

**DR. A.P.J. ABDUL KALAM TECHNICAL  
UNIVERSITY LUCKNOW**



**Evaluation Scheme & Syllabus**

**For**

**B. Tech. IV Year**

**Agricultural Engineering**

**ON**

**CHOICE BASED CREDIT SYSTEM**

**(CBCS)**

**[Effective from the Session: 2019-20]**

## SEVENTH SEMESTER

SL NO.	Subject Code	Subject Name	Teaching Deptt	L-T-P	Th/Lab Marks	Sessional		Total	Credit
						Test	Assig/Att.		
1		Open Elective -1	core Department	3---0---0	70	20	10	100	3
2		Deptt Elective Course- 3	core Department	3---0---0	70	20	10	100	3
3		Deptt Elective Course -4	core Department	3---1---0	70	20	10	100	4
4	RAG701	BMSD Agricultural Structures and Environmental Control	core Department	3---1---0	70	20	10	100	4
5	RAG702	Dairy & Food Engg	core Department	3---0---0	70	20	10	100	3
		<b>Lab</b>							
6	RAG751	BMSD Agricultural Structures and Environmental Control	core Department	0---0---2	50		50	100	1
7	RAG752	Dairy & Food Engg Lab	core Department	0---0---2	50		50	100	1
8	RAG753	Industrial Training Lab	core Department	0---0---3			100	100	2
9	RAG754	Project-1 Lab		0---0---6			200	200	3
	<b>Total</b>				<b>450</b>	<b>100</b>	<b>450</b>	<b>1000</b>	<b>24</b>

### Deptt. Elective course-3

- |   |         |  |
|---|---------|--|
| 1 | RAG070  | Remote sensing and GIS                               |
| 2 | RAG071  | Waste land development                               |
| 3 | RAG072  | Watershed Planning and management                    |
| 4 | RAG073  | Flood and control measures                           |
| 5 | RAG074A | Water quality and management Measures                |
| 6 | RAG074B | Information Technology for land and water management |

### Deptt. Elective course-4

- |   |         |  |
|---|---------|--|
| 1 | RAG075  | Ground water well & Pumps                      |
| 2 | RAG076  | Human engineering and Safety                   |
| 3 | RAG077  | Precision agriculture and system Management    |
| 4 | RAG078  | CAD/CAM computer Graphics                      |
| 5 | RAG079A | Testing of Agricultural equipment and Tractors |
| 6 | RAG079B | Plastic in Agriculture                         |

## EIGHTH SEMESTER

SL NO.	Subject Code	Subject Name	Teaching Deptt	L-T-P	Th/Lab Marks	Sessional		Total	Credit
						Test	Assig/Att.		
1		Open Elective -2	Other Department	3---0---0	70	20	10	100	3
2		Deptt Elective Course 5	core Department	3---1---0	70	20	10	100	4
3		Deptt Elective Course -6	core Department	3---0--0	70	20	10	100	3
4	RAG851	GD & Seminar	core Department	0---0---3			100	100	2
5	RAG852	Project-2	core Department	0---0---12	350		250	600	12
	<b>Total</b>				<b>560</b>	<b>60</b>	<b>380</b>	<b>1000</b>	<b>24</b>

### Deptt. Elective course-5

1	RAG080	Minor irrigation and command area development
2	RAG081	Management of canal irrigation system
3	RAG082	Reservoir and pond design
4	RAG083	Rural Water Supply and Sanitation
5	RAG084	Landscape irrigation design and management
6	<b>RAG085</b>	<b>Novel Technologies for Food Processing and Shelf Life Extension (NPTEL)</b>

### Deptt. Elective course-6

1	RAG086	Agribusiness Management and Trade
2	RAG087	Bio energy system-design and Application
3	RAG088	Entrepreneurship Development
4	RAG089	Renewal Power Sources
5	RAG090	Renewal energy and Management
6	<b>RAG091</b>	<b>Soil Science and Technology(NPTEL)</b>

## SEVENTH SEMESTER

### **BMSD, Agricultural Structures and Environment control (3-1-0) 4**

#### **Unit-I**

Building Materials: Rocks, Stones, Bricks Properties and varieties of Tiles, Lime, Cement, Concrete, Sand. Glass, Rubber, Plastics, iron, Steel, Aluminium, Copper, Nickle. Timber. Building components: Lintels, Arches, stair cases, Different types of floors, Finishing: Damp Proofing and water proofing, Plastering, pointing, white washing and distempering – Painting, Building design, Design procedures, Technology, building construction, Types of agricultural buildings and related needs, application of design theory and practice to the conservation, sloped and flat roof buildings.

#### **Unit-II**

construction economics: Preliminary estimates, Detailed Estimates of Buildings source of cost information, use of cost analyses for controlling design, Factors affecting building costs; cost evaluation of design and planning alternatives for building and estate development, Measurement and pricing, Economic methods for evaluating investments in buildings and building systems: cost-in-use, benefit-to-costs and savings-to-investment ratios, rate of return, net benefits, payback.

#### **Unit-III**

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. 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-IV**

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. Rural living and development, rural roads, their construction cost and repair and maintenance.

#### **Unit-V**

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

### **BMSD, Agricultural Structures and Environment Control Lab (0-0-2) 1**

- (1) Measurements for environmental parameters and cooling load of a farm building,
- (2) Design and layout of a dairy farm.
- (3) Design and layout of a poultry house.
- (4) Design and layout of a goat house/sheep house.
- (5) Design of a farm fencing system
- (6) Design of a feed/fodder storage structures,
- (7) Design of grain storage structures,
- (8) Design and layout of commercial bag and bulk storage facilities,
- (9) Study and performance evaluation of different domestic storage structure,
- (10) Estimation of a Farm building.

**Suggested Reading:**

- 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.
- Nathonson, 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, Dutta & CO, Lucknow.

**Dairy and Food Engineering (3-0-0) 3****Unit-I**

Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.

**Unit-II**

Dairy development in India, engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems.

**Unit-III**

Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products;

**Unit-IV**

Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression.

**Unit-V**

Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing.

**Dairy and Food Engineering Lab (0-0-2) 1**

- (1) Study of pasteurizers, Study of sterilizers, Study of homogenizers.
- (2) Study of separators, Study of butter churns, Study of evaporators.
- (3) Study of milk dryers, Study of freezers, Study of filtration.
- (4) Design of food processing plants & preparation of layout.
- (5) Visit to multi-product dairy plant, Estimation of steam requirements.
- (6) Estimation of refrigeration requirements in dairy & food plant.
- (7) Visit to Food industry.

**Suggested Reading:**

- Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
- McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
- Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.
- Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press.
- Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher.

## **Department Elective Courses -3**

### **Remote Sensing and GIS (3-0-3) 3**

#### **Unit-I**

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows.

#### **Unit-II**

Principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs.

#### **Unit- III**

Planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method.

#### **Unit- IV**

Ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing.

#### **Unit-V**

GIS and basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

#### **Suggested Reading:**

- Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
- Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
- George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
- Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
- Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.

### **Waste land Development (3-0-3) 3**

#### **Unit-I**

Land degradation – concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands.

#### **Unit-II**

Planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans. Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization.

### **Unit-III**

Water harvesting and recycling methods. Afforestation - agro-horti-forestry-silvipasture methods, forage and fuel crops - socioeconomic constraints. Shifting cultivation, optimal land use options.

### **Unit-IV**

Wasteland development – hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands. Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management. Micro-irrigation in wastelands development.

### **Unit-V**

Sustainable wasteland development - drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.

### **Suggested Reading:**

- Abrol, I.P., and V.V. Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi.
- Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage - Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana.
- Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi.
- Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi.

## **Watershed Planning and Management (3-0-3) 3**

### **Unit-I**

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

### **Unit-II**

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.

### **Unit-III**

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.

### **Unit-IV**

Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation.

### **Unit-V**

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.

## **Floods and Control Measures (3-0-0) 3**

### **Unit-I**

Floods - causes of occurrence, flood classification - probable maximum flood, standard project flood, design flood, flood estimation - methods of estimation; estimation of flood peak - rational method, empirical methods, unit hydrograph method.

### **Unit-II**

Statistics in hydrology, flood frequency methods - log normal, Gumbel's extreme value, log-Pearson type-III distribution; depth-area-duration analysis. Flood forecasting. Flood routing - channel routing, Muskingum method, reservoir routing, modified Pul's method. Flood control - history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement.

### **Unit-III**

Gully erosion and its control structures - design and implementation. Ravine control measures. River training works, planning of flood control projects and their economics.

### **Unit-IV**

Earthen embankments - functions, classification - hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.

### **Unit-V**

Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes - analysis of failure by different methods. Subsurface dams - site selection and constructional features. Check dam - Small earthen embankments - types and design criteria. Subsurface dams - site selection and constructional features.

### **Suggested Reading:**

- 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.
- Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
- Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New York, Delhi.
- Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
- Bureau of Reclamation. 1987. Design of Small Dams. US Department of Interior, Washington DC, USA.
- Arora, K.R. 2014. Soil Mechanics and Foundation Engineering (Geotechnical Engineering). Standard Publishers Distributors, Delhi.
- Garg, S.K. 2014. Soil Mechanics and Foundation Engineering. Khanna Publishers Pvt. Ltd., New Delhi.



Stephens Tim. 2010. Manual on Small Earth Dams - A Guide to Siting, Design and Construction. Food and Agriculture Organization of the United Nations, Rome.

## **Water Quality and Management Measures (3-0-0) 3**

### **Unit-I**

Natural factors affecting quality of surface water and groundwater, water quality objectives in relation to domestic, industrial and agricultural activities, drinking water quality standards.

### **Unit-II**

Irrigation water quality classification as per USSL and All Indian Coordinated Research Project (AICRP) criteria,

### **Unit-III**

Point and non-point water pollution sources, and water contamination due to inorganic and organic compounds.

### **Unit-IV**

Water contamination related to agricultural chemicals, food industry, hydrocarbon and synthetic organic compounds. Arsenic and fluoride contamination in groundwater and remedial measures.

### **Unit-V**

Water decontamination technologies, cultural and management practices for using poor quality water for irrigation.

### **Suggested Reading::**

FAO. 1996. Control of water pollution from agriculture - FAO irrigation and drainage paper 55  
Gray, N.F. Water Technology. Raj Kamal Electric Press, Kundli, Haryana.

Hussain, S.K. 1986. Text Book of Water Supply and Sanitary Engineering. Oxford & IBH  
Publishing Co. New Delhi.

Manahan, S.E. 2009. Fundamentals of Environmental Chemistry. CRC Press, New York.

McGauhey, P.H. 1968. Engineering Management of water quality. McGraw Hill Book Company,  
New York.

Minhas, P.S. and Tyagi, N.K. 1998. Guidelines for irrigation with saline and alkali waters. Bull. No,  
1/98, CSSRI, Karnal, p. :36

Punmia, B.C. and Lal, P.B.B. 1981. Irrigation and water power engineering. Standard Publishers  
Distributors, Delhi.

## **Information Technology for Land and Water Management (3-0-0) 3**

### **Unit-I**

Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Existing system of information generation and organizations involved in the field of land and water management.

### **Unit-II**

Application and production of multimedia. Internet application tools and web technology. Networking system of information. Problems and prospects of new information and communication technology. Development of database concept for effective natural resources management.

### **Unit-III**

Application of remote sensing, geographic information system (GIS) and GPS. Rational data base management system. Object oriented approaches. Information system, decision support systems and expert systems.

### **Unit-IV**

Agricultural information management systems - use of mathematical models and programmes. Application of decision support systems, multi sensor data loggers and overview of software packages in natural resource management. Video-conferencing of scientific information.

## **Unit-V**

Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

### **Suggested Reading::**

- Climate-Smart Agriculture – Source Book. 2013. Food and Agriculture Organization, Rome.
- Daniel P. Loucks and Eelco van Beek. 2005. Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications. UNESCO, Paris.
- Dipak De and Basavaprabhu Jirli (Eds.). 2010. Communication Support for Sustainable Development. Ganga Kaveri Publishing House, Varanasi – 221001.
- FAO. 1998. Land and Water Resources Information Systems. FAO Land and Water Bulletin 7, Rome.
- Fuling Bian and Yichun Xie (Eds.). 2015. Geo-Informatics in Resource Management and Sustainable Ecosystem. Springer, New York.
- ICFAI Business School (IBS). 2012. Information Technology and Systems. IBS Centre for Management Research, Hyderabad.
- Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Environmental Science. Springer, New York.
- Sarvanan. R. 2011. Information and Communication Technology for Agriculture and Rural Development. New India Publishing Agency, New Delhi.
- Soam, S.K., P.D. Sreekanth and N.H. Rao (Eds.). 2013. Geospatial Technologies for Natural Resources Management. New India Publishing Agency, Delhi.

## **Department Elective course-4**

**Ground water well & Pumps            (3-1-0)            4**

### **Unit-I**

Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tube wells and open wells, familiarization of various types of bore wells; design of open wells; groundwater exploration techniques.

### **Unit-II**

methods of drilling of wells: percussion, rotary, reverse rotary; design of tube well and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's Theis recovery method; well interference, multiple well systems,

### **Unit-III**

Estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques. Pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity.

### **Unit-IV**

Head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

### **Suggested Reading:**

- Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata McGraw Hill.
- Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).
- Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.

**Unit-I**

Human factors in system development – concept of systems; basic processes in system development, performance reliability, human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays.

**Unit-II**

Speech communications. Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices.

**Unit-III**

Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

**Unit-IV**

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

**Unit-V**

Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.

**Suggested Reading:**

Chapanis A. 1996. Human Factors in System Engineering. John Wiley & Sons, New York.

Dul J. and Weerdmeester B. 1993. Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.

Mathews J. and Knight A. A. 1971. Ergonomics in Agricultural Equipment Design. National Institute of Agricultural Engineering.

Astrand P. And and Rodahl K. 1977. Textbook of Work Physiology. Mc Hill Corporation, New York.

Mark S. Sanders and Ernest James McCormick. 1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.

Keegan J J, Radke AO. 1964. Designing vehicle seats for greater comfort. SAE Journal;72:50~5.

Yadav R, Tewari V.K. 1998. Tractor operator workplace design-a review. Journal of Terra mechanics 35: 41-53.

**Unit-I**

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines.

**Unit-II**

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.

**Unit-III**

Introduction to sensors and application of sensors for data generation. Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations.

**Unit-IV**

Application to PERT and CPM for machinery system management. Protected cultivation.

## **Unit-V**

Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets.

### **Suggested Reading:**

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.

**CAD & CAM computer graphics. (3-1-0) 4**

## **UNIT-I**

Introduction: Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications Computer Graphics-I CAD/CAM systems, Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner.

### **Unit-II**

Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Colour CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

### **Unit-III**

Computer Graphics-II Graphics standards, Graphics Software, Software Configuration, Graphics Functions.

### **Unit-IV**

Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm.

### **Unit-V**

Implementation of CAD in - CAM - CIM - RPT, kinematic analysis, Manufacturability analysis, simulation and Animation – Types – Techniques.

### **Suggested Reading:.**

Ibrahim Zeid, "CAD / CAM - Theory and Practice 2E", Tata Mcgraw-Hill, New Delhi, 2010.

Radhakrishnan.P, "CAD / CAM / CIM", New age international, 2008.

Chriss McMahan and Jimmie Browne, "CAD/CAM", Addison Wesley, New York, 2000.

**Testing of Agricultural Machinery and Tractors (3-1-0) 4**

## **UNIT- I**

Basic objectives of testing of agricultural equipment; concept and importance. Different terminology used in testing of agricultural equipment, I.C engines and tractors. Different types of transducer and their uses, instrumentation for draft, slip, sinkage, soil resistance, sound and vibration. Hardness of material. Test codes: Nebraska, OECD, RNAM,BS,ISO,BIS etc. Testing of primary and secondary tillage tools, sowing/planting equipment, weeding tools,

## **UNIT- II**

Harvesting machinery, power threshers, combine harvesters, sprayers, dusters etc. as per BIS standard. Testing of I.C. engines and tractors as per BIS test codes. Basic objectives of testing agricultural equipment: Concept and importance. Different terminology used in testing of agricultural equipment, I.C. engines and tractors. Different types of transducers and their uses, instrumentation for draft, slip, sinkage, soil resistance, sound and vibration measuring instruments. Hardness measuring instruments.















Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste.

**Suggested Reading:**

Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.

Alan L: Farredbruch & R.H. Buse. 1983. Fundamentals of Solar Academic Press, London.

Bansal N.K., Kleemann M. & Meliss Michael. 1990. Renewable Energy Sources & Conversion Technology; Tata Mecgrow Publishing Company, New Delhi.

Rathore N. S., Kurchania A. K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.

Mathur, A.N. & N.S. Rathore. 1992. Biogas Production Management & Utilization. Himanshu Publications, Udaipur.

Khandelwal, K.C. & S.S. Mahdi. 1990. Biogas Technology.

Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

Mathur A.N. & N.S. Rathore. Renewable Energy Sources Bohra Ganesh Publications, Udaipur.