Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE251**	**Title of the Course**	Soil Mechanics (CE)	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**1**	**0**	**2**	
Course Objectives	• Basic of soil mechanics – index properties and engineering properties. • Basic of slope's stability.						

Course Outcomes	
CO1	To share the elementary knowledge of soil mechanics.
CO2	To share the index and engineering properties of soil.
CO3	To share the basics the slope's stability and requirement.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-1**	Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil, classification of soils, effective and neutral stress, elementary concept of Boussinesq and Wester guards' analysis, new mark influence chart.	4	CO 1
2	**Unit-2**	Seepage Analysis; Quick condition-two-dimensional flow-Laplace equation, Velocity potential and stream function, Flow net construction. Shear strength, Mohr stress circle, theoretical relationship between principal stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory, effective stress principle.	3	CO2
3	**Unit-3**	Determination of shear parameters by direct shear test, triangle test & vane shear test. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction test field compaction method and control.	4	CO 3
4	**Unit-4**	Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure: plastic equilibrium in soils, active and passive states,	3	CO 4
5	**Unit-5**	Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.	3	CO 5
Practicals				
Determination of water content of soil; Determination of specific gravity of soil; Determination of field density of soil by core cutter method; Determination of field density by sand replacement method; Grain size analysis by sieving (Dry sieve analysis); Grain size analysis by hydrometer method; Determination of liquid limit by Casagrande's method; Determination of liquid limit by cone penetrometer and plastic limit; Determination of shrinkage limit; Determination of permeability by constant head method; Determination of permeability by variable head method; Determination of compaction properties by standard proctor test; Determination of shear parameters by Direct shear test; Determination of unconfined compressive strength of soil; Determination of shear parameters by Tri-axial test; Determination of consolidation properties of soils.			32	CO1, 2, 3, 4, 5

Reference Books:

Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.

Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.

Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO 7
CO1	3	1	1	1	1	3	1	1	3	1	1	1	3	2	1	2	2	3	3	3	3
CO2	2	2	2	1	1	3	1	1	3	1	1	1	3	2	1	2	2	3	3	3	3
CO3	1	3	3	1	1	3	1	1	3	1	1	1	3	2	1	2	2	3	3	3	3
CO4	2	2	2	2	2	2	2	2	2	2	2	2	3	2	1	2	2	3	3	3	3
CO5	2	2	2	2	2	2	2	2	2	2	2	2	3	2	1	2	2	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE252**	**Title of the Course**	Design of Structures	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**1**	**0**	**2**	
Course Objectives	• To study the different types of load exerted on the structure and to design the connections. • To design the structural steel members in tension, compression and bending. • To design the steel roof trusses and to design the singly and doubly reinforced section. • To design the flanged beam, slabs and columns. • To design the foundation, retaining walls and silos.						

Course Outcomes	
CO1	Learner will learn how different types of load act on the structure and will able to design the connections.
CO2	Learner will be able to design the structural steel members in tension, compression and bending.
CO3	Learner will be able to design the singly reinforced sections, doubly reinforced sections and steel roof trusses.
CO4	Learner will learn how to design the flanged beam, slabs and columns.
CO5	Learner will learn how to design the foundation, retaining walls and silos.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending.	6	CO 1, 2
2	**Unit-2**	Design of steel roof truss. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion.	6	CO 3, 5
3	**Unit-3**	Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos.	7	CO 4, 5
Practicals				
Design and drawing of single reinforced beam, double reinforced beam, Design and drawing of steel roof truss; Design and drawing of one way, two way slabs, Design and drawing of RCC building; Design and drawing of Retaining wall. To measure workability of cement by slump test			30	CO1, 2, 3, 4, 5

Reference Books:

Junarkar, S.B. 2001. Mechanics of Structures Vol. I Charotar Publishing Home, Anand.

Khurmi R. S. 2001. Strength of materials. S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi – 110055.

Kumar Sushil 2003. Treasure of R.C.C. Design. R.K. Jain. 1705-A, Nai Sarak , Delhi-110006, P.B.1074.

e-Learning Source:

https://ecourses.icar.gov.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																			
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	3	2	1	2	1	1	2	1	1	2	1	1	2	3	2	2	2	2	2	2
CO2	2	3	2	1	2	1	1	2	1	2	2	1	1	2	3	3	3	3	3	3	3
CO3	2	3	2	1	2	1	2	2	1	1	2	1	1	2	3	3	3	3	3	3	3
CO4	1	3	3	1	2	1	2	2	1	1	2	1	1	2	3	3	3	3	3	3	3
CO5	1	3	2	1	2	1	1	2	1	1	2	1	1	2	3	3	3	3	3	3	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE253**	**Title of the Course**	Farm Machinery and Equipment-I	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**2**	
Course Objectives	1. To expose the students to farm mechanization benefits and constraints, farm machinery selection and cost analysis. 2. To introduce the students to the working principles of farm equipment, tillage, sowing, planting machinery. 3. To identify the components of primary, secondary tillage implements, land reclamation and earth moving equipment. 4. To impart the knowledge of numerical analysis based on power, draft, capacity of farm machinery. 5. To provide knowledge about material of construction for farm machinery.						

Course Outcomes	
CO1	have knowledge about the present status of farm mechanization, selection of farm machinery and cost analysis.
CO2	be able to know the working principles of farm equipment, tillage, sowing, planting machinery.
CO3	have the basic knowledge of primary, secondary tillage implements, land reclamation and earth moving equipment.
CO4	have the knowledge to solve numerical analysis based on power, draft, capacity of farm machinery.
CO5	be able to select the material of construction for farm machinery.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Introduction to farm mechanization. Classification of farm machines. Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery. Calculation of field capacities and field efficiency.	6	CO 1
2	**Unit-2**	Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment.	6	CO 2, 3
3	**Unit-3**	Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, subsoiler, harrows, cultivators, Identification of major functional components.	6	CO 2
4	**Unit-4**	Attachments with tillage machinery. Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills. Introduction to planters, bed-planters and other planting equipment. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation.	8	CO 4
5	**Unit-5**	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.	8	CO 5
Practicals:				
Familiarization ation with different farm implements and tools. Study of hitching systems, Problems on machinery management. Study of primary and secondary tillage machinery–construction, operation, adjustments and calculations of power and draft requirements. Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments. Study of transplanters – paddy, vegetable, etc. Identification of materials of construction in agricultural machinery and study of material properties. Study of heat treatment processes subjected to critical components of agricultural machinery.			32	CO 1, 2, 3, 4, 5

Reference Books:

Kuegpgneesr tRedA R, Reaody iBngasrg er & EL Barger. Principles of Farm Machinery.

Srivastava AC. Elements of Farm Machinery.

Lal Radhey and AC Datta. Agricultural Engineering.

Smith HP and LH Wilkey. Farm Machinery and Equipment

Culpin Claude. Farm Machinery

e-Learning Source:

https://ecourses.icar.gov.in/

					Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	2	2	1	2	3	1	1	1	1	2	1	2	3	2	3	2	2	3	3
CO2	3	3	2	3	1	1	3	1	1	1	1	3	1	3	3	2	2	2	3	2	3
CO3	3	3	2	3	1	1	3	1	1	1	1	3	1	3	3	2	2	2	2	2	3
CO4	3	3	3	3	1	2	3	1	1	1	1	2	1	3	3	2	2	1	3	2	3
CO5	3	3	3	1	1	1	3	1	1	1	1	1	1	2	3	2	1	2	3	2	3

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AG231**	**Title of the Course**	Principles of Horticultural Crops and Plant Protection	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**1**	**0**	**2**	
Pre-Requisite		**Co-requisite**					
Course Objectives	1. To provide information to the students on the basic principles of Horticulture and Plant protection. 2. To impart knowledge to the student about soil and climate requirement of different horticultural crops. 3. Knowledge regarding importance of cultural practices and propagation of horticultural crops 4. Knowledge about tools and implements used for garden crops.						

Course Outcomes	
CO1	Gives information regarding Cultivation of Fruits, vegetables and flowers
CO2	Able to know about different criteria for site selection
CO3	Students are able to know water and fertilizer application
CO4	Students can use the basic knowledge on packaging of horticultural produce
CO5	Students can use the basic knowledge on management of horticultural disease and pest.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Scope of horticultural. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Criteria for site selection, layout and planting methods, nursery raising, commercial varieties/hybrids.	7	CO 1
2	**Unit-2**	Sowing and planting times and methods, seed rate and seed treatment for vegetable crops; macro and micro propagation methods, plant growing structures, pruning and training,	7	CO 2
3	**Unit-3**	Crop coefficients, water requirements and critical stages, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging.	8	CO 3
4	**Unit-4**	Crop coefficients, water requirements and critical stages, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging.	8	CO 4, 5
Practicals:				
Judging maturity time for harvesting of crop; Study of seed viability and germination test; Identification and description of important fruits, flowers and vegetable crops; Study of different garden tools; Preparation of nursery bed; Practices of pruning and training in some important fruit crops, visit to commercial greenhouse/ polyhouse; cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control); seed extraction techniques; identification of important pests and diseases and their control.			30	CO 1, 2, 3, 4, 5

Reference Books:

Bansal. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.

Saraswathy, S., T.L. Preethi, S. Balasubramanyan, J. Suresh, N. Revathy and S. Natarajan. 2007. Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.

Arjunan, G., Karthikeyan, G, Dinakaran, D. and Raguchander, T. 1999. Diseases of Horticultural Crops. AE Publications, Coimbatore.

Sharma Neeta and Mashkoor Alam. 1997. Postharvest diseases of Horticultural crops. International Book publishing Co. UP.B.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	2	2	1	1	1	2	1	2	1	2	1	3	2	2	2	3	3	2	2
CO2	1	1	3	2	1	1	1	1	1	1	1	3	2	3	2	2	2	3	3	2	2
CO3	2	1	2	2	1	1	1	1	1	1	1	3		2	2	2	2	3	3	2	2
CO4	2	1	1	1	1	1	1	2	2	2	1	1	1	3	2	2	2	3	3	2	2
CO5	1	1	3	2	1	1	1	1	1	2	1	2	1	2	2	2	2	3	3	2	2

4- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AG232**	**Title of the Course**	Principles of Agronomy	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**2**	
Course Objectives	6. To introduce the basic knowledge of introduction of Agronomy and its scope. 7. To study about seed and sowing, crop nutrition and tillage. 8. To familiarize the students with the agencies involved in the seed production and management in India 9. To aware the students about the concept of weed management and quality of irrigation water. 10. To study about the crop rotation and its benefit. 11. To learn about organic farming and sustainable agriculture.						

Course Outcomes	
CO1	Students will be able to explain the agronomy, its scope and crop nutrition.
CO2	Students are understanding well with the economic value of agriculture product, use of manures and fertilizers in agricultural crop and its impact on crop yield.
CO3	Students are aware about concept of weed management and crop weed competition.
CO4	Students know the concept of crop rotation, its principles and its benefits.
CO5	Learned the organic farming and sustainable agriculture.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Introduction and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development.	8	1
2	**Unit-2**	Principles of tillage, tilth and its characteristics. Crop seasons. Methods, time and depth of sowing of major field crops.	8	2
3	**Unit-3**	Methods and time of application of manures and fertilizers. Organic farming-Sustainable agriculture.	8	3, 4
4	**Unit-4**	Soil water plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping.	8	4, 5
Practicals:				
Identification of crops and their varieties, seeds, manures, fertilizers and weeds; Fertilizer application methods; Different weed control methods; Practice of ploughing, Practice of Puddling, Practice of sowing.			30	CO 1, 2, 3, 4, 5

Reference Books:

William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.

Arnon L. 1972. Crop Production in Dry Regions. Leonard Hill Publishing Co. London.

Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.

Gupta O P. 1984. Scientific Weed Management in the Tropics and Sub- Tropics. Today and Tomorrow's Printers and Publishers. New Delhi.

Rao V S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.

Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers Ludhiana.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	1	1	3	1	1	1	1	2	1	2	3	3	3	2	2	2	2
CO2	3	3	2	3	1	2	3	1	1	1	1	3	1	2	3	3	3	2	2	2	2
CO3	3	2	2	3	1	2	3	1	1	1	1	3	1	2	3	3	3	2	2	2	2
CO4	2	2	3	3	1	2	3	1	1	1	1	2	1	3	3	3	3	2	2	2	2
CO5	2	3	2	2	1	1	3	1	1	1	1	1	1	2	3	3	3	2	2	2	2

5- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**EE231**	**Title of the Course**	Electrical Machines and Power Utilization	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**2**	
Course Objectives	• Knowledge of laws of magnetic circuit and transformers • To get knowledge of phase or diagram of transformer and DC generators • To attain knowledge of working of DC motors • To attain knowledge of poly-phase induction motor • To have the knowledge of working and application of single phase induction motor						

Course Outcomes	
CO1	Knowledge of magnetic circuit
CO2	Analyze the performance of transformers
CO3	Evaluate the performance of DC motors and apply in field of agriculture engineering
CO4	Knowledge of poly-phase induction motors
CO5	Knowledge of working and application of single-phase induction motor and apply in field of agriculture engineering

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-1**	Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses,	6	1
2	**Unit-2**	Transformer: principle of working, construction of single-phase transformer, EMF equation, phasor diagram on load, leakage reactance, voltage regulation, power and energy efficiency, open circuit and short circuit tests,	6	2
3	**Unit-3**	Principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics, DC motor characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control,	6	3
4	**Unit-4**	Polyphase induction motor: construction, operation, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods, single phase induction motor: double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors,	6	4, 5
5	**Unit-5**	Various methods of three phase power measurement; power factor, reactive and apparent power, Concept and analysis of balanced poly-phase circuits; Series and parallel resonance.	6	4, 5
Practical				
To obtain load characteristics of d.c. shunt/series /compound generator; To study characteristics of DC shunt/ series motors; To study d.c. motor starters; To Perform load-test on 3 ph. induction motor & to plot torque V/S speed characteristics; To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. parameters & to draw circle diagram; To study the speed control of 3 ph. induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor; To study star- delta starters physically and (a) to draw electrical connection diagram (b) to start the 3 ph. induction motor using it. (c) to reverse the direction of 3 ph. I.M.; To start a 3-phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. and to plot torque –speed characteristics; To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent ckt. drawn on the basis of double revolving field theory; To perform load –test on 1 ph. induction motor & plot torque –speed characteristics; To study power consumed in a three-phase circuit; Two lights in series controlled by one switch; Two lights in parallel controlled by one switch.			30	CO 1, 2, 3, 4, 5,

Reference Books:

Thareja B L & Theraja AK. 2005. A text book of Electrical Technology. Vol. I S. Chand & Company LTD., New Delhi.

Theraja B L & Theraja AK 2005. A text book of Electrical Technology. Vol. II S.Chand & Company LTD., New Delhi.

Vincent Del Toro. 2000. Electrical Engineering Fundamentals. Prentice-Hall of India Private LTD., New Delhi.

Anwani M L. 1997. Basic Electrical Engineering. Dhanpat Rai & Co.(P) LTD. New Delhi.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	POS1	POS2	POS3	POS4	PSO5	PSO6	PSO7
CO1	1	2	2	1	3	1	1	3	1	1	3	1	2	2	3	3	3	2	2	1	2
CO2	1	3	3	1	3	1	3	3	3	1	1	1	2	2	3	3	3	2	2	1	2
CO3	2	3	2	2	1	3	1	1	3	1	1	1	2	2	3	3	3	2	2	1	2
CO4	2	3	2	2	1	3	1	1	3	1	1	1	2	2	3	3	3	2	2	2	2
CO5	2	3	2	2	1	1	1	1	3	1	1	2	2	2	3	3	3	2	2	2	2

6- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**LN211**	**Title of the Course**	Communication Skills and Personality Development	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**1**	**0**	**2**	
Course Objectives	1. To provide the knowledge about Communication Skills: Structural and functional grammar; meaning and process of communication, Verbal and non-verbal communication 2. To provide the knowledge about Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. 3. To educate the students about Reading and comprehension of general and technical articles, precis writing, summarizing. 4. To provide Knowledge regarding abstracting; individual and group presentations, impromptu presentation, public speaking. **5.** To provide the knowledge about Group discussion. Organizing seminars and conferences						

Course Outcomes	
CO1	Able to know about communication Skills: Structural and functional grammar; meaning and process of communication, Verbal and non-verbal communication
CO2	Students able to know about Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures
CO3	Students able to know about reading and comprehension of general and technical articles, precis writing, summarizing
CO4	Able to know about abstracting; individual and group presentations, impromptu presentation, public speaking
CO5	Students able to understand the basic Knowledge regarding Group discussion. Organizing seminars and conferences

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Communication Skills: Structural and functional grammar; meaning and process of communication, Verbal and non-verbal communication	4	1
2	**Unit-2**	Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.	4	2
3	**Unit-3**	Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking	4	3, 4
4	**Unit-4**	Group discussion. Organizing seminars and conferences.	4	4, 5
Practical				
Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations.			30	CO 1, 2, 3, 4, 5

Reference Books:

Balasubramanian T. 1989. A Text book of Phonetics for Indian Students. Orient Longman, New Delhi.

Balasubrmanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.

Naterop, Jean, B. and Rod Revell. 1997. Telephoning in English. Cambridge University Press, Cambridge.

Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan India Ltd. New Delhi.

Krishnaswamy,. N and Sriraman, T. 1995. Current English for Colleges. Macmillan India Ltd. Madras.

Narayanaswamy V R. 1979. Strengthen your writing. Orient Longman, New Delhi.

Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill publishing Company, New Delhi.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	1	1	1	2	1	1	1	3	2	3	2	2	2	3	2	2	2	2
CO2	3	3	3	1	2	1	1	2	1	1	2	3	3	3	2	2	3	3	2	2	2
CO3	3	3	2	1	1	1	2	1	1	1	2	3	3	3	2	2	2	2	2	2	3
CO4	3	3	3	2	2	1	1	1	2	1	2	3	3	3	2	2	2	2	2	2	3
CO5	3	3	2	2	1	1	2	2	1	1	2	3	3	3	2	2	2	2	2	2	3

7- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**ME228**	**Title of the Course**	Machine Design (ME)	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**0**	
Course Objectives	• Demonstrate understanding of various design considerations • Illustrate basic principles of machine design • Design machine elements for static as well as dynamic loading. • Design machine elements on the basis of strength/ rigidity concepts.						

Course Outcomes	
CO1	Students become able to understand the Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties.
CO2	Students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
CO3	Demonstrate the design process of shaft, keys, couplings and bolted joints under various load conditions.
CO4	Demonstrate the design process of springs, belt drives, gears and screw jack.
CO5	Design of muff, sleeve, and rigid flange couplings

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties.	8	1
2	**Unit-2**	Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded subjected to static loads.	8	2
3	**Unit-3**	Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading. Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings.	8	3
4	**Unit-4**	Design of helical and leaf springs. Design of flat belt and V-belt drives and pulleys. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anti-friction bearings.	8	4, 5
5				

Reference Books:

Jain R K. 2013. Machine Design. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.

Khurmi R S and Gupta J K. 2014. A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	1	2	1	2	1	3	1	1	3	1	2	3	3	2	3	2	3	3
CO2	3	3	2	1	1	2	2	1	1	1	1	3	1	2	3	3	2	3	3	3	3
CO3	2	2	3	2	1	2	2	1	3	3	3	3	1	2	3	3	2	3	3	3	2
CO4	3	3	2	1	1	1	2	1	1	3	1	3	1	2	3	3	2	3	3	3	2
CO5	1	1	1	1	2	1	2	2	1	2	2	2	2	2	3	3	2	3	3	3	2

8- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**ME229**	**Title of the Course**	Thermodynamics, Refrigeration and Air Conditioning (ME)	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**2**	
Course Objectives	1. Be able to have the basic concepts of thermal sciences and application of first law of thermodynamics for closed system. 2. To understand and apply first and second law of thermodynamics to various processes. 3. To understand basic principle and analysis of different types of refrigeration systems. **4.** To have knowledge about common refrigerants and basic of psychrometry. **5.** To have basic knowledge about air conditioning principles.						

Course Outcomes	
CO1	Demonstrate basic concepts of thermal sciences and application of first law of thermodynamics for closed system.
CO2	Understand and apply first and second law of thermodynamics to various processes.
CO3	Understand basic principle and analysis of different types of refrigeration systems.
CO4	Demonstrate about common refrigerants and basic of psychrometry.
CO5	Demonstrate basic knowledge about air conditioning principles.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Thermodynamics properties, closed and open system, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of first law in heating and expansion of gases in non-flow processes.	6	1
2	**Unit-2**	First law applied to steady flow processes. Carnot cycle, Carnot theorem. Entropy, physical concept of entropy, change of entropy of gases in thermodynamics process. Otto, diesel and dual cycles.	6	2
3	**Unit-3**	Principles of refrigeration, - units, terminology, production of low temperatures, air refrigerators working on reverse Carnot cycle and Bell Coleman cycle. Vapour refrigeration-mechanism, P-V,P-S,P-H diagrams, vapor compression cycles, dry and wet compression, super cooling and sub cooling. Vapour absorption refrigeration system.	6	3
4	**Unit-4**	Common refrigerants and their properties. Design calculations for refrigeration system. Cold storage plants. Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process.	7	4
5	**Unit -5**	Air conditioning – principles –Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems – humidifiers and dehumidifiers – cooling load calculations, types of air conditioners – applications.	6	5
Practical:				
Tutorials on thermodynamic air cycles, Study and application of P V and T S chart in refrigeration, P H chart (or) Mollier diagram in refrigeration, Numerical on air refrigeration cycle systems, Numerical on vapour compression cycle refrigeration system, Study of domestic water cooler, Study of domestic household refrigerator, Study of absorption type solar refrigeration system, Study cold storage for fruit and vegetables, Freezing load and time calculations for food materials, Determination of refrigeration parameters using refrigeration tutor – II, Numerical on design of air conditioning systems, Study of window air conditioner, Study on repair and maintenance of refrigeration and air-conditioning systems. Visit to chilling or ice making and cold storage plants.			32	CO 1, 2, 3, 4, 5

Reference Books:

Kothandaraman C P Khajuria P R and Arora S C. 1992. A Course in Thermodynamics and Heat Engines. Dhanpet Rai and Sons, 1682 Nai Sarak, New Delhi.

Khurmi R S. 1992. Engineering Thermodynamics. S Chand and Co. Ltd., Ram Nagar, New Delhi.

Mathur M L and Mehta F S. 1992. Thermodynamics and Heat Power Engineering. Dhanpat Rai and Sons 1682 Nai Sarak, New Delhi.

Ballney P. L. 1994. Thermal Engineering. Khanna Publishers, New Delhi.

Nag P K.1995. Engineering Thermodynamics. Tata McGraw Hill Publishing Co.Ltd., 12/4 Asaf Ali Raod, New Delhi.

e-Learning Source:

https://ecourses.icar.gov.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																				
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	1	2	2	2	1	1	1	2	2	1	3	2	2	2	2	3	3	2
CO2	3	3	2	1	2	2	1	1	1	1	2	2	1	3	2	2	2	2	3	3	2
CO3	3	3	2	2	2	2	1	1	1	1	2	1	2	3	2	2	2	2	3	3	2
CO4	3	3	2	2	2	2	1	2	1	1	2	1	2	3	2	2	2	2	3	3	2
CO5	3	3	2	1	2	2	1	1	1	1	2	1	1	3	2	2	2	2	3	3	2

9- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**MT222**	**Title of the Course**	Mathematics in Agricultural Engineering -III	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**0**	**2**	
Course Objectives	6. To provide the knowledge about Numerical analysis and Laplace transformation: finite difference, various difference operators and their relationships. factorial notation, interpolation with equal integrals. 7. To provide the knowledge about Newton's forward and backward interpolation formula. Bessel's and Stirling's difference interpolation formulae. Interpolation with unequal intervals. Newton's divided difference formula 8. To educate the students about Lagrange's interpolation formula. numerical differentiations, numerical integrations, difference equations and their solutions, numerical solutions of ordinary differential equations by Picard's, Taylor's series. 9. To aware the students about the Fuller's and modified Fuller's methods. Runga-Kutta method; Laplace transformation and its applications to the solutions of ordinary and simultaneous differential equations. 10. To provide Knowledge regarding Testing of Hypothesis-Level of Significance-Degrees of freedom-Statistical errors, Large sample test (Z-test), Small sample test t-test (One tailed, two tailed and Paired tests), Testing of Significance through variance (F-test), Chi -Square test, contingency table, Correlation, Regression					

Course Outcomes	
CO1	Students able to provide the knowledge about Numerical analysis and Laplace transformation: finite difference, various difference operators and their relationships. factorial notation, interpolation with equal integrals
CO2	Able to know about provide the Newton's forward and backward interpolation formula. Bessel's and Stirling's difference interpolation formulae. Interpolation with unequal intervals. Newton's divided difference formula
CO3	Students able to provide the knowledge about Lagrange's interpolation formula. numerical differentiations, numerical integrations, difference equations and their solutions, numerical solutions of ordinary differential equations by Picard's, Taylor's series
CO4	Able to know about about the Fuller's and modified Fuller's methods. Runga-Kutta method; Laplace transformation and its applications to the solutions of ordinary and simultaneous differential equations
CO5	Students able to understand the basic Knowledge regarding Testing of Hypothesis-Level of Significance-Degrees of freedom-Statistical errors, Large sample test (Z-test), Small sample test t-test (One tailed, two tailed and Paired tests), Testing of Significance through variance (F-test), Chi -Square test, contingency table, Correlation, Regression

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-1**	Numerical analysis and Laplace transformation: finite difference, various difference operators and their relationships. factorial notation, interpolation with equal integrals.	6	1
2	**Unit-2**	Newton's forward and backward interpolation formula. Bessel's and Stirling's difference interpolation formulae. Interpolation with unequal intervals. Newton's divided difference formula.	6	2
3	**Unit-3**	Lagrange's interpolation formula. numerical differentiations, numerical integrations, difference equations and their solutions, numerical solutions of ordinary differential equations by Picard's, Taylor's series.	6	3
4	**Unit-4**	Fuller's and modified Fuller's methods. Runga-Kutta method; Laplace transformation and its applications to the solutions of ordinary and simultaneous differential equations.	7	4
5	**Unit-5**	Testing of Hypothesis-Level of Significance-Degrees of freedom-Statistical errors, Large sample test (Z-test), Small sample test t-test (One tailed, two tailed and Paired tests), Testing of Significance through variance (F-test), Chi -Square test, contingency table, Correlation, Regression.	7	5
Practical				
Interpolation, Numerical differentiation and integration solutions of difference equations, numerical solution of ordinary differential equations of first order and first degree, Laplace and inverse Laplace transformations and their application to solution of ordinary and simultaneous differential equations. Problems on One Sample, Two sample Z-tests when Population S.D. is known and unknown, Problems on one sample, Two sample and paired t-test Chi-Square test – 2x2 and m x n, Calculation of Correlation coefficient and its testing, Contingency Table and F-test.			30	CO 1, 2, 3, 4, 5

Reference Books:

Chandel SRS. A Hand book of Agricultural Statistics. Achal Praskasam Masndir, Kanpur.

Agrawal B L. Basic Statistics. Wiley Eastern Ltd. New Age International Ltd.

Nageswara Rao G. Statistics for Agricultural Sciences. BS Publications.

Rangaswamy R. A Text Book of Agricultural Statistics. New Age Int. Publications Ltd.

Gupta S.C. Fundamental Applied Statistics.

e-Learning Source:

https://ecourses.icar.gov.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	1	2	1	1	3	3	3	3	2	1	2	2	2	2	2	3	2	3
CO2	3	3	3	1	2	2	1	3	3	3	2	3	1	3	2	2	2	2	3	3	3

CO3	3	3	2	1	2	1	1	3	3	3	2	3	1	3	2	3	2	2	3	3	3
CO4	3	3	3	1	2	1	1	3	3	3	2	3	1	3	2	3	2	2	3	3	2
CO5	3	3	2	1	2	1	1	3	3	3	2	3	1	3	2	2	2	2	3	3	2

10- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE256**	**Title of the Course**	**Building Construction and Cost Estimation**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**IV**	**2**		**0**	
Course Objectives	**1. To know about the building materials: Rocks, Stones, Bricks Properties and varieties of Tiles To gain the basic knowledge about Building components like Lintels, Arches, stair cases** **2. To impart knowledge about the types of agricultural buildings and related needs, application of design theory and practice to the conservation** **3. To impart knowledge on Factors affecting building costs; cost evaluation of design and planning alternatives for building** **4. To gain basic knowledge of detailed estimates of buildings source of cost information** **5. To know about the cost-in-use, benefit-to-costs and savings-to-investment ratios**						

Course Outcomes	
CO1	Learner will have the knowledge of varieties of Tiles, Lime, Cement, Concrete, Sand. Glass, Rubber, Plastics, iron, Steel
CO2	Learner will have the knowledge about the different types of floors, finishing
CO3	Learner will have the knowledge of sloped and flat roof buildings, construction economics
CO4	Learner will have the knowledge of economic methods for evaluating investments in buildings and building systems
CO5	Learner will have the knowledge about cost-in-use, benefit-to-costs and savings-to-investment ratios

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Learner will have the knowledge of varieties of Tiles, Lime, Cement, Concrete, Sand. Glass, Rubber, Plastics, iron, Steel	7	CO 1
2	**Unit II**	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,	8	CO 2
3	**Unit III**	Types of agricultural buildings and related needs, application of design theory and practice to the conservation, sloped and flat roof buildings, construction economics: Preliminary estimates, Detailed Estimates of Buildings source of cost information, use of cost analyses for controlling design,	7	CO 3
4	**Unit IV**	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	8	CO 4, 5

Reference Books:

1. Punmia B.C. Ashok Kumar Jain and Arun Kumar Jain. Building Construction. LaxmiPublications (P) ltd., New Delhi.
2. Duggal S K. Building material. New Age International Publishers.
3. Sane Y.S. Planning and Designing of Buildings.
4. Rangwala S C. 1994. Engineering Materials. Charotar Publishing House,Anand.

e-Learning Source:

"https://ecourses.icar.gov.in/"

"https://www.youtube.com/watch?v=8DX4T64-fpk

https://ilizone.iul.ac.in/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	1	1	3	1	1	1	1	2	1	1	3	2	3	2	1	2	2
CO2	3	3	2	3	1	1	2	1	1	1	1	1	1	1	2	2	3	2	2	3	1
CO3	2	2	2	3	1	1	3	1	1	1	1	3	1	1	3	2	2	3	2	2	1
CO4	2	2	3	3	1	1	3	1	1	1	1	2	1	1	3	3	3	2	3	2	2
CO5	2	3	2	2	1	1	2	1	1	1	1	1	1	1	3	2	3	3	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**ME232**	**Title of the Course**	**Auto CAD Applications**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**0**		**2**	
Course Objectives	**1. To introduce the basic concept of CAD to design and drawing by using computer.** **2. To impart basic knowledge of OSNAP and its command.** **3. To impart the practice on 3D commands for design and drawing.** **4. To know about working principle of CNC machine.** **5. To solve the problems based on CNC programming.**						

Course Outcomes	
CO1	Know the basic knowledge of CAD to design and drawing by using computer.
CO2	Have the ability to have the knowledge OSNAP and its command.
CO3	Know the practical application of 3D commands for design and drawing
CO4	Have the ability to know the working principle of CNC machine.
CO5	Have the basic knowledge to solve the problems based on CNC programming.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Application of computers for design**	Application of computers for design. CAD- Overview of CAD window – Explanation of various options on drawing screen. Study of draw and dimension tool bar. Practice on draw and dimension tool bar	7	CO 1
2	**Practice on OSNAP and format tool bar**	Study of OSNAP, line thickness and format tool bar. Practice on OSNAP, line thickness and format tool bar. Practice on mirror, offset and array commands. Practice on trim, extend, chamfer and fillet commands. Practice on copy, move, scale and rotate commands	6	CO 2
3	**Drawing of 2 D-drawing and PEDIT**	Drawing of 2 D- drawing using draw tool bar. Practice on creating boundary, region, hatch and gradient commands. Practice on Editing polyline- PEDIT and Explode commands. Setting of view ports for sketched drawings	7	CO 3
4	**2 D drawing of machine parts and stuffing box**	Printing of selected view ports in various paper sizes. 2Ddrawingof machine parts with all dimensions and allowances- Foot step bearing and knuckle joint. Sectioning of foot step bearing and stuffing box. Drawing of hexagonal, nut and bolt and other machine parts	6	CO 4
5	**Practice on 3-D commands and CNC machine**	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. Demonstration on CNC machine and simple problems	7	CO 5

Reference Books:

1. Rao P.N.. 2002. CAD/CAM Principles and Applications. McGraw-Hill Education Pvt.Ltd.,New Delhi.
2. Sareen Kuldeep and Chandan Deep Grewal. 2010. CAD/CAM Theory and Practice.S.Chand& Company Ltd., New Delhi.
3. Zeid Ibrahim. 2011. Mastering CAD/CAM with Engineering. McGraw-Hill EducationPvt.Ltd., New Delhi.
4. Lee Kunwoo. 1999. Principles of CAD/CAM/CAE Systems. Addison Vesley Longman, Inc.

e-Learning Source:

"https://ecourses.icar.gov.in/"

https://ilizone.iul.ac.in/

						Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	1	1	1	1	1	1	1	1	1	1	3	3	3	2	3	3	2	2
CO2	3	3	2	1	1	1	1	1	1	1	1	1	1	3	2	2	3	2	2	2	2
CO3	3	3	2	3	1	1	1	2	1	1	1	1	1	3	3	3	3	2	3	3	1
CO4	3	3	2	1	1	1	1	2	1	1	1	1	1	3	3	2	2	3	3	2	3
CO5	3	3	2	1	1	1	1	1	1	1	1	1	1	3	3	3	3	2	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**EC241**	**Title of the Course**	**Applied Electronics and Instrumentation**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**IV**	**2**		**1**	
Course Objectives	**1. To understand the basic concepts of various semi-conductor materials and will be able to design Electronics devices.** **2. To learn the concept of signal amplification through BJT.** **3. To understand the basic concepts of operational amplifier and develop analysis capability in OPAMP Circuits.** **4. To understand the basic knowledge of number system and logic gates.** **5. To understand the basic concepts of DAC, ADC and LVDT and learn the working of electronic instruments.**						

Course Outcomes	
CO1	Students shall be able to understand the basic concepts of various semi-conductor materials and will be able to design Electronics devices.
CO2	Students shall be able to learn the concept of signal amplification through BJT.
CO3	For a given system Students shall be able to understand the basic concepts of operational amplifier and develop analysis capability in OPAMP Circuits.
CO4	For a given number system Students shall be able to understand the basic knowledge of conversion and logic gates.
CO5	Students shall be able to learn basic concepts of DAC, ADC and LVDT and learn the working of electronic instruments.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit I**	Semiconductors. P—n junction. V—I characteristics of p—n junction. Diode as a circuit element. Rectifier. Clipper. Damper, voltage multiplier, capacitive filter.	6	CO 1
2	**Unit II**	Diode circuits for OR & AND (both positive and negative logic), bipolar junction transistor: operating point. Classification (A.B& C) of amplifier. Various biasing methods (fixed. Self-potential divider). H-parameter model of a transistor.	4	CO 2
3	**Unit III**	Analysis of small signal. CE amplifier. Phase shift oscillator, analysis of differential amplifier using transistor. Ideal OP-AMP characteristics. Linear and non-linear applications of OP-AMP (adder. Sub tractor. Integrator, active rectifier.	6	CO 3
4	**Unit IV**	Comparator. Differentiator. Differential, instrumentation amplifier and oscillator). ener diode voltage regulator. Transistor series regulator. Current limiting. OP-AMP voltage regulators. Basic theorem of Boolean algebra.	5	CO 4
5	**Unit V**	Combinational logic circuits(basic gates. SOP rule and Kmap). Binary ladder D/A converter, successive approximation A/D converter, generalized instrumentation,	6	CO 5
6	**Unit VI**	Measurement of displacement. Temperature. Velocity, force and pressure using potentiometer. Resistance thennometer. Thermocouples. Bourclen tube. LVDT. Strain gauge and tacho-generator.	5	CO 5
Practical				
To study V-I characteristics of p-n junction diode: To study half wave. Full wave and bridge rectifier: To study transistor characteristics in CE configurations: To design and study fixed and self bias transistor: To design and study potential divider bias transistor: To study a diode as clipper and clamper: To study a OP-AMP IC 741 as inverting and non- inverting amplifier: To study a OP-AMP IC 741 as differentiator and integrator to study a differential amplifier using two transistor: To study a OP-AMP IC 741 as differential amplifier: To study a ener regulator circuit: To study a OP-AMP IC 741 as a active rectifier: To study a OPAMP IC 741 as a comparator: To familiarize with various types of transducers.			32	CO 1, 2, 3, 4, 5

Reference Books:

1. Mehta V K. Principles of Electronics. S. Chand and Co., New Delhi.
2. Shaney A K. Measurement of Electronicsand Electronic Instrumentation. KhannaPublications.
3. Roy Chowdary. Integrated Electronics. John Wiley International.
4. Kumar Anand. Digital Electronics. A. PHI.

e-Learning Source:

"https://ecourses.icar.gov.in/"

https://ilizone.iul.ac.in/

					Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	1	3	3
CO2	3	3	3	1	1	1	1	1	1	1	1	1	1	1	3	2	3	2	2	3	1
CO3	3	3	3	2	1	1	1	1	1	1	1	1	1	1	3	3	2	3	2	2	1
CO4	3	3	2	2	1	1	1	1	1	1	1	1	1	1	3	3	3	2	3	2	2
CO5	3	3	2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE257**	**Title of the Course**	**Tractor and Automotive Engines**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**2**	**0**	**1**	
Course Objectives	**1. To know about the sources of farm power** **2. To gain the basic knowledge about engine components their construction** **3. To impart knowledge about the engine valve systems, valve mechanism** **4. To impart knowledge on fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio** **5. To gain basic knowledge of fuel injection system – Injection pump**						

Course Outcomes	
CO1	Learner will have the knowledge of classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle
CO2	Learner will have the knowledge about the engine components their construction, operating principles and functions
CO3	Learner will have the knowledge of valve timing diagram, and valve clearance
CO4	Learner will have the knowledge of properties of fuels, calculation of air-fuel ratio
CO5	Learner will have the knowledge about additives in the coolant, radiator efficiency and ignition system of SI engines

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Study of sources of farm power –conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet.	6	CO 1
2	**Unit II**	Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2- stroke and4-stroke engine cycles and CI and SI engines.	7	CO 2
3	**Unit III**	Study of Engine Valve systems, valve mechanism, Valve timing diagram, and valve clearance adjustment Study of Cam profile, valve lift and valve opening area. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners.	7	CO 3
4	**Unit IV**	Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines. Study of carburetion system, carburetors and their main functional components.	6	CO 4
5	**Unit V**	Study of fuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Engine governing– need of governors, governor types and governor characteristics. Study of lubrication system –need, types, functional components. Study of lubricants – physical properties, additives and their application.	6	CO 5
Practical				
Introduction to different systems of CI engines; Engine parts and functions, working principles etc. Valve system – study, construction and adjustments; Oil & Fuel – determination of physical properties; Air cleaning system; Fuel supply system of SI engine; Diesel injection system& timing; Cooling system, and fan performance, thermostat and radiator performance evaluation; Part load efficiencies & governing; Lubricating system & adjustments; Starting and electrical system; Ignition system; Tractor engine heat balance and engine performance curves; Visit to engine manufacturer/ assembler/ spare parts agency			30	CO 1, 2, 3, 4, 5

Reference Books:

1. Liljedahl J B and Others. Tractors and Their Power Units.
2. Rodichev V and G Rodicheva. Tractors and Automobiles.
3. Mathur ML and RP Sharma. A course in Internal Combustion Engines.
4. Singh Kirpal. Automobile Engineering – Vol II.

e-Learning Source:

"https://ecourses.icar.gov.in/"

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Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	1	1	3	1	1	1	1	2	1	2	3	3	3	3	3	2	3
CO2	3	3	2	3	1	1	2	1	1	1	1	1	1	2	3	2	3	3	2	3	2
CO3	2	2	2	3	1	1	3	1	1	1	1	3	1	2	3	3	2	3	2	2	1
CO4	2	2	3	3	1	1	3	1	1	1	1	2	1	3	2	3	3	2	3	2	3
CO5	2	3	2	2	1	1	2	1	1	1	1	1	1	2	3	2	3	3	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE258**	**Title of the Course**	**Engineering Properties of Agricultural Produce**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**1**	**0**	**1**	
Course Objectives	**1. To understand the Importance of engineering properties of agricultural produce.** **2. To get knowledge about thermal characteristics and properties of agricultural produce like heat capacity, specific heat, thermal conductivity and thermal diffusivity and heat of respiration etc.** **3. To learn about the friction and aerodynamics of agricultural produce.** **4. To know about Rheological properties of food product like force, deformation, stress, strain, elastic, plastic and viscous behavior etc.** **5. To know about the Electrical properties; dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant and method of determination.**						

Course Outcomes	
CO1	To Study of Importance of engineering properties of agricultural produce
CO2	Understand the knowledge about thermal characteristics and properties of agricultural produce like heat capacity, specific heat, thermal conductivity and thermal diffusivity and heat of respiration etc.
CO3	To study about the friction and aerodynamics of agricultural produce
CO4	Understand about rheological properties of food product like force, deformation, stress, strain, elastic, plastic and viscous behavior etc.
CO5	To learn about the about the electrical properties; dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant and method of determination

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit I**	Classification and importance of engineering properties of Agricultural Produce, shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables,	6	CO 1
2	**Unit II**	Thermal properties, Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration; Co-efficient of thermal expansion, Friction in agricultural materials; Static friction, Kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials,	5	CO 2
3	**Unit III**	Aero dynamics of agricultural products, drag coefficients, terminal velocity. Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo- plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods, Flow curves.	7	CO 3, 5
4	**Unit IV**	Electrical properties; dielectric loss factor, loss tangent, A.C. conductivity anddielectric constant, method of determination. Application of engineering properties in handling processing machines and storage structures	6	CO 4, 5
Practical				
Determination of the shape and size of grains, fruits and vegetables, Determination of bulk density and angle of repose of grains, Determination of the particle density/true density and porosity of solid grains, Finding the co-efficient of external and internal friction of different crops, Finding out the terminal velocity of grain sample and study the separating behaviour in a vertical wind tunnel, Finding the thermal conductivity of different grains, Determination of specific heat of some food grains, Determination of hardness of food material and determination of viscosity of liquid foods			30	CO 1, 2, 3, 4, 5

Reference Books:

1. Mohesin, N.N. 1980. Physical Properties of Plants & Animals. Gordon & BreachSciencePublishers , New York.
2. Mohesin, N.N. 1980. Thermal Properties of Foods and Agricultural Materials. Gordon&Breach Science Publishers , New York.
3. Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs. ElsevierAppliedscience Pub. Co. Inc. New York.
4. Rao, M.A. and Rizvi, S.H., 1995. Engineering Properties of Foods. Marcel Dekker Inc.NewYork.

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Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	1	1	1	1	1	3	3	3	1	1	1	3	2	2	3	1	3	3
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	2	2	3	2
CO3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	3	2	2	3
CO4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	2	2	3	3	2
CO5	3	1	1	1	1	1	1	1	3	1	1	1	1	1	3	3	3	3	2	2	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE259**	**Title of the Course**	**Watershed Hydrology**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**1**	**0**	**1**	
Course Objectives	**1. To impart knowledge hydrologic cycle; precipitation-forms, rainfall measurement, mass curve, hydrograph** **2. To get knowledge about test for consistency of rainfall records; interception; infiltration; evaporation** **3. To understand stream length, stream area, stream slope and Horton's laws; runoff-factors affecting** **4. To learn about hydrology of dry land areas-drought and its classification** **5. To get introductory knowledge about watershed management and planning**						

Course Outcomes	
CO1	Understand the basic concepts of hydrologic cycle; precipitation-forms, rainfall measurement
CO2	Apply the principles of Horton's laws; runoff-factors affecting, measurement
CO3	Acquaint with the watershed management and planning
CO4	Understand about rational method, Cook's method, SCS method, Curve number method
CO5	Acquaint with the stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	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.	7	CO 1
2	**Unit II**	Hydrologic processes-Interception, infiltration –factors influencing, measurement and indices. Evaporation – Estimation and measurement. 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.	6	CO 2
3	**Unit III**	Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. Hydrograph – Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations.	6	CO 3
4	**Unit IV**	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.	7	CO 4, 5
Practical				
Visit to meteorological observatory and study of different instruments. Design of rain gauge network. Exercise on intensity – frequency – duration curves. Exercise on depth – area – duration and double mass curves. Analysis of rainfall data and estimation of mean rainfall by different methods. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records. Exercise on computation of infiltration indices. Computation of peak runoff and runoff volume by Cook's method and rational formula. Computation of runoff volume by SCS curve number method. Study of stream gauging instruments – current meter and stage level recorder. Exercise on geomorphic parameters of watersheds. Exercise on runoff hydrograph. Exercise on unit hydrograph. Exercise on synthetic hydrograph. Exercise on flood routing			32	CO 1, 2, 3, 4, 5

Reference Books:

1. Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw HillPublishingCo., New York.
2. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, NewDelhi.
3. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-HillPublishing Co., Japan.
4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.

e-Learning Source:

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Course Articulation Matrix: (Mapping of Cos with Pos and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	1	1	1	1	1	1	2	2	1	1	2	2	3	3	1	2	3
CO2	3	3	3	1	2	2	1	1	1	1	2	3	1	1	2	3	3	2	2	3	1
CO3	3	3	2	1	2	1	1	1	1	1	2	3	1	1	3	2	2	3	2	2	3
CO4	3	3	3	1	1	1	1	1	1	2	2	3	1	1	3	3	2	3	3	2	2
CO5	3	3	2	1	2	2	1	1	1	1	2	3	1	1	2	2	3	3	2	2	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE260**	**Title of the Course**	**Irrigation Engineering**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**2**	**0**	**1**	
Course Objectives	**1. To know about the Major and medium irrigation schemes of India** **2. To gain the basic knowledge of present status of development and utilization of different water resources of the country** **3. To impart knowledge of open channel water conveyance system** **4. To impart knowledge on Estimation of earth work; soil water plant relationship** **5. To gain basic knowledge of water requirement of crops**						

Course Outcomes	
CO1	Learner will have the knowledge of purpose of irrigation, environmental impact of irrigation projects, source of irrigation water
CO2	Learner will have the knowledge about measurement of irrigation water: weir, flumes and orifices and other methods
CO3	Learner will have the knowledge of design and lining of irrigation field channels
CO4	Learner will have the knowledge of measurement and estimation of ET, water and irrigation requirement of crops
CO5	Learner will have the knowledge about methods of water application

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit I**	Major and medium irrigation schemes of India, purpose of irrigation, environmental impact of irrigation projects, source of irrigation water,	6	CO 1
2	**Unit II**	Present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods;	7	CO 2
3	**Unit III**	Open channel water conveyance system: design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; underground pipe conveyance system: components and design; land grading: criteria for land levelling, land levelling design methods,	7	CO 3
4	**Unit IV**	Estimation of earth work; soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response;	6	CO 4
5	**Unit V**	Water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methodsof water application: border, check basin and furrow irrigation-adaptability, specification and design considerations.	7	v5
Practical				
Measurement of soil moisture by different soil moisture measuring instruments; measurement of irrigation water; measurement of infiltration characteristics; determination of bulk density, field capacity and wilting point; estimation of evapotranspiration; land grading methods; design of underground pipeline system; estimation of irrigation efficiency; study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method; evaluation of border irrigation method; evaluation of furrow irrigation method; evaluation of check basin irrigation method.			32	CO 1, 2, 3, 4, 5

Reference Books:

1. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House NewDelhi.
2. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private LimitedNew Delhi 2nd Edition.
3. Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration guidelines forcomputing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations,Rome.
4. Murthy VVN. 2013. Land and Water Management Engineering. Kalyani Publishers,

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Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	1	3	2	1	1	1	1	2	1	2	3	2	3	3	3	2	3
CO2	3	3	2	3	1	3	2	1	1	1	1	1	1	2	3	3	3	2	2	3	3
CO3	2	2	2	3	1	3	3	1	1	1	1	3	1	2	3	2	2	3	3	2	3
CO4	2	2	3	3	1	3	3	1	1	1	1	2	1	3	3	3	3	2	3	2	2
CO5	2	3	2	2	1	3	2	1	1	1	1	1	1	2	3	3	3	3	2	2	3

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE261**	**Title of the Course**	**Sprinkler and Micro irrigation Systems**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**1**	**0**	**1**	
Course Objectives	**1. To impart knowledge about Sprinkler irrigation and its adaptability, problems and prospects, types of sprinkler irrigation systems** **2. To understand the Selection of pump and power unit for sprinkler irrigation system** **3. To learn different components and design of drip irrigation system** **4. To understand the process of Maintenance of micro irrigation system** **5. To analysis the performance evaluation of sprinkler irrigation system**						

Course Outcomes	
CO1	Learner will have the knowledge of sprinkler irrigation systems and its components and will be able to design it.
CO2	Learner will be able to select pump and power unit for sprinkler system and will be able to evaluate performance of sprinkler irrigation system.
CO3	Learner will have the knowledge of micro- irrigation systems and its components and will be able to design it.
CO4	Learner will have the knowledge of problems associated with micro-irrigation systems and the engineering solutions for it.
CO5	NA

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub main and main pipe line, design steps.	5	CO 1
2	**Unit II**	Selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency.	6	CO 2
3	**Unit III**	Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: general considerations, wetting patters, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps; necessary steps for proper operation of a drip irrigation system.	6	CO 3
4	**Unit IV**	Maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.	5	CO 4
Practical				
		Study of different components of sprinkler irrigation system; design and installation of sprinkler irrigation system; determination of precipitation pattern, discharge and uniformity coefficient; cost economics of sprinkler irrigation system; study of different components of drip irrigation; design and installation of drip irrigation system; determination of pressure discharge relationship and emission uniformity for given emitter; study of different types of filters and determination of filtration efficiency; determination of rate of injection and calibration for chemigation/fertigation; design of irrigation and fertigation schedule for crops; field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system	32	CO 1, 2, 3, 4, 5

Reference Books:

1. Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. SpringerSciencebusiness Media, New York.
2. Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers,NewDelhi.
3. Mane M. S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems,JainBrothers, New Delhi.
4. Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigationmethods, (IARI Monograph No.1). Water Technology Centre, IARINew Delhi.

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						Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	2	2	1	1	3	1	1	1	1	2	1	2	3	2	3	3	1	2	2
CO2	3	3	2	3	1	1	3	1	1	1	1	3	1	3	3	3	3	2	2	3	3
CO3	3	3	2	2	1	1	3	1	1	1	1	3	1	3	3	2	2	3	2	2	1
CO4	2	3	3	3	1	1	3	1	1	1	1	2	1	3	2	3	3	3	3	2	2
CO5	3	3	1	2	1	1	3	1	1	1	1	1	1	2	3	3	3	3	2	2	2

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**AE262**	**Title of the Course**	**Fundamentals of Renewable Energy Sources**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**2**	**0**	**1**	
Course Objectives	**1. To know about the solar energy and energy available from Sun, Solar radiation data** **2. To gain the basic knowledge of wind energy and energy available from wind** **3. To impart knowledge of biogas: types of biogas plants, biogas generation** **4. To impart knowledge on concept and limitation of Renewable Energy Sources** **5. To gain basic knowledge of thermodynamic principle and construction of IC engines.**						

Course Outcomes	
CO1	Learner will have the knowledge of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES
CO2	Learner will have the knowledge about Principle of natural and forced convection drying system, Solar Photo voltaics
CO3	Learner will have the knowledge of determination of torque coefficient, Induction type generators, working principle of wind power plant.
CO4	Learner will have the knowledge of factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry
CO5	Learner will have the knowledge of stand-alone,grrid connected solar power station

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit I**	Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with nonrenewable sources.	7	CO 1
2	**Unit II**	Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaics: p-n junctions. Solar cells, PV systems, Stand alone,Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics.	6	CO 2
3	**Unit III**	Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant.	6	CO 3
4	**Unit IV**	Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifiers, various types of biomass cook stoves for rural energy needs.	6	CO 4
5	**Unit V**	Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.	6	CO 5
Practical				
Study of different types of solar cookers, solar water heating system, natural convection solar dryer, forced convection solar dryer, solar desalination unit, solar greenhouse for agriculture production, biogas plants, biomass gasifiers, biomass improved cook-stoves, solar photovoltaic system			28	CO 1, 2, 3, 4, 5

Reference Books:

1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
3. Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.
4. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non- Conventional EnergySources,Himanshu Publications.

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Course Articulation Matrix: (Mapping of COs with POs and PSOs)

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CO2	3	3	2	3	1	1	2	1	1	1	1	1	1	2	2	3	3	2	2	3	3
CO3	2	2	2	3	1	1	3	1	1	1	1	3	1	2	3	3	2	3	3	2	3
CO4	2	2	3	3	1	1	3	1	1	1	1	2	1	3	3	3	2	2	3	2	2
CO5	2	3	2	2	1	1	2	1	1	1	1	1	1	2	2	2	2	3	2	2	3

4- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation