

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Agriculture Technology, VII-Semester

AT-7001 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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Credit Based Grading System

Agriculture Technology, VII-Semester

AT-7002 Soil and 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 divisor.
- 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.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Agriculture Technology, VII-Semester

AT-7003 Instrumentation

Unit I

Semiconductors. p—n junction. V—I characteristics of p—n junction. diode as a circuit element. rectifier. clipper. damper, voltage multiplier, capacitive filter. diode circuits for OR &AND (both positive and negative logic), bipolar junction transistor: operating point. classification (A.B & C) of amplifier. various biasing methods (fixed. self potential divider). h-parameter model of a transistor. analysis of small signal. CE amplifier. phase shift oscillator, analysis of differential amplifier using transistor. ideal OP-AMP characteristics. linear and non-linear applications of OP-AMP (adder. subtractor. integrator, active rectifier. comparator. differentiator. differential, instrumentation amplifier and oscillator). zener diode voltage regulator. transistor series regulator. current limiting. OP-AMP voltage regulators.

Unit II

Basic theorem of Boolean algebra. Combinational logic circuits(basic gates. SOP rule and Kmap). binary ladder D/A converter, successive approximation A/D converter, generalized instrumentation,

Unit III

Measurement of displacement, temperature, velocity, force and pressure using potentiometer. resistance thermometer, thermocouples. Bourdon tube, pressure gauges. LVDT, strain gauge circuits, wheatstone bridge and other bridges and tachogenerator, load cells.

Practical

- To study V-I characteristics of p-n junction diode: To study half wave. full wave and bridge rectifier: To study transistor characteristics in CE configurations: To design and study fixed and self bias transistor: To design and study potential divider bias transistor: To study a diode as clipper and clamper: To study a OP-AMP IC 741 as inverting and non- inverting amplifier: To study a OP-AMP IC 741 as differentiator and integrator to study a differential amplifier using two transistor: To study a OP-AMP IC 741 as differential amplifier: To study a zener regulator circuit: To study a OP-AMP IC 741 as a active rectifier: To study a OP-AMP IC 741 as a comparator:
- To familiarize with various types of transducers. Strain gauge bridges, thermocouple, pressure gauges measurement of load (load cell), torque, power and energy, etc. and its calibration

References

- Mehta V K. Principles of Electronics. S. Chand and Co., New Delhi.
- Shaney A K. Measurement of Electronics and Electronic Instrumentation. Khanna Publications.
- Roy Chowdary. Integrated Electronics. John Wiley International.
- Kumar Anand. Digital Electronics. A. PHI.
- Gupta Sanjeev, Sonthosh Gupta. Electronic Devices and Circuits. Danapath Rai Publications

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Agriculture Technology, VII-Semester

Elective –III AT- 7004 (1) 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

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Agriculture Technology, VII-Semester

Elective –III AT- 7004 (2) Food Plant Equipment Design

Theory

Raw food materials, harvesting, handling and packaging of food materials. Unit operations in processing plants, plant layout and its evaluation. Salient features of processing plants for cereals, horticultural crops, poultry and meat products. Guidelines for design and cost analysis of processing plants.

Suggested Reading:

- Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
- Chakraverty, A. and De, D.S. 1981. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH.
- Gary, Krutz, Lester Thompson and Paul Clear. 1984. Design of Agricultural Machinery. John Wiley & Sons.
- Hall, C.W. and Davis, D.C. 1979. Processing Equipment for Agricultural Products. AVI Publ.
- Henderson, S. and Perry, S.M. 1976. Agricultural Process Engineering. 5th Ed. AVI Publ.
- Johnson, A.J. 1986. Process Control Instrumentation Technology. 2nd Ed. Wiley International & ELBS.
- Romeo T. Toledo. 1997. Fundamentals of Food Process Engineering. CBS.
- Slade, F.H. 1967. Food Processing Plant. Vol. I. Leonard Hill Books.
- Phirke, P.S. 2009. Processing and conveying equipment design. Jain Brothers.
- Chakraborty, S.K. 2013. Fundamental Food Engineering, Narosa Publishing House Pvt. Ltd., New Delhi, ISBN:978-81-8487-334-4.
- Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.

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Agriculture Technology, VII-Semester

Elective –III AT- 7004 (3) Farm Machinery Management

Importance and objectives of farm mechanization in Indian Agriculture, its impact, strategies, myths and future needs. Estimation of operating cost of tractors and farm machinery. Management and performance of power, operator, Labour. Economic performance of machinery, field capacity, field efficiency and factors affecting field efficiency. Tractor power performance in terms of PTO, drawbar and fuel consumption. Power requirement problems to PTO, DBHP. Selection of farm machinery, size selection, timeliness of operation, optimum width and problem related to its power selection; selecting proper power level and problems related to it. Reliability of agricultural machinery. Replacement of farm machinery and inventory control of spare parts. Systems approach to farm machinery management and application of programming techniques to farm machinery selection and scheduling. Network Analysis: Transportation, CPM & PERT, Dynamic programming, Markov chain.

Suggested Readings

- Hunt, D, Farm Power and Machinery Management, Iowas State University Press, USA, 1979
- Kapoor V.K. Operation Research: Concepts, Problems and Solutions by Sultan Chand & sons-2012
- Culpin, C, Profitable farm mechanization, Lock Wood & Sons, London, 1996
- Singh, S. and Verma, S.R. Farm Machinery Maintenance and Management. DIPA, ICAR, KAB-I, New Delhi.
- Carveille, L.A. (1980). Selecting farm machinery. Louisiana Cooperative Extn. Services publication
- FAO (1980). Agricultural Engineering in develop: selection of mechanization inputs, FAO, Agri service Bulletin

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Agriculture Technology, VII-Semester

Elective –III AT- 7004 (4) Experimental design & statistical methods in agriculture

Theory:

Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control. Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design - concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. Bioassays- direct and indirect, indirect assays based on quantal dose response, parallel line and slope ratio assays potency estimation.

Suggested Reading:

- Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
- Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
- Federer WT. 1985. Experimental Designs. MacMillan.
- Fisher RA. 1953. Design and Analysis of Experiments.
- Oliver & Boyd. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory & Practice. John Wiley.

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Agriculture Technology, VII-Semester

Elective –IV AT- 7005 (1) Farm Machinery Design

Theory

Farm machinery design - modern trends - tasks and requirements - economic considerations - durability, reliability and rigidity. Physico mechanical properties of soils - technological process of ploughing - wedge theory - working process of mould board plough - determination of basic parameters - Design of coulters - shares - mould boards. Machines and implements for surface and inter row tillage - peg toothed harrow - disk harrows - rotary hoes - graders - rollers - cultivators - design of V shaped sweeps - rigidity of working tools. Rotary machines - trajectory of motion of rotary tiller tynes - forces acting - power requirement. Machines with working tools executing an oscillatory motion. Design considerations for Grain hoppers – seed metering mechanism – furrow openers and seed tubes. Machines for fertilizer application – discs type broadcasters. Organic fertilizer application - Properties of organic manure – spreading machines. Liquid fertilizer distributors. Planting and transplanting – paddy transplanters – potato planters. Hydraulic nozzles. Power operated hydraulic sprayer design principles. Controlled droplet application. Spray drift and its mitigation. Use of drones for spraying – design of spray generation and application issues. Crop harvesting- plant properties- physical and mechanical properties of plant stem-plant bending modeling. Harvesters, basic principles of design and its sub-systems. Cereal threshing and separation- design of tangential and axial threshing units. Performance indices of threshing units. Factors influencing the threshing process and power requirement. Separation process and design of straw walker. Cleaning unit process and operation. Grain pan- chaffer and bottom sieve.

Suggested Readings

- Bosoi, E.S., O.V.Verniaev, I.I. Smirnov and E.G. Sultan-Shakh. (1990). Theory, construction and calculations of Agricultural Machinery - Vol.I. Oxonian Press Pvt. Ltd. No.56, Connaught Circle, New Delhi.
- William. R.Gill and Glen E.Vanden Berg.. Soil dynamics in tillage and traction. Supdt. of documents, U.S. Govt. Printing Office, Washington, D.C. 20402.
- Bernacki, C., J.Haman and Cz.Kanafajski (1972). Agricultural Machines, Theory and Construction. Vol - I. U.S. Dept. of Commerce, National Technical Information Service, Springfield, Virginia.22151.
- Yatsuk, E.P. (1981). Rotary soil working machines construction, calculation and design. American Publishing Co. Pvt.Ltd, New Delhi.
- Varshney AC et al. 2004. Data book for Agricultural Machinery Design. ICAR- Central Institute of Agricultural Engineering, Berasia Road, Bhopal.

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Agriculture Technology, VII-Semester

Elective –IV AT- 7005 (2) Micro Irrigation Systems

Theory:

Micro Irrigation Systems: types-drip, sprinkler, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps; necessary steps for proper operation of a drip irrigation system; maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation. Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;

Suggested Readings

- Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+business Media, New York .
- Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
- Mane M.S and Ayare B.L. and Magar S.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.
- Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.
- Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Pub. House New Delhi.
- Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.

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Agriculture Technology, VII-Semester

Elective –IV AT- 7005 (3) Aquaculture Engineering

Theory:

Scope of aquaculture engineering and its application in fish farming. Type of Fish culture' Practices and Requirements of cultural Species Planning of Fish Farm Survey and site selection; Study of hydrometer ecological and environmental problems; Study of engineering aspects of water availability and sources; Surface and' ground water quality; Types of soils and salts presents in soil; Vegetation; Socio-economic aspects; Design of Fish Farms Component of fish farm; Design of nursery; Transition and rearing ponds; Types of' earthen ponds and their design; Design of dykes; Earth work estimation; Pond capacity estimation; Project layout. Water Management System Design of drainage system for aqua-cultural farm; Design of fish race ways, ladders and fish lifts; Spillways; Design of sluices; Design of channels; Gates and canals for tied fed and pump fed farms. Different types of pumps; Functional design of biological and mechanical filters; Types of design of' aeration equipment; Feeders; Blowers.

Suggested Reading:

- Wheaton, F.W. "Aqua-cultural Engineering". John Wiley, 1997.
- Bose, AN., Ghosh, S.N. Yang C.T. and Mitra, A. "Coastal Aqua-cultural Engineering". Cambridge University Press, 1991.
- Hunt, M. "Text Book of Fish Culture - Breeding and Cultivation of Fish". Fishing News Book Ltd., 1979.

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Agriculture Technology, VII-Semester

Elective –IV AT- 7005 (4) ICT in Agriculture

Introduction & scope of ICT in Agriculture, Need for ICT in Agricultural Extension. National Policies on ICT in Agricultural Extension. Role of communications in ICT: Concept, elements & their characteristics. Message: meaning, dimensions of a message characteristics of a good message, message treatment and effectiveness, distortion of message. Methods of communication: meaning and function. Forms of communication. Role of Mass Media in dissemination of farm technology. Modern communication media: electronic video, tele text, tele conference, computer assisted instruction. Telephone/Mobile Technology: Farmer Call Centre, SMS Broadcast Service, m-krishi. ICT initiatives of NGOs and Private Companies. ICT initiatives by ICAR and SAUs, Value Added Services, Fisher Friend Project, SMS Services to farmers by Department of Agriculture. Practices of ICT for Agricultural Extension: aAQUA, Digital Green, e-Agrik (e-Agriculture), e- Sagu (e-cultivation), KISSAN (Karshaka Information Systems Service and Networking), Solutions through Information, VASAT-Virtual Academy for the Semi-Arid Tropics, Touch Screen Kiosk, e-Extension (e-Soil Health Card Program) Village. Village Knowledge Centre (VRC/VRC/CIC): Introduction, concept, process for setting VRC. Warana Wired Village Project, Web Portals: AGRISNET, DACNET, In DG, DEAL, i-KISAN, e-Krishi, ASHA, IFFCO- Agri-Portal, Agriwatch Portal, i-Shakti. ICTs for market information and Agri-Business: AGMARKNET, e-KRISHI VIPNAN, ICT-e-CHOPAL, EID GarryIndiagriline.

Suggested Reading:

- G.L. Ray, 2006. Extension communication and management. Kalyani Publ.
- A.S. Sandhu, 2004. Text book on Agricultural communication process and methods. Oxford & TBH.
- R Saravanan, C Kathiresan & T Indra Devi, 2011. Information & communication technology for agriculture and rural development. New India Publ. Agency