (Intellectual Property Rights)

Course Objective

Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*

Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS.* The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative*, Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

Course Outcome:

1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection

3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House
2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014
3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.
4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.
5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.
6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.

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Agriculture Technology, VI-Semester

Open Elective AT- 604 (D) Renewable Energy Sources

Unit I

Classification of energy sources, contribution of these of sources in agricultural sector. Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources.

Unit II

Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaics: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics.

Unit III

Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant.

Unit IV

Bio-mass energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.

Practical

Study of different types of solar cookers, solar water heating system, natural convection solar dryer, forced convection solar dryer, solar desalination unit, solar greenhouse for agriculture production, biogas plants, biomass based gasifiers, biomass improved cook-stoves, solar photovoltaic system.

References

- Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
- Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
- Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.
- Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.
- Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
- Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

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Agriculture Technology, VI-Semester

AT-605 CAD Lab

List of Experiments:

1. Layout and sketching of different geometries
2. Drawing environment in AUTOCAD
3. Elements of drawing and draw commands
4. 3D functions in AUTOCAD
5. 2D: Figures for practice using AutoCAD
6. ISOMETRIC drawing for practice using AutoCAD
7. 3-D solid figures using AUTOCAD
8. Introduction to CREO 3.0
9. Learning different Operations like Threading, Sweep, Swept-blend.
10. Modeling & Assembling

References:

1. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishers.
2. Beginning AutoCAD 2019 Exercise Workbook by Cheryl R. Shrock, Steve Heather.
3. CAD Exercises by Sachidanand Jha.

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Agriculture Technology, VI-Semester

AT-606 IC Engine Testing

Practical

Different types of IC Engines. Familiarization with IC Engine Components and Systems, Piston, cranking rod, cranking rod, valves, governors, flywheel, crankcase, different types of engine oil, firing interval, fuel storage and supply system, cooling system. Engine performance parameters. Constructional features and difference between 2-stroke and 4-stroke engines. Performance curves of engines. Test codes for engine testing. Engine testing as per BIS code. Test code for tractor engine testing, Drawbar performance in the lab; PTO test and measure the tractor power in the lab/field; Determining the turning space, turning radius and brake test, hydraulic pump performance test and air cleaner and noise measurement test; Visit to tractor testing centre/industry.

Learning Outcome:

Help the student to understand the systems of IC engine and factors affecting the performance of engine.

References:

Liljedahl J B & Others. Tractors and Their Power Units.
Raymond N, EA Yong and S Nicolas. Vehicle Traction Mechanics.
Maleev VL. Internal Combustion Engines.
Kirpal Singh. Automobile Engineering – Vol I and Vol II.
Richey C.B. Agricultural Engineering Handbook.
Mehta ML, SR Verma, SK Mishra, VK Sharma. Testing & Evaluation of Agricultural Machinery