

**DAYALBAGH EDUCATIONAL INSTITUTE  
FACULTY OF ENGINEERING  
B.TECH. (AGRICULTURAL ENGINEERING)**

**SIXTH SEMESTER**

<b>COURSE NUMBER</b>	<b>COURSE TITLE</b>	<b>Credits</b>	<b>End sem. Exam.</b>	<b>Theory/ Practical</b>
MEM614	MACHINE DESIGN	3.0	Y	T
MEM615	DESIGN PRACTICE AND CAD APPLICATIONS	2.0	Y	P
AEM601	AGRICULTURAL STRUCTURES AND ENVIRONMENT CONTROL	3.0	Y	T
AEM602	WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT	3.0	Y	T
AEM603	REMOTE SENSING AND GIS	2.0	Y	T
AEM604	SOIL AND WATER LAB	1.0	Y	P
AEM605	FARM MACHINERY AND EQUIPMENT II	2.0	Y	T
AEM606	FARM MACHINERY AND EQUIPMENT II LAB	1.0	Y	P
AEM607	RENEWABLE POWER SOURCES	2.0	Y	T
EGC681	DESIGN ENGG./THEME DEVELOP. PROJECT	1.0	Y	P
CEC681	CULTURAL EDUCATION	2.0	N	T
CAC681	CO-CURRICULAR ACTIVITIES	3.0	N	P
<b>MAINSTREAM AGRICULTURAL ENGINEERING</b>				
AEM608	DRAINAGE ENGINEERING	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
<b>DAIRY ENGINEERING SPECIALIZATION</b>				
AEM611	RHEOLOGY OF DAIRY PRODUCTS	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
<b>AGRITECH &amp; ENTREPRENEURSHIP SPECIALIZATION</b>				
AEM612	INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
<b>TOTAL CREDITS</b>		<b>29.0</b>		

**Course Number: MEM614, Course Title: MACHINE DESIGN**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 39

**UNIT 1**

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.

**UNIT 2**

Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded joints 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.

**UNIT 3**

Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings.

**UNIT 4**

Design of flat belt and V-belt drives and pulleys. Design of gears.

**UNIT 5**

Design of screw motion mechanisms like screw jack, lead screw, etc., Selection of anti-friction bearings.

**SUGGESTED READING:**

Jain R.K., MACHINE DESIGN

Khurmi R.S. and Gupta J.K., A TEXT BOOK OF MACHINE DESIGN

**Course No: MEM615, Course Title: DESIGN PRACTICE AND CAD APPLICATIONS**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 4(L:0+T:0+P:4+S:0), Min.pds./sem:52

1. Application of computers for design. CAD- Overview of CAD window — Explanation of various options on drawing screen.
2. Study of draw and dimension tool bar. Practice on draw and dimension tool bar.
3. Study of OSNAP, line thickness and format tool bar, line thickness and format tool bar. Practice on mirror, offset and array commands.
4. Practice on trim, extend, chamfer and fillet commands. Practice on copy, move, scale and rotate commands.
5. Drawing of 2 D- drawing using draw tool bar. Practice on creating boundary, region, hatch and gradient commands.
6. Practice on Editing polyline- PEDIT and Explode commands. Setting of view ports for sketched drawings. Printing of selected view ports in various paper sizes.
7. 2D- drawing of machine parts with all dimensions and allowances- Foot step bearing and knuckle joint. Sectioning of foot step bearing and stuffing box.
8. Drawing of hexagonal, nut and bolt and other machine parts.
9. Practice on 3-D commands- Extrusion and loft. Practice on 3-D commands-on sweep and press pull. Practice on 3-D Commands- revolving and joining.
10. Demonstration on CNC machine and simple problems.

**Suggested Readings**

Rao P.N.. 2002. CAD/CAM Principles and Applications. McGraw-Hill Education Pvt. Ltd., New Delhi.

Sareen Kuldeep and Chandan Deep Grewal. 2010. CAD/CAM Theory and Practice. S.Chand & Company Ltd., New Delhi.

**Course Number: AEM601, Course Title: AGRICULTURAL STRUCTURES AND ENVIRONMENTAL CONTROL**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

**Unit1**

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,

#### Unit2

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.

#### Unit3

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.

#### Unit4

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.

#### Unit5

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.

#### Suggested Readings

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.

### **Course Number: AEM602, Course Title: WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 42

#### Unit1

Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. Hydrologic processes- Interception, infiltration -factors influencing, measurement and indices. Evaporation - Estimation and measurement.

#### Unit2

Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method. Geomorphology of watersheds - Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency.

#### Unit3

Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood. Flood routing - channel and reservoir routing. Drought - classification, causes and impacts, drought management strategy.

#### Unit4

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, soil characteristics, vegetative cover, 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.

#### Unit5

Dry farming techniques, Integrated watershed management - concept, components, Participatory watershed management - role of watershed associations, user groups and self-help groups. People's participation in watershed management, Estimate preparation for watershed projects- Detailed estimate-Analysis of rates-Abstract of estimate. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis. Preparation of detailed project report (DPR) for watershed projects.

#### Suggested Readings

- Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.  
Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.  
Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.  
Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Ltd Pub, New Delhi.  
Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.  
Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.  
Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.K.  
Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.  
Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.  
Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.  
Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.  
Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.

### **Course No: AEM603, Course Title: REMOTE SENSING AND GIS**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

#### Unit1

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.

#### Unit2

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, planning aerial photography- end lap and side lap.

#### Unit3

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; ground control for aerial photograph.

#### Unit4

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.

#### Unit5

GI Sand 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 Readings

- 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 Pubn Agency, New Delhi.
- George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) P Ltd, Hyderabad.
- Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Ltd, 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.
- Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.
- Sahu, K.C. 2008. Text Book of Remote Sensing and Geographic Information Systems. Atlantic Publishers and Distributors (P) Ltd., New Delhi.
- Shultz, G.A. and E.T. Engman. 2000. Remote Sensing in Hydrology and Water Management Springer, New York

#### **Course No: AEM604, Course Title: SOIL AND WATER LAB**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Study of different types and forms of water erosion.
2. Exercises on computation of rainfall erosivity index.
3. Computation of soil erodibility index in soil loss estimation.
4. Exercises on soil loss estimation/measuring techniques.
5. Study of rainfall simulator for erosion assessment.
6. Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor. Determination of sediment concentration through oven dry method.
7. Design and layout of contour bunds / graded bunds.
8. Design and layout of broad base terraces / bench terraces.
9. Design of vegetative waterways.
10. Study of different types of farm ponds / Computation of storage capacity of embankment type of farm ponds. Design of dugout farm ponds. Design of percolation pond and nala bunds.
11. Runoff measurement using H-flume.
12. Exercise on hydraulic jump / Hydrologic, hydraulic and structural design of drop spillway and stability analysis.
13. Practice on softwares for design of soil and water conservation structures.
14. Field visit to watershed project areas treated with soil and water conservation measures / structures.

#### **Course Number: AEM605, Course Title: FARM MACHINERY AND EQUIPMENT-II**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

##### Unit1

Introduction to plant protection equipment – sprayers and dusters. Classification of sprayers and sprays. Types of nozzles. Calculations for calibration of sprayers and chemical application rates. Introduction to interculture equipment.

##### Unit2

Use of weeders – manual and powered. Study of functional requirements of weeders and main components. Familiarization of fertilizer application equipment. Study of harvesting operation – harvesting methods, harvesting terminology. Study of mowers – types, constructional details, working and adjustments.

##### Unit3

Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle of operation and constructional details. Importance of hay conditioning, methods of hay conditioning, and calculation of moisture content of hay. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications.

##### Unit4

Types of threshers- tangential and axial, their constructional details and cleaning systems. Study of factors affecting thresher performance. Study of grain combines, combine terminology, classification of grain combines, study of material flow in combines. Computation of combine losses, study of combine troubles and troubleshooting. Study of chaff cutters and capacity calculations. Study of straw combines – working principle and constructional details.  
Unit5

Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled. Study of potato and groundnut diggers. Study of Cotton harvesting – Cotton harvesting mechanisms, study of cotton pickers and strippers, functional components. Study of maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools.

#### Suggested Readings

Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.

Smith HP and LH Wilkey. Farm Machinery and Equipment.

Culpin Claude. Farm Machinery.

Srivastava AC. Elements of Farm Machinery.

Lal Radhey and AC Datta. Agricultural Engineering Principles of Farm Machinery.

### **Course No: AEM606, Course Title: FARM MACHINERY AND EQUIPMENT-II LAB**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Familiarization with plant protection and interculture equipment.
2. Study of sprayers, types, functional components.
3. Study of dusters, types and functional components.
4. Calculations for chemical application rates.
5. Study of nozzle types and spread pattern using patternator.
6. Familiarization with manual and powered weeding equipment and identification of functional components.
7. Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters.
8. Study of various types of mowers, reaper, reaper binder. Study of functional components of mowers and reapers.
9. Familiarization with threshing systems, cleaning systems in threshers. Calculations of losses in threshers.
10. Familiarization with functional units of Grain combines and their types. Calculations for grain losses in a combine.
11. Study of root crop diggers and familiarization with the functional units and attachments.
12. Familiarization with the working of cotton and maize harvesters.
13. Familiarization with vegetable and fruit harvesters.

### **Course Number: AEM607, Course Title: RENEWABLE POWER SOURCES**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

#### Unit1

Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. OTEC, MHD, hydrogen and fuel cell technology. Fuel cells and its associated parameters.

#### Unit2

Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste. Design & use of different commercial sized biogas plant.

#### Unit3

Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant

#### Unit4

Wind farms. Aero-generators. Wind power generation system. Power generation from biomass (gasification & Dendro thermal), Mini and micro small hydel plants.

## Unit5

(Practicals) Performance evaluation of solar water heater and solar cooker; Characteristics of solar photovoltaic panel; evaluation of solar air heater/dryer; Performance evaluations: biomass gasifier engine system (throatless & downdraft), fixed dome type biogas plant and floating drum type biogas plant; Estimation of calorific value of biogas & producer gas; Testing of diesel engine operation using dual fuel and gas alone.

### Suggested Readings

Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.  
Alan L: Farredbruch & R.H. Buse. 1983. Fundamentals of Solar Cells. 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.

### **Course Number: EGC681, Course Title: DESIGN ENGG./THEME DEVELOP. PROJECT**

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01  
Total Credits:1.0, Periods(55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem: 39  
The students submit projects connected to Design Engineering Concept and Theme development of real life industrial problems.

### **Course Number: CEC681, Course Title: CULTURAL EDUCATION**

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 1999-2000  
Total Credits:2, Periods(55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 26  
1. Introduction: (a) What is culture (b) Meaning and scope of Indian culture (c) The composite nature of Indian culture.  
2. Pre-Vedic Harappan Culture.  
3. Indian Literature: (a) Indian language (b) Vedic language (c) Epics & Purans (d) Major authors in classical Sanskrit literature (e) Buddhist literature, Pali Tripitakas, Pali literature (f) Buddhist literature of Mahayan Sutra (g) Jain literature of Agamas (h) Main currents of Bhakti literature.  
4. State and Society: (a) Ideals of Kinship (b) Republican traditions (c) Education d) Marriage and family life (e) Varna organisation-Caste system (f) Position of women (g) Religion, state & society.  
5. ARTS: (a) Architecture- (i) Stupas and Viharas (ii) Temples (iii) Mosques and Palaces (b) Sculpture and paintings (c) Music and Dance (d) Sports and entertainment (e) Art of Warfare.  
6. UNITY IN DIVERSITY: (a) Non-Aryan elements (b) West-Asian elements (c) Aryan elements (d) European elements.

### SUGGESTED READINGS:

Basham AL: THE WONDER THAT WAS INDIA Rawlinsson: CULTURAL HISTORY OF INDIA  
Stella Kramrisch: INDIAN SCULPTURE Coomaraswamy AK: HISTORY OF INDIAN & UNCONESIAN ART  
Coomaraswamy AK: ARTS & CRAFTS OF INDIA Percy Brown: INDIAN PAINTINGS  
Chatterjee Suniti Kumar: LANGUAGES AND LITERATURE OF MODERN INDIA V Raghvan: INDIAN HERITAGE  
Bishan Swarup: THEORY OF INDIAN MUSIC Diwakar RD & KM: INDIAN INHERITANCE PT. I TO III  
Edward Conze: BUDDHIST SCRIPTURES Saxena Maheshwar Narain: SANGIT SHASTRA  
Ray, Nihar Ranjan: AN APPROACH TO INDIAN ART Wintarnitz: HISTORY OF INDIAN LITERATURE (3 Vol)  
Ramkrishna Mission: CULTURAL HERITAGE OF INDIA Mocdonell AA: HISTORY OF SANSKRIT LITERATURE  
Sahitya Akademi, N.Delhi: CONTEMPORARY INDIAN LITERATURE Mukerjee RK: SOCIAL FUNCTIONS OF ART  
Saxena Ranveer: KALA AUR KALAKAR Lunia BN: PRACHIN BHARTIYA SANSKRATI  
Singh Rajkishore: BHARTIYA KALA AUR SANSKRATI Upadhyay Baldeo: SANSKRATI SHASTRO KA ITIHAS

### **Course Number: CAC681, Course Title: CO-CURRICULAR ACTIVITIES**

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01  
Total Credits:3, Periods(55 mts. each)/week: 3 for 26 weeks, Min.pds./sem: 52  
Participation by the students in sports and games, literary, social, cultural and professional activities is compulsory. The proficiency attained in them is evaluated every year and counted

in the assessment of the overall performance of the student to encourage a balanced and all-round development of their personality.

**Course Number: AEM608, Course Title: DRAINAGE ENGINEERING**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

Unit1

Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state.

Unit2

surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table; derivation of Hooghoudt's and Ernst's drain spacing equations.

Unit3

Subsurface drainage system: Design of subsurface drainage system; drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains.

Unit4

Drainage structures, drainage structures; vertical drainage; bio- drainage; mole drains; salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

Unit5

Special drainage systems: vertical drainage; bio-drainage; mole drains. Salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

Suggested Readings

Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles , Methods and Applications.

Vikas Publication House, Noida (UP).

Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised).

Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers, New Delhi.

Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage- Principles and Practices, Westville Publishing House. FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy.

**Course No: AEM609, Course Title: EXPERIENTIAL LEARNING**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits:1.0, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:52

FOR MAINSTREAM AGRICULTURAL ENGINEERING

Visit to IARI, ICAR facilities, Time series climate data analyses using programming language, To calculate crop water requirement by real time soil moisture measurement, Exercises on running computer software packages dealing with water balance, crop production, land development, land and water allocation, watershed analysis etc, to conduct a GPS survey to locate different water bodies and different land use practices in the campus, to identify drought prone and flood areas using RS and GIS, Understanding operation and maintenance of Tractor, Autonomous vehicles and Unmanned Aerial Vehicles (UAVs) for farming, AI and related high level languages like Java/python Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor. Driving practice of tractor. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement. Hitching & De-hitching of mounted and trail type implement to the tractor. Driving practice with a trail type trolley – forward and in reverse direction. Introduction to tractor maintenance – precautionary and break-down maintenance. Tractor starting with low battery charge. Introduction to trouble shooting in



tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage. Care and maintenance procedure of agricultural machinery during operation and off-season. Repair and maintenance of implements – adjustment of functional parameters in tillage implements. Replacement of broken components in tillage implements. Replacement of furrow openers and change of blades of rotavators. Maintenance of cutter bar in a reaper. Adjustments in a thresher for different crops. Replacement of V-belts on implements. Setting of agricultural machinery workshop. Service, maintenance, repair and operation of pumps, electric motors and different irrigation equipment.

**Suggested Readings**

Ghosh RK and S Swan. Practical Agricultural Engineering.  
Black PO and WE Scahill. Diesel Engine Manual.  
Southorn N. Tractor operation and maintenance.  
Jain SC and CR Rai. Farm Tractor Maintenance and Repair.  
Operators manuals of tractors.  
Service manuals provided by manufacturers.

**FOR DAIRY ENGINEERING SPECIALIZATION**

Visit to IARI, ICAR facilities, Understanding operation and maintenance of RFID, HPP (High Pressure Processing), Pulse Electric Field (PEF), nano and imaging sensors in dairy and food processing, high level languages like Java/python, Maintenance and operation of R & AC equipment used in Dairy Plant. Operation and maintenance of different machinery and equipment used in Food Processing industries.

**FOR AGRITECH AND ENTREPRENEURSHIP SPECIALIZATION**

Visit to IARI, ICAR facilities, SWOT analysis to start a food processing business, Preparation of business proposal for small scale industry, Analysis of financial statements (Balance Sheet, Profit loss statement), Application of project appraisal technique, Formulation of project feasibility reports, Individual Presentation of model project proposals in the class, Group Presentation of model project proposals in the class.

**Course Number: AEM610, Course Title: STREAM SEMINAR**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:0+S:2), Min.pds./sem: 26

The students will present seminar on the topics of their interest pertaining to agricultural engineering in their stream of specialization. The presentation will be evaluated based on topic selection presentation, response to questions during discussion.

**Course Number: AEM611, Course Title: RHEOLOGY OF DAIRY PRODUCTS**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

**UNIT 1**

Introduction to rheology of foods: Definition of „texture“, „rheology“ and „psychophysics“ – their structural basis; physical considerations in study of foods; salient definitions – Stress tensor and different kinds of stresses.

**UNIT 2**

Rheological classification of Fluid Foods : Shear-rate dependence and time dependence of the flow-curve; Non-Newtonian fluids; thixotropy; Mechanisms and relevant models for non-Newtonian flow; Effect of temperature; Compositional factors affecting flow behaviour; Viscosity of food dispersions – dilute and semi-dilute systems, concentration effects.

**UNIT 3**

Comparative assessment of different types of Viscometers, and their Merits and Limitations: Co-axial cylinders, Spindle- or Impeller-type viscometers, Cone-plate viscometer, Capillary

viscometers, Falling-sphere viscometer, Vibratory viscometers, Extrusion viscometer, Orifice viscometer.

#### UNIT 4

Rheology of semi-solid and solid food ; Rheological characterization of foods in terms of stress-strain relationship; Viscoelasticity; Transient tests - Creep Compliance and Stress Relaxation; mechanical models for viscoelastic foods: Maxwell, Kelvin, Burgers and generalized models and their application; Dynamic measurement of viscoelasticity.

#### UNIT 5

Large Deformations and failure in foods: Definitions of fracture, rupture and other related phenomena; Texture Profile Analysis; Instrumental measurements – Empirical and Fundamental methods; Rheometers and Texture Analyzers; Measurement of Extensional viscosity; Acoustic measurements on crunchy foods.

Rheological and textural properties of selected dairy products: Measurement modes and techniques; Effect of processing and additives (stabilizers and emulsifiers) on food product rheology; Relationship between instrumental and sensory data.

SUGGESTED READINGS Barbosa-Canovas GV, Kokini JL, Ma L & Ibarz A. 1997. *Rheology of Semi-liquid foods*. *Adv. Food & Nutr. Res.*, 39:1-69. DeMann JM, Voisey PW, Rasper VF & Stanley DW. 1976. *Rheology and Texture in Food Quality*. AVI Publ. NDRI. 1996. *Sensory Evaluation & Rheology of Milk & Milk Products*. Lecture Compendium, CAS/DT Short Course, Aug. 22-Sept.13, 1996. Dairy Technology Division, NDRI, Karnal. Sherman P. 1970. *Industrial Rheology*. Academic Press.

### **Course Number: AEM612, Course Title: INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

#### Unit1

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.

#### Unit2

Application and production of multimedia. Internet application tools and web technology. Networking system of information.

#### Unit3

Problems and prospects of new information and communication technology. Development of database concept for effective natural resources management. Application of remote sensing, geographic information system (GIS) and GPS. Land demarcation and correction at farm fields, Rational data base management system.

#### Unit4

Object oriented approaches. Information system, decision support systems and expert systems. Agricultural information management systems - use of mathematical models and programmes.

#### Unit5

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

#### Suggested Readings

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.