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B.Tech in Agricultural Engineering

SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAE501	DCS	Tractor Systems and Controls	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class.

Course Objectives:

1. To learn the function of tractor systems and controls system.
2. To apply the principles of design of tractor systems and controls system.
3. To identify ergonomic considerations and operational safety in Tractor.
4. To learn the fundamental concepts of tractor mechanics.

Course Outcomes:

1. Students will be able to understand the function of transmission, clutch, and gear Box systems.
2. Students will be able to have knowledge and skill on tractor brake system and steering system.
3. Students will be able to understand various types of hydraulic system in a tractor.
4. Students will be able to understand various tractor static equilibrium.
5. Students will be able to understand tractor stability especially at turns.

Syllabus:

UNIT I **10HRS**

Transmission system – types, need for transmission system in a tractor. Major functional systems.

Study of clutch – need, types, functional requirements, construction, and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems.

Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio.

UNIT II **9HRS**

Differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive.

Brake system – types, principle of operation, construction, calculation for braking torque.

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UNIT III **8HRS**

Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the hydraulic system adjustments and ADDC Automatic Depth and Draft Control System. Study of tractor power outlets – PTO. PTO standards, types, and functional requirements.

Introduction to traction - Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device.

UNIT IV **7HRS**

Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor.

Wheels and Tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.

UNIT V **8HRS**

Steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors.

Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes

Text Books:

1. Dr. Rohinish Khurana, Dr. V. M. Duraiswamy, Tractor Systems & Controls.
2. J. B. Liljedahl, P. K. Turnquist, D. W. Smith and Makoto Hoki, "Tractors and Their Power Units", 4th edition, CBS Publishers, 1996
3. Kumar S,Tractor at A Glance 2017.

Reference Books:

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

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List of Practical's:

1. Introduction to transmission systems and components.
2. Study of clutch functioning, parts, and design problem on clutch system.
3. Study of different types of gear box, calculation of speed ratios, design problems on gear box.
4. Study of brake systems and some design problems.
5. Steering geometry and adjustments.
6. Study of hydraulic systems in a tractor, hydraulic trainer, and some design problems.
7. Determination of location of CG of a tractor, Moment of Inertia of a tractor.
8. Study on differential and final drive and planetary gears.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teacher Assessment*
BTAE502	DCS	Farm Machinery and Equipment-I	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To provide a sound knowledge in the study of agricultural power and machinery in order to facilitates student's interest in agricultural engineering.
2. Discuss various power sources available for agricultural work.
3. Be able to select, and use appropriate agricultural machinery.

Course Outcomes:

1. Student will able to understand with farm mechanization, and identify the major functional components of farm machinery and forces acting on various tillage implements.
2. Student will able to understand significance of power to operate farm machinery.

Syllabus:

UNIT I **10HRS**

Introduction to farm mechanization. Classification of farm machines. Identification and selection of machines for various operations on the farm and cost estimation. Unit operation in crop production. Hitching systems and controls of farm machinery. Calculation of field capacities and field efficiency use with numerical problems. Calculations for economics of machinery usage, comparison of ownership with hiring of machines.

UNIT II **9HRS**

Introduction to seed-bed preparation. Familiarization with land reclamation and earth moving equipment. Familiarization with land reclamation and earth moving equipment. Tillage: objectives, methods and terminology, introduction and classification of primary & secondary tillage equipment. Machinery used for primary tillage, secondary tillage, rotary tillage, deep tillage, minimum tillage and conservation tillage. Draft measurement of tillage equipment, Methods of Ploughing.

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UNIT III

Study of mould board plough: accessories, adjustments, operation and material of construction mould board ploughs. Disc plough: standard and vertical; principle of operation, adjustments and accessories. **8HRS**

Sub-soiler and chisel plough: types, working and construction. Construction and working of Disc harrows, Spike-tooth and spring-tine harrows. Forces acting upon tillage tool/ implement and symbols used in tillage force analysis.

UNIT IV **7HRS**

Introduction to sowing, planting & transplanting equipment. Study of working of seed drills, no-till drills, happy seeder and strip-till drills. Brief description and working of planters. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation.

UNIT V

Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components. **8HRS**

Text Books:

1. Kepner, R.A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery, CBS Publishers and Distributors, Delhi-17
2. Bosoi, E.S. (1990). Theory, Construction and Calculation of Agricultural Machines (Vol. 1 and 2). Oxonion Press Pvt. Ltd., New Delhi.
3. Smith Harris Pearson, H.E., and Lambent Herry Wilkes, M.S. (1977). Farm Machinery and Equipment. Tata Mc Graw-Hill Publishing Company Ltd., New Delhi.
4. Srivastava, A.C. (1990). Elements of Farm Machinery. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi

Reference Books:

1. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi.
2. JagdiswarSahay – Elements of Agricultural Engineering .
3. Nakra C.P (1970). Farm machinery and equipment. Dhanpat Rai Publishing Company Ltd, New Delhi

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List of Practical's:

1. Introduction to various farm machines.
2. Study of hitching and control systems.
3. Field capacity and field efficiency measurement for at least two machines/implements.
4. Study of primary and secondary tillage– construction, operation, adjustments and calculations of power and draft requirements.
5. Construction details, adjustments and working of M.B. plow, disc plow and disc harrow.
6. Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments.
7. Study of transplanters – paddy, vegetable, etc.
8. Identification of materials of construction in agricultural machinery and study of material properties.
9. Study of heat treatment processes subjected to critical components of agricultural machinery.

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							THEORY			PRACTICAL	
							D SEM University E	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment
BTAE503	DCS	Agricultural Structures and Environmental Control	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class.

Course Objectives:

1. To make students familiar with different farm structures with environmental control parameters
2. To understand the importance of planning and lay out of a farmstead.
3. Know about various standards for various dairy, piggery, poultry and other farm structures.
4. Know about rural electrification, concepts of ecosystem, bio-diversity, environmental pollution and control, solid waste, plant waste management

Course Outcomes:

1. To prepare estimate for different farm buildings, structures, roads, fencing and construction, repair and maintenance of farm structures
2. Design and layout of farm buildings, poultry houses, goat houses, bio-gas plant, farm roads, fencing etc.
3. Measure different environmental parameters and indicators, ventilation, air temperature, cooling load of farm buildings

Syllabus:

Unit I **10HRS**

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.

Unit II **9HRS**

B.I.S standard for dairy, poultry, piggery and other farm structures. Design, construction, building materials, methods of cost estimation and cost estimation of farm residence, farm structures; animal shelters, compost pits, fodder silos, fencing and implements sheds, barn for cows, buffalos, and poultry etc.

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Unit III **8HRS**

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.

Unit IV **7HRS**

Importance of 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),

Unit V **8HRS**

Design considerations for grain storage go downs, Bag storage structures, Shallow and Deep bins, Calculation of pressure in bins, Storage of seeds, 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.

Text/ Reference Books:

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

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List of Practical's: (If Practical Credit Shown in Syllabus)

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.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAE504	DCS	Post Harvest Engineering of Cereals, Pulses and Oil Seeds	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To provide basic knowledge of storage, losses, nutritional value, milling and processing of cereal grains, pulses & oilseeds.
2. To provide knowledge of Milling processes and equipment's involved.
3. To provide knowledge of Quality Aspects of milled products.

Course Outcomes:

After successful completion of the course the students will be able to:

1. Understand the postharvest losses, storage, and nutritional value of grains.
2. Characterize the grains, pulses, and oilseeds based on milling characteristics.
3. Gain insight into milling and subsequent processing of milled products for value addition.
4. Gain insight into the quality aspects of milled products and the relevant parameters and their estimation

Syllabus:

UNIT I **10HRS**

Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity, and effectiveness of screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, color sorters, cyclone, shape graders.

UNIT II **9HRS**

Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill. Material handling equipment. Types of conveyors: Belt, roller, chain, and screw. Elevators: bucket, Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Pneumatic conveying.

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UNIT III

Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC determination, Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sun-mechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray. **8HRS**

UNIT IV

Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods, and pastes. Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. **7HRS**

UNIT V

Milling of wheat, unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling, and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin-screw extruders. By-product's utilization. **8HRS**

Text Books:

1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
4. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi

Reference Books:

1. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London.
3. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
4. Singh, R. Paul. and Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

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List of Practical's:

1. Performance evaluation of different types of cleaners and separators.
2. Determination of separation efficiency.
3. Study of different size reduction machines and performance evaluation.
4. Determination of fineness modulus and uniformity index.
5. Study of different types of conveying and elevating equipment's.
6. Study of different types of mixers.
7. Measurement of moisture content: dry basis and wet basis.
8. Study on drying characteristics of grains and determination of drying constant.
9. Determination of EMC (Static and dynamic method).
10. Study of various types of dryers.
11. Study of different equipment's in rice mills and their performance evaluation.
12. Study of different equipment's in pulse mills and their performance evaluation.
13. Study of different equipment's in oil mills and their performance evaluation.
14. Type of process flow charts with examples relating to processing of cereals pulses and oil seeds.
15. Visit to grain processing industries.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAE505	**DCS**	**Watershed Planning and Management**	1	0	1	2	50	30	0	15	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class.

Course Objectives:

To give the students overall idea about:

1. Proper use of all available resources of a watershed for optimum production with minimum hazards to natural resources.
2. Relate interdisciplinary topics such as the use of public policies, regulations, and management tools to effectively manage water resources for a sustainable future.

Course Outcomes:

These educational objectives are supported by a curriculum that seeks to have its graduates achieve the following student outcomes:

1. Understand the concepts of watershed management and its effect on land, water, and ecosystem resources.
2. Analyse public policies and practices of watershed planning.
3. Assess the impact of watershed planning through case studies.
4. Develop control and mitigation techniques for watershed problems.

Syllabus:

UNIT-I **10HRS**

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 **9HRS**

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.

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UNIT-III **8HRS**

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.

UNIT-IV **7HRS**

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.

UNIT-V **8HRS**

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.

Textbooks/ Reference Books:

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. 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.
3. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
4. 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.
5. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
6. Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.
7. Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
8. Tideman,E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.

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List of Practical's:

1. Exercises on delineation of watersheds using toposheets.
2. Surveying and preparation of watershed map.
3. Quantitative analysis of watershed characteristics and parameters.
4. Watershed investigations for planning and development.
5. Analysis of hydrologic data for planning watershed management.
6. Water budgeting of watersheds.
7. Prioritization of watersheds based on sediment yield index.
8. Study of functional requirement of watershed development structures.
9. Study of watershed management technologies.
10. Practice on software's for analysis of hydrologic parameters of watershed.
11. Study of role of various functionaries in watershed development programmes.
12. Techno-economic viability analysis of watershed projects.
13. Visit to watershed development project areas.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAE506	DCS	Renewable Power Sources	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. The students will be able to familiarize with fundamentals of renewable power sources.
2. To develop the ability to quantify the magnitude of renewable power sources.
3. Awareness about renewable energy sources and technologies.
4. Adequate inputs on a variety of issues in harnessing renewable energy.
5. Recognize current and possible future role of renewable energy sources.

Course Outcomes:

1. Student will able to understand the renewable power sources.
2. Student will able to understand about wind power system.
3. Student will able to understand various types of biogas plant.
4. Student will able to understand various types of solar and wind power system.
5. Student will able to understand the technology of fuel cell.

Syllabus:

UNIT I **10HRS**

Energy sources & Availability- Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization of renewable sources. Power generation from urban, municipal and industrial waste.

UNIT II **9HRS**

Biomass Energy- Biogas technology and mechanisms, generation of power from biogas, design & use of different commercial sized biogas plant. Power generation from biomass (gasification & Dendro thermal).

UNIT III **8HRS**

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

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UNIT IV **7HRS**

Wind Energy- Wind farms- characteristics of wind, Aero-generators, Wind power generation. system.

UNIT V **8HRS**

Other Energy Sources- OTEC, MHD, hydrogen and fuel cell technology, Mini and micro small hydel plants, Fuel cells and its associated parameters.

Text Books:

1 Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2 Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.
3 Bansal N.K., Kleemann M. & Meliss Michael. 1990. Renewable Energy Sources & Conversion Technology; Tata Mecgrow Publishing Company, New Delhi.

Reference Books:

1. Alan L: Farredbruch & R.H. Buse. 1983. Fundamentals of Solar Academic Press, London....
2. Rathore N. S., Kurchania A. K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
3. Mathur, A.N. & N.S. Rathore. 1992. Biogas Production Management & Utilization. Himanshu Publications, Udaipur.
4. Khandelwal, K.C. & S.S. Mahdi. 1990. Biogas Technology.

List of Practical's:

1. Performance evaluation of solar water heater.
2. Performance evaluation of solar cooker.
3. Characteristics of solar photovoltaic panel.
4. Evaluation of solar air heater/dryer.
5. Performance evaluation of biomass gasifier engine system (throatless & downdraft).
6. Performance evaluation of a fixed dome type biogas plan.
7. Performance evaluation of floating drum type biogas plant.
8. Estimation of calorific value of biogas & producer gas.
9. Testing of diesel engine operation using dual fuel and gas alone.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAE507	DCS	Skill Development Training-I	0	0	5	5	0	0	0	60	40

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components:

Course Objectives:

1. Experiential Learning (EL) with business mode helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their own enterprise and turn job creators instead of job seekers.
2. The students will be able to understand the meaning of Entrepreneurship.
3. To develop the confidence of the students.
4. Awareness about skill development program.
5. Adequate knowledge about new business development process.

Course Outcomes:

1. Student will able to understand the new business model.
2. Student will able to understand about agriculture business.
3. Student will able to understand various types of training program related to domain.
4. Student will learn the various skills sets in entrepreneurship.
5. Student will learn problem solving skills.

The Hon'ble Prime Minister of India launched 'Student READY' programme on 25th July 2015. The term 'READY' refers to "Rural Entrepreneurship Awareness Development Yojana".

Student READY skill development training – I programme is a new initiative of Indian Council of Agricultural Research to reorient graduates of Agriculture and allied subjects for ensuring and assuring employability and develop entrepreneurs for emerging knowledge intensive agriculture. This programme includes five components i.e. Experiential Learning, Rural Awareness Works Experience, In-Plant Training / Industrial attachment, Hands-on training (HOT) / Skill development training and Students Projects.

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Student READY program of the Agricultural Engineering is proposed to have the following components:

1. Summer break after IV semester -Student READY Skill Development Training-I for five weeks in the summer break after IV semester with a credit load of 0+5 credit hours.
2. To promote professional skills and knowledge through meaningful hands on experience.
3. To build confidence and to work in project mode.

References:-

REPORT OF THE ICAR FIFTH DEANS' COMMITTEE recommended syllabi of disciplines of agricultural sciences and engineering.

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SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCEAE501	ODS	SOIL AND WATER CONSERVATION ENGINEERING	2	0	1	3	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. The students should be able to understand the fundamentals of soil erosion, its estimation and measurement.
2. To understand the basic concepts for prevention of soil erosion and methods to minimize soil erosion

Course Outcomes:

1. The students will understand the fundamentals of soil erosion, its estimation and measurement.
2. The students will be familiar with concepts for prevention of soil erosion and methods to minimize soil erosion

Syllabus:

UNIT I **10HRS**

Soil erosion - causes, types, and agents of soil erosion; water erosion - forms of water erosion, mechanics of erosion; Effect of slope, slope length, soil, vegetation, topographical features and rainfall on erosion, gullies and their classification, stages of gully development

UNIT II **9HRS**

Soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters; Rainfall erosivity - estimation by KE>25 and EI30 methods; Soil erodibility - topography, crop management and conservation practice factors.

UNIT III **8HRS**

Measurement of soil erosion - Runoff plots, soil samplers; Water erosion control measures - agronomical measures- contour cropping, strip cropping, conservation tillage and mulching.

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UNIT IV **7HRS**

Engineering measures– Bunds and terraces; Bunds - contour and graded bunds - design and surplussing arrangements; Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching; Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains; Grassed waterways and design.

UNIT V **8HRS**

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.

Text Books:

1. Singh 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.
2. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
3. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Reference Books:

1. Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering.4th Edition, John Wiley and Sons Inc. New York.
2. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi
3. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR&TI, Dehradun, Allied Printers, Dehradun.
4. Theib Y. Oweis, Dieter Prinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
5. Studer Rima Mekdaschi and Hanspeter Liniger. 2013. Water Harvesting - Guidelines to Good Practice. Centre for Development and Environment, University of Bern, Switzerland.

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List of Practical's:

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. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE.
5. Exercises on soil loss estimation/measuring techniques.
6. Study of rainfall simulator for erosion assessment.
7. Estimation of sediment rate using Coshocton wheel sampler and multislot devisor.
8. Determination of sediment concentration through oven dry method.
9. Design and layout of various type of bunds and terraces.
10. Design of vegetative waterways.
11. Exercises on rate of sedimentation and storage loss in tanks.
12. Computation of soil loss by wind erosion.
13. Design of shelterbelts and wind breaks for wind erosion control.
14. Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCEAE502	ODS	DRAINAGE ENGINEERING	1	0	1	2	50	30	0	15	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. The students should be able to understand the necessity of planning an irrigation system to provide water at the right time and right place.
2. To understand the basic concepts for planning, design and management of land drainage works in cultivated areas

Course Outcomes:

1. The students will understand the necessity of planning an irrigation system to provide water at the right time and place.
2. The students will understand the basic concepts for planning, design and management of land drainage works in cultivated areas

Syllabus:

UNIT I **10HRS**

Drainage definition; need for land drainage; history of land drainage; water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state.

UNIT II **9HRS**

Surface irrigation methods of water application, border, check basin, furrow, and contour irrigation; sprinkler and drip irrigation method, merits, demerits, selection and design; surface drainage coefficient, types of surface drainage, design of surface drains.

UNIT III **8HRS**

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; design of subsurface drainage system.

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UNIT IV **7HRS**

Drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains; drainage structures; vertical drainage; bio-drainage; mole drains.

UNIT V **8HRS**

Salt Balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water. various type of conjunctive use; advantages; conjunctive use planning.

Text Books:

1. Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP).
2. Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised).

Reference Books:

1. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi.
2. Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage Principles and Practices, Westville Publishing House.
3. FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy

List of Practical's:

1. In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method.
2. Estimation of drainage coefficients
3. Installation of piezometer and observation wells.
4. Determination of drainable porosity.
5. Design of surface drainage systems.
6. Design of gravel envelop.
7. Design of subsurface drainage systems.
8. Determination of chemical properties of soil and water.
9. Study of drainage tiles and pipes.
10. Study of sub-surface drainage system Installation.

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