HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore– 641032

DEPARTMENT OF AGRICULTURAL ENGINEERING

Revised Curriculum and Syllabus for the

Batch 2020-2024, 2021 – 2025 and 2022 - 2026

(ODD SEMESTER)

(Academic Council Meeting Held on 19.06.2023)

2019 and 2022 REGULATIONS

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION

Providing excellence in quality education and research for enhancing and sustaining productivity in the farming sector with advanced machinery and new technologies.

Providing excellence for individuals to develop technologically superior in the branch of agriculture engineering, socially conscious and nationally responsible citizens

MISSION

M1. To provide excellence in academic activities and learning environment for make over our students into proficient in modern technology, research process, transfer of technology and agripreneurship.

M2. To provide innovative solutions for various issues in agriculture production and new inventions in core through research, extension and entrepreneurship.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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PO 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Ability to understand agricultural scenario in World and India and superimpose agricultural engineering technologies for uplifting the agriculture.

PSO 2. Ability to solve various issues in agriculture by infusing farm mechanization, conservation strategies for soil, water and renewable energy, advanced irrigation techniques and post harvest technology.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. Graduates shall exhibit their sound theoretical, practical skills and knowledge for successful employments or higher studies or research or entrepreneurial assignments.

PEO 2. Graduates shall have lifelong learning skills, professional ethics and good communication capabilities along with entrepreneur skills and leadership, so that they can succeed in their life.

PEO 3. Graduates shall become leaders and innovators by devising Engineering solutions for social issues and problems, thus caring for the society.

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Department of Agricultural Engineering

Syllabus Revision carried out in 2023-2024 ODD Semester

2019 Regulation – 2021 Batch V semester- Syllabus revision

S.No	Year	Sem	Course Code & Name	Existing Syllabus	Revised Syllabus	% of Change
1	III	V	21AG5202- Refrigeration and Cold Chain Management	**Unit III: Psychrometric Process and Cooling Load Calculation** Representation of various psychometric processes on psychometric chart and their analysis, by-pass factor, Thermal comfort; Cooling and heating load Calculations sensible heat factor, latent heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, and apparatus dew point.	**Unit III: Psychrometric Process and Cooling Load Calculation** Psychometric chart-—various psychometric processes and their analysis-sensible heating, sensible cooling, humidification and dehumidification, by-pass factor, sensible heat factor, latent heat factor; Thermal comfort- Cooling load-components, sensible heat gain, latent heat gain-calculations.	16
				Unit IV: Air Conditioning System and Cold Storage Design Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year- round air conditioning system- unitary and central air conditioning system. Domestic refrigerator and freezer. Basic design requirements for cold storage, insulation materials properties and types. Cold storage design for fruits and vegetables.	**Unit IV: Air Conditioning System and Cold Storage Design** Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year- round air conditioning system- unitary and central air conditioning system. Cold storage- types-design consideration, insulation materials properties	4

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				Unit V: Shelf – Life & Cold Chain Management Defining overall Shelf-life, importance of shelf- life; remaining shelf life in the context of Chilled & Frozen foods; The premises of cold chain - Need for the chain for chilled / frozen food item, various links of the chain; Storage of frozen foods; Chilling and freezing; freeze drying, Chilling injury; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature – time indicators (TTI); Time – temperature –correlation-the kinetic approach, effective temperature; Transportation regulations.	**Unit V: Shelf – Life & Cold Chain Management** Defining overall shelf-life, importance of shelf- life; cold chain- optimum temperature, cold chain equipment- Chilling and freezing-methods; Storage of frozen foods; quality changes during freezing and frozen storage-Chilling injury; cold – shortening.	10
2	III	V	**21AG5203 & Theory of Machines**	**Unit II: CAM and Flywheel** Types of cams and followers - Follower motion - Uniform, Parabolic, SHM and cycloidal. Cam terminology - Cam profiles construction for roller, flat faced and knife edge follower - -Flywheels of engines and punching press- Turning moment diagrams – Fluctuation of energy, speed.	**Unit II: CAM and Flywheel** Types of cams and followers - Follower motion - Uniform, Parabolic, SHM and cycloidal. Cam terminology - Cam profiles construction for roller, flat faced and knife edge follower - Functions of fly wheel -Types of fly wheels- Flywheels of engines and punching press- Turning moment diagrams – Fluctuation of energy, speed.	8
				Unit V: Governors Governors - Types - Centrifugal governors – Porter & Proell governor, Hartnell,	**Unit V: Governors and Balancing** Governors - Types - Centrifugal governors – Porter	18

				Hartung – Characteristics	& Proell governor, Hartnell, Hartung – Characteristics- Need of balancing-Concept of static and dynamic balancing Balancing of rotating mass by another mass in the same plane- Concept of reference plane	
3	III	V	21AG5252 & Soil and Water Conservation Engineering	**Unit I: Mechanics of water and wind Erosion** Soil Erosion – Causes and Conservation status in India - Mechanics of water erosion – types of water erosions—Classification of Gully – Special forms of Erosion – Wind Erosion Mechanics of Wind Erosion -Sand Dunes and Desertification.	**Unit I: Mechanics of water and wind Erosion** Soil Erosion – Agents - Causes and Conservation status in India -Mechanics of water erosion –Factors of Erosion- types of water erosions—Classification of Gully – Special forms of Erosion – Wind Erosion Mechanics of Wind Erosion -Sand Dunes and Desertification.	4
				Unit II: Estimation of Soil Loss Rainfall and Runoff Erosivity – Soil Erodibility - Runoff computation for soil conservation: SCS-CN method –Rational Formula - Universal Soil Loss Equation (USLE) – standard plot – Modified Universal Soil Loss Equation (MUSLE) – Revised Universal Soil Loss Equation (RUSLE)- Tolerance limit (T Value) of soil loss– Land use capability classification - Wind drift losses. Soil loss measurement devices	**Unit II: Estimation of Soil Loss** Rainfall and Runoff Erosivity – Soil Erodibility - Runoff computation for soil conservation: SCS-CN method – Rational Formula - Universal Soil Loss Equation (USLE) – standard plot – Modified Universal Soil Loss Equation (MUSLE) – Revised Universal Soil Loss Equation (RUSLE)- Tolerance limit (T Value) of soil loss– Land use capability classification - Wind drift losses. Soil loss measurement devices – Runoff Plots, Multislot Divisor, Coshocton wheel silt sampler.	12

4	III	V	**21AG5002 & CAD for Agricultural Engineering**	**Exp.No.3** Creating 2D drawings with general steps and assembly of simple machines **Exp.No.6** Drawing of shaft coupling, splines, Gears and connecting road	**Exp.No.3** Creating 2D drawings with general steps of simple machines **Exp.No.6** Drawing of shaft coupling, Gears and connecting road	20

2019 Regulation – 2020 Batch VII semester- Syllabus revision						
S.No	**Year**	**Sem**	**Course Code & Name**	**Existing Syllabus**	**Revised Syllabus**	**Percentage (%) of Change**
1	IV	VII	**19AG7202R-Remote Sensing and Geographical Information System**	**Unit I: Concepts of Remote Sensing and Satellites** Introduction to Remote Sensing- Energy Sources and Interaction- Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT, SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution -Remote Sensing Applications	**Unit I: Concepts of Remote Sensing and Satellites** Introduction to Remote Sensing- Energy Sources and Interaction- Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT, SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution.	4
				Unit III: Concepts of GIS Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.	**Unit III: Concepts of GIS** Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – Definition – Components – Hardware and Software – GIS tools	10

2	IV	VII	19AG7304R & Process Engineering of Fruits and Vegetables	**Unit I: Structure, Composition, Ripening and Spoilage** Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage	**Unit I: Structure, Composition, Ripening and Spoilage** Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage – Climatic and non-climatic fruits - Maturity indices for fruits.	8
				Unit II: Cleaning, Grading and On-Farm Processing Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipment's – construction and working – pre-cooling – importance, methods, pretreatments and advantages.	**Unit II: Cleaning, Grading and On-Farm Processing** Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipment's – construction and working – pre-cooling – importance, methods, pretreatments and advantages – Transportation and handling of fruits and vegetables – controlled atmosphere and modified atmosphere process	10

				Unit III: Preservation of Fruits and Vegetables Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques.	**Unit III: Preservation of Fruits and Vegetables** Thermal and non-thermal process of preservation of fruits and vegetables – canning of fruits and vegetables – process – methods – Advantage – Disadvantages – Drying and dehydration – freezing – Application – Methods quality parameters.	25
3	IV	VII	**19AG7001R & Renewable Energy Laboratory**	**Exp.No.4** Determine the efficiency of the pyrolysis reactor **Exp.No.5** Determine the efficiency of the biomass gasifier reactor	**Exp.No.4** Determine composition of biogas **Exp.No.5** Testing of engine performance	20
3	IV	VII	**19AG7002R & Remote Sensing and GIS Laboratory For Agricultural Engineers**	**Exp.No.1** Measurement of relief displacement using parallax bar **Exp.No.2** Stereoscopic vision test **Exp.No.3** Satellite images interpretation – visual **Exp.No.4** Image enhancement practice **Exp.No.5** Database Management Systems **Exp.No.6** Spatial data input	**Exp.No.1** Introduction to QGIS and SAGA **Exp.No.2** Projection by using QGIS **Exp.No.3** Georefrencing by Using QGIS **Exp.No.** Image Registration **Exp.No.5** Digitization of a Toposheet **Exp.No.6** Map Preparation using QGIS	60

				and editing - Digitising		

Syllabus Revision carried out in 2023-2024 ODD Semester

2019 Regulation (2020 batch) - VII semester = **11.42 %**
2019 Regulation (2021 batch) - V semester = **7.07 %**

Over all Percentage **18.49%** of Change Effected in the syllabus

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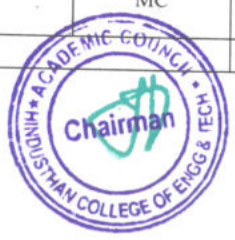
(For the students admitted during the academic year 2022-2023 and onwards)

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22MA1101	MATRICES AND CALCULUS	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	ENGINEERING DRAWING	ESC	1	4	0	3	5	40	60	100
THEORY WITH LAB COMPONENT											
3.	22PH1151	PHYSICS FOR NON-CIRCUIT ENGINEERING	BSC	2	0	2	3	4	50	50	100
4.	22HE1151	ENGLISH FOR ENGINEERS	HSC	2	0	2	3	4	50	50	100
5.	22IT1151	PYTHON PROGRAMMING AND PRACTICES	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6.	22HE1071	UHV	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	ENTREPRENEURSHIP & INNOVATION	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
8.	22MC1091	INDIAN CONSTITUTION	MC	2	0	0	0	2	100	0	100
	22MC1092	அறிவியல தமிழ									
TOTAL CREDITS				**17**	**5**	**6**	**19**	**29**	**470**	**330**	**800**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22MA2102	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES.	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	ENVIRONMENTAL STUDIES	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	BASICS OF MATERIAL SCIENCE	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4.	22CY2151	CHEMISTRY FOR BIOLOGICAL SCIENCES	BSC	2	0	2	3	4	50	50	100
5.	22AG2252	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	PCC	2	0	2	3	4	50	50	100
6.	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION	HSC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	ENGINEERING PRACTICES	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	DESIGN THINKING	AEC	1	0	2	2	2	100	0	100
9.	22HE2072	SOFT SKILLS -1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2091	தமிழர மரபு	MC	2	0	0	0	2	100	0	100
	22MC2092	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE									
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL CREDITS				**17**	**1**	**12**	**22**	**29**	**630**	**370**	**1000**



SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22MA3109	TRANSFORMS AND APPLICATIONS	BSC	3	1	0	4	4	40	60	100
2.	22AG3201	SOIL TECHNOLOGY	PCC	3	0	0	3	3	40	60	100
3.	22AG3202	FLUID MECHANICS AND PUMPS	PCC	3	1	0	4	4	40	60	100
4.	22AG3203	ENGINEERING THERMODYNAMICS	PCC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22AG3251	UNIT OPERATIONS IN AGRICULTURAL PROCESSING	PCC	2	0	2	3	4	50	50	100
6.	22AG3252	SURVEYING AND LEVELLING	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22AG3001	SOIL TECHNOLOGY LABORATORY	PCC	0	0	4	2	4	60	40	100
EEC Courses (SE/AE)											
8	22HE3071	SOFT SKILLS -2	SEC	1	0	0	1	1	100	0	100
9	22AG3072	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	AE	2	0	0	2	2	40	60	100
TOTAL CREDITS				**19**	**2**	**8**	**25**	**29**	**460**	**440**	**900**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22HE4101	IPR AND START-UPS	HSC	2	0	0	2	2	40	60	100
2.	22MA4101	APPLIED PROBABILITY AND STATISTICS FOR AGRICULTURAL ENGINEERING	BSC	2	1	0	3	4	40	60	100
3.	22AG4201	FARM EQUIPMENT AND MACHINERY	PCC	3	0	0	3	3	40	60	100
4.	22AG4202	THEORY OF MACHINES	PCC	3	0	0	3	3	40	60	100
5.	22AG4203	HYDROLOGY AND WATER RESOURCES ENGINEERING	PCC	3	1	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6.	22AG4251	SOIL AND WATER CONSERVATIONENGINEERING	PCC	2	0	2	3	4	50	50	100
7.	22AG4252	STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
8.	22AG4001	OPERATION AND MAINTENANCES OF FARM MACHINERY AND ENGINES LABORATORY	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	SOFT SKILLS -3	SEC	1	0	0	1	1	100	0	100
TOTAL CREDITS				**18**	**2**	**8**	**23**	**29**	**460**	**440**	**900**

* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III then the Internship I offered in the semester IV can be clubbed with Internship II(Total: 4 weeks-2 credits)

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22AG5201	TRACTORS AND ENGINE SYSTEMS	PCC	3	1	0	4	4	40	60	100
2.	22AG53XX	PROFESSIONAL ELECTIVE-1	PEC	3	0	0	3	3	40	60	100
3.	22AG53XX	PROFESSIONAL ELECTIVE-2	PEC	3	0	0	3	3	40	60	100
4.	22AG53XX	PROFESSIONAL ELECTIVE-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22AG5251	IRRIGATION AND DRAINAGE ENGINEERING	PCC	2	0	2	3	4	50	50	100
6.	22AG5252	FOOD AND DAIRY ENGINEERING	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22AG5001	RENEWABLE ENERGY LABORATORY	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE5071	SOFT SKILLS -4 /FOREIGN LANGUAGES	SEC	1	0	0	1	1	100	0	100
TOTAL CREDITS				**17**	**1**	**8**	**22**	**26**	**420**	**380**	**800**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22AG6201	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	PCC	3	0	0	3	3	40	60	100
2.	22AG6202	PROFESSIONAL ETHICS	HSC	3	0	0	3	3	40	60	100
3.	22AG63XX	PROFESSIONAL ELECTIVE-4	PEC	3	0	0	3	3	40	60	100
4.	22AG63XX	PROFESSIONAL ELECTIVE-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	OPEN ELECTIVE – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	OPEN ELECTIVE – 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22AG6001	CAD FOR AGRICULTURAL ENGINEERING LABORATORY	PCC	0	0	4	2	4	60	40	100
8.	22AG6002	POST HARVEST TECHNOLOGY	ESC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6701	SOFT SKILLS - 5	SEC	2	0	0	2	2	100	0	100
TOTAL CREDITS				**20**	**0**	**8**	**24**	**28**	**460**	**440**	**900**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22AG7201	MECHANICS OF TILLAGE AND TRACTION	PCC	3	0	0	3	3	40	60	100
2.	22AG7202	WASTE AND BY PRODUCT	PCC	3	1	0	4	4	40	60	100

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)

To be offered for students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AI6451	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS	OEC	2	0	0	3	4	40	60	100
2.	22CS6451	BLOCKCHAIN TECHNOLOGY	OEC	2	0	0	3	4	40	60	100
3.	22EC6451	CYBER SECURITY	OEC	2	0	0	3	4	40	60	100
4.	22EC6452	IOT CONCEPTS AND APPLICATIONS	OEC	2	0	0	3	4	40	60	100
5.	22IT6451	DATA SCIENCE AND ANALYTICS	OEC	2	0	0	3	4	40	60	100
6.	22BM6451	AUGMENTED AND VIRTUAL REALITY	OEC	2	0	0	3	4	40	60	100

OPEN ELECTIVES I AND II

To be offered for students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AE6401	SPACE SCIENCE	OEC	3	0	0	3	3	40	60	100
2.	22MT6401	INTRODUCTION TO INDUSTRIAL ENGINEERING	OEC	3	0	0	3	3	40	60	100
3.	22MT6402	INDUSTRIAL SAFETY AND ENVIRONMENT	OEC	3	0	0	3	3	40	60	100
4.	22CE6401	CLIMATE CHANGE AND ITS IMPACT	OEC	3	0	0	3	3	40	60	100
5.	22CE6402	ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT	OEC	3	0	0	3	3	40	60	100
6.	22ME6401	RENEWABLE ENERGY SYSTEM	OEC	3	0	0	3	3	40	60	100
7.	22ME6402	ADDITIVE MANUFACTURING SYSTEMS	OEC	3	0	0	3	3	40	60	100
8.	22EI6401	INTRODUCTION TO INDUSTRIAL INSTRUMENTATION AND CONTROL	OEC	3	0	0	3	3	40	60	100
9.	22EI6402	GRAPHICAL PROGRAMMING USING VIRTUAL INSTRUMENTATION	OEC	3	0	0	3	3	40	60	100
10.	22AU6401	FUNDAMENTALS OF AUTOMOBILE ENGINEERING	OEC	3	0	0	3	3	40	60	100
11.	22AU6402	AUTOMOTIVE VEHICLE SAFETY	OEC	3	0	0	3	3	40	60	100
12.	22EE6401	DIGITAL MARKETING	OEC	3	0	0	3	3	40	60	100
13.	22EE6402	RESEARCH METHODOLOGY	OEC	3	0	0	3	3	40	60	100
14.	22FT6401	TRADITIONAL FOODS	OEC	3	0	0	3	3	40	60	100
15.	22CH6401	BIOMASS AND BIOREFINERY	OEC	3	0	0	3	3	40	60	100
16.	22AG6401	URBAN AGRICULTURE AND ORGANIC FARMING	OEC	3	0	0	3	3	40	60	100

		UTILIZATION									
3.	22AG73XX	PROFESSIONAL ELECTIVE-6	PEC	3	0	0	3	3	40	60	100
4.	22XX74XX	OPEN ELECTIVE – 3*	OEC	3	0	0	3	3	40	60	100
5.	22XX74XX	OPEN ELECTIVE – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22AG7001	REMOTE SENSING AND GIS LABORATORY	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22AG7701	INTERNSHIP	SEC	-	-	-	2	2	100	0	100
TOTAL CREDITS				**15**	**1**	**4**	**20**	**22**	**360**	**340**	**700**
Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
EEC Courses (SE/AE)											
1.	22AG8901	PROJECT WORK	SEC	0	0	20	10	20	100	100	200
TOTAL CREDITS				**0**	**0**	**20**	**10**	**20**	**100**	**100**	**200**

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the students who are going to be admitted in the Academic Year 2021 – 22.

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	HSC	3	3	-	2	-	3	-	-	**11**
2.	BSC	7	9	4	3	-	-	-	-	**23**
3.	ESC	6	4	3	-	-	2	-	-	**15**
4.	PCC	-	3	15	17	12	5	9	-	**61**
5.	PEC	-	-	-	-	9	6	3	-	**18**
6.	OEC	-	-	-	-	-	6	6	-	**12**
7.	EEC	3	3	3	1	1	2	2	10	**25**
8.	MC									
Total		**19**	**22**	**25**	**23**	**22**	**24**	**20**	**10**	**165**

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title does not belong to their own programme. (Note: Each programme in our institution is expected to provide one course only)

1.	22AG7401	MODERN AGRICULTURAL TECHNOLOGIES	OEC	3	0	0	3	3	40	60	100

OPEN ELECTIVE IV

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22LS7401	GENERAL STUDIES FOR COMPETITIVE EXAMINATIONS	OEC	3	0	0	3	3	40	60	100
2.	22LS7402	HUMAN RIGHTS, WOMEN RIGHTS AND GENDER EQUITY	OEC	3	0	0	3	3	40	60	100
3.	22LS7403	INDIAN ETHOS AND HUMAN VALUES	OEC	3	0	0	3	3	40	60	100
4.	22LS7404	FINANCIAL INDEPENDENCE AND MANAGEMENT	OEC	3	0	0	3	3	40	60	100
5.	22LS7405	YOGA FOR HUMAN EXCELLENCE	OEC	3	0	0	3	3	40	60	100
6.	22LS7406	DEMOCRACY AND GOOD GOVERNANCE	OEC	3	0	0	3	3	40	60	100
7.	22LS7407	NCC LEVEL - II	OEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I Farm Machinery and Power	VERTICAL II Water Management and Protected cultivation	VERTICAL III Renewable Energy Engineering	VERTICAL IV Food Processing	VERTICAL V IT and Agricultural Business management	VERTICAL VI Advances in Agricultural Engineering
22AG5301 Farm Power & Machinery Management	**22AG5304** Watershed planning and Management	**22AG5307** Biomass Management for Fodder & Energy	**22AG5310** Heat and Mass Transfer for Agricultural Engineering	**22AG5313** Integrated Farming System	**22AG5316** Automation in Agriculture
22AG5302 Tractor Systems and Controls	**22AG5305** Groundwater and Well Engineering	**22AG5308** Renewable Energy Sources	**22AG5311** Food Process Equipment and Design	**22AG5314** Agri Business Management	**22AG5317** Electric and Hybrid Vehicle
22AG5303 Tractor Design and Testing	**22AG5306** Design of Micro-irrigationsystem	**22AG5309** Renewable Energy Technology	**22AG5312** Food Plant Design andManagement	**22AG5315** Sustainable Agriculture and Food Security	**22AG5318** Foundation of Robotics and Drone
22AG6301 Hydraulic Control system and design	**22AG6303** Protected Cultivation	**22AG6305** Solar and Wind energysystem	**22AG6307** Storage and Packaging Technology	**22AG6309** Systems Analysis in Agricultural Engineering	**22AG6311** Applications of RS & GIS in Resource Management
22AG6302 Testing and evaluation of farm machinery and equipment	**22AG6304** On-farm water management	**22AG6306** Biochemical and Thermochemical conversion of biomass	**22AG6308** Refrigeration and cold Storage	**22AG6310** IT in Agricultural System	**22AG6312** Fundamentals of Nano Technology in Agriculture
22AG7301 Human Engineering and Safety in Farm Machinery Operations	**22AG7302** Irrigation Water Quality andWaste Water Management	**22AG7303** Energy Audit	**22AG7304** Emerging Technologies in FoodProcessing	**22AG7305** Design and Maintenance of Green House	**22AG7306** Gender and Integrated water Resource Management

Note:

Students are permitted to choose all professional electives from any of the verticals.

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PROFESSIONAL ELECTIVE -I

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5301	FARM POWER & MACHINERY MANAGEMENT	PEC	3	0	0	3	3	40	60	100
2.	22AG5302	TRACTOR SYSTEMS AND CONTROLS	PEC	3	0	0	3	3	40	60	100
3.	22AG5303	TRACTOR DESIGN AND TESTING	PEC	3	0	0	3	3	40	60	100
4.	22AG6301	HYDRAULIC CONTROL SYSTEM AND DESIGN	PEC	3	0	0	3	3	40	60	100
5.	22AG6302	TESTING AND EVALUATION OF FARM MACHINERY AND EQUIPMENT	PEC	3	0	0	3	3	40	60	100
6.	22AG7301	HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS	PEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE -II

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5304	WATERSHED PLANNING AND MANAGEMENT	PEC	3	0	0	3	3	40	60	100
2.	22AG5305	GROUNDWATER AND WELL ENGINEERING	PEC	3	0	0	3	3	40	60	100
3.	22AG5306	DESIGN OF MICRO-IRRIGATION SYSTEM	PEC	3	0	0	3	3	40	60	100
4.	22AG6303	PROTECTED CULTIVATION	PEC	3	0	0	3	3	40	60	100
5.	22AG6304	ON-FARM WATER MANAGEMENT	PEC	3	0	0	3	3	40	60	100
6.	22AG7302	IRRIGATION WATER QUALITY AND WASTE WATER MANAGEMENT	PEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE -III

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5307	BIOMASS MANAGEMENT FOR FODDER & ENERGY	PEC	3	0	0	3	3	40	60	100
2.	22AG5308	RENEWABLE ENERGY SOURCES	PEC	3	0	0	3	3	40	60	100
3.	22AG5309	RENEWABLE ENERGY TECHNOLOGY	PEC	3	0	0	3	3	40	60	100
4.	22AG6305	SOLAR AND WIND ENERGY SYSTEM	PEC	3	0	0	3	3	40	60	100
5.	22AG6306	BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS	PEC	3	0	0	3	3	40	60	100
6.	22AG7303	ENERGY AUDIT	PEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE -IV

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5310	HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERING	PEC	3	0	0	3	3	40	60	100
2.	22AG5311	FOOD PROCESS EQUIPMENT AND DESIGN	PEC	3	0	0	3	3	40	60	100
3.	22AG5312	FOOD PLANT DESIGN AND MANAGEMENT	PEC	3	0	0	3	3	40	60	100
4.	22AG6307	STORAGE AND PACKAGING TECHNOLOGY	PEC	3	0	0	3	3	40	60	100
5.	22AG6308	REFRIGERATION AND COLD STORAGE	PEC	3	0	0	3	3	40	60	100
6.	22AG7304	EMERGING TECHNOLOGIES IN FOODPROCESSING	PEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE -V

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5313	INTEGRATED FARMING SYSTEM	PEC	3	0	0	3	3	40	60	100
2.	22AG5314	AGRI BUSINESS MANAGEMENT	PEC	3	0	0	3	3	40	60	100
3.	22AG5315	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	PEC	3	0	0	3	3	40	60	100
4.	22AG6309	SYSTEMS ANALYSIS IN AGRICULTURALENGINEERING	PEC	3	0	0	3	3	40	60	100
5.	22AG6310	IT IN AGRICULTURAL SYSTEM	PEC	3	0	0	3	3	40	60	100
6.	22AG7305	DESIGN AND MAINTENANCE OF GREEN HOUSE	PEC	3	0	0	3	3	40	60	100

PROFESSIONAL ELECTIVE -VI

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22AG5316	AUTOMATION IN AGRICULTURE	PEC	3	0	0	3	3	40	60	100
2.	22AG5317	ELECTRIC AND HYBRID VEHICLE	PEC	3	0	0	3	3	40	60	100
3.	22AG5318	FOUNDATION OF ROBOTICS AND DRONE	PEC	3	0	0	3	3	40	60	100
4.	22AG6311	APPLICATIONS OF RS & GIS IN RESOURCE MANAGEMENT	PEC	3	0	0	3	3	40	60	100
5.	22AG6312	FUNDAMENTALS OF NANO TECHNOLOGY IN AGRICULTURE	PEC	3	0	0	3	3	40	60	100
6.	22AG7306	GENDER AND INTEGRATED WATER RESOURCE MANAGEMENT	PEC	3	0	0	3	3	40	60	100

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the enrollment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional)

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Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	23	22	24	20	10	165

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SEMESTER - III

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AG3201	SOIL TECHNOLOGY	3	0	0	3

Course Objective

- To expose the students to the fundamental knowledge on Soil physical parameters.
- To learn about Permeability – Compaction, Bearing Capacity and types and methods of soil survey and interpretative groupings

Unit	Description	Instructional Hours
I	**INTRODUCTION AND SOIL PHYSICS** Soil - definition - major components –Soil forming minerals and processes- soil profile - Physical properties - texture –density-porosity-consistence-colour- -specific gravity - capillary and non- capillary -plasticity. Soil air - soil temperature - soil water - classification of soil water- Movement soil water. Soil colloids – organic and inorganic matter-Ion exchange- pH – Plant nutrient availability	9
II	**SOIL CLASSIFICATION AND SURVEY** Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping- mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.	9
III	**PHASE RELATIONSHIP AND SOIL COMPACTION** Phase relations- Gradation analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.	9
IV	**ENGINEERING PROPERTIESOF SOIL** Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability-Darcy's law-field and lab methods - Assessment of seepage - Compressibility	9
V	**BEARING CAPACITY AND SLOPE STABILITY** Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations- Terzaghi"s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method- slope protection measures.	9
	Total Instructional Hours	**45**

COURSE OUTCOMES

After completion of the course the learner will be able to

CO1:Fundamental knowledge of soil physical parameters.
CO2:The procedures involved in soil survey, soil classification.
CO3:The phase relationship and soil compaction.
CO4:Concepts of bearing capacity and slope stability
CO5: Understanding the important of BIS standards

TEXT BOOKS:

T1 Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008

T2 Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

REFERENCE BOOKS:

R1 Edward J. Plaster., "Soil Science", Cengage Learning India Ltd, New Delhi, 2009.

R2 Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2007

R3 Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007

R4 Sehgal, S.B., "Text Book of Soil Mechanics", CBS Publishers and Distributors New Delhi, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech.	22AG3202	FLUID MECHANICS AND PUMPS	3	1	0	4

Course Objective

1. To understand the properties of fluids
2. To acquire knowledge on fluid flow
3. To understand the behavior of fluid flow through pipes
4. To gain knowledge on open channel flows
5. To gather knowledge on dimensional analysis and study the various types of pumps

Unit	Description	Instructional Hours
	FLUID PROPERTIES AND FLOW CHARACTERISTICS	
I	Properties of fluids – Fluid statics – Pressure Measurements – Buoyancy and floatation – Flow characteristics – Eulerian and Lagrangian approach – Concept of control volume and system – Reynold's transportation theorem – Continuity equation, energy equation and momentum equation – Applications.	12
	FLOW THROUGH PIPES AND BOUNDARY LAYER	
II	Reynold's Experiment – Laminar flow through circular conduits – Darcy Weisbach equation – friction factor – Moody diagram – Major and minor losses – Hydraulic and energy gradient lines – Pipes in series and parallel – Boundary layer concepts – Types of boundary layer thickness.	12
	DIMENSIONAL ANALYSIS AND MODEL STUDIES	
III	Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models	12
	TURBINES	
IV	Impact of jets – Velocity triangles – Theory of rotodynamic machines – Classification of turbines – Working principles – Pelton wheel – Modern Francis turbine – Kaplan turbine – Work done – Efficiencies – Draft tube – Specific speed – Performance curves for turbines – Governing of turbines.	12
	PUMPS	
V	Classification of pumps – Centrifugal pumps – Working principle – Heads and efficiencies– Velocity triangles – Work done by the impeller – Performance curves – Reciprocating pump working principle – Indicator diagram and it's variations – Work saved by fitting air vessels – Rotary pumps.	12
	Total Instructional Hours	60

COURSE OUTCOMES	Upon successful completion of the course, students shall have ability to CO1: Comprehend the properties of fluids CO2: Understand the various types of fluid flow CO3: Calculate the discharge and compute energy losses in pipe flow CO4: Classify open channel flows and also design the most economical sections for open channel flows CO5: Select appropriate model to provide solution to a real time problem related to hydraulics and also assess the performance of pumps

TEXT BOOKS:

T1 Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.

T2 S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill Education (India) Pvt. Ltd., 2017.

T3 Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017.

REFERENCE BOOKS:

R1 Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.

R2 Subramanya K, Fluid Mechanics and Hydraulic Machines: Problems and Solutions, McGraw Hill

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22AG3203	ENGINEERING THERMODYNAMICS	3	0	0	3

Course Objective

- To make the students understand the basic laws of thermodynamics and heat transfer as applied in the different branches of Agricultural Engineering.
- To impart a good exposure on the principles of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc. applied to Agricultural Engineering Machinery and Process designs .

Unit	Description	Instructional Hours
	BASIC CONCEPTS OF THERMODYNAMICS	
I	First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Heat Reservoir, source and sink. Heat Engine, Refrigerator, and Heat pump-Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility -Applications.	9
	FIRST AND SECOND LAW OF THERMODYNAMICS	
II	First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility -Applications.	9
	HEAT ENGINES	
III	Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine , Turbine Components - Refrigeration Cycle – Vapour Compression & Vapour Absorption System ,Gas Refrigeration System – Air Conditioning..	9
	GASES AND VAPOUR MIXTURES	
IV	Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton"s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.	9
	HEAT TRANSFER	
V	Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation.	9
	Total Instructional Hours	45

Course Outcome	CO1: Classify mechanisms and inversions and determine mobility of a mechanism. CO2: Construct cam profiles for various followers and turning moment diagram for flywheel. CO3: Classify various gear trains and apply to automation. CO4: Apply friction principles to clutches, belt, brake and screw. CO5: Evaluate the sensitivity of governor

TEXT BOOKS:

T1	Yunus A. Cenegal and Michael A.Boles, "Thermodynamics: An Engineering Approach", Fourth Edition, Tata McGraw-hill, 2004.
T2	Michael J.Moran, Howard N.Shapiro, "Fundamentals of Engineering Thermodynamics", Fourth Editon, John wiley &Sons, 2000.

REFERENCE BOOKS:

R1	R.K.Rajput, "A Text book of Engineering Thermodynamics", Third Edition, Laxmi publication (P) Ltd., 2007.
R2	Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.
R3	Domkundwar.S., C.P.Kothandaraman "A Course in Thermal Engineering", Fifth Edition, Dhanpat Rai & Co (p) Ltd, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech.	22AG3251	UNIT OPERATIONS IN AGRICUTURAL PROCESSING	2	0	2	3

Course Objective The students would be exposed to the fundamental knowledge in Evaporation, Filtration, Sedimentation, Processing, Sieve analysis, Crystallization and Distillation in processing of agricultural produce.

Unit	Description	Instructional Hours
I	**EVAPORATION AND CONCENTRATION** Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation- performance of evaporators and boiling point elevation – capacity – economy and heat balance- types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator	9
II	**MECHANICAL SEPARATION** Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press- sedimentation – gravitational sedimentation of particles in a fluid – Stoke"s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.	9
III	**SIZE REDUCTION** Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger"s, Bond"s and Kick"s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.	9

IV	**CONTACTEQUILIBRIUM SEPARATION** Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium equilibrium concentration relationships – operating conditions-calculation of separation in contact equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment-properties of tower packing – types – construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – equipment	9
V	**CRYSTALLISATION AND DISTILLATION** Crystallization-Equilibrium –Rate of crystal growth stage-Equilibrium crystallization-Crystallizers- Equipment-Classification- Construction and operation – Crystallizers-Tank-Agitated batch- Swenson-Walker and Vacuum crystallizers-Distillation-Binary mixtures-Flash and differential distillation-Steam distillation –Theory-Continuous distillation with rectification –Vacuum distillation - Batch distillation-Operation and process-Advantages and limitation-Distillation equipments- Construction and operation-Factors influencing the operation.	9
	Total Instructional Hours	**45**

COURSE OUTCOMES

At the end of the study the student will have knowledge on

CO1:Fundamentals of various unit operations of Agricultural Processing.

CO2: Understand the liquid characteristics and performance of single and multiple effect evaporation

CO3: Classify the filter media types and its requirements and sedimentation of particles in a fluid.

CO4: Size reduction equipment and calculating the power requirements

CO5: Understand the equilibrium separation processes and importance of crystallisation and distillation in agricultural processing.

TEXT BOOKS:

T1 Earle, R.L., "Unit operations in Food Processing", Pergamon Press, Oxford, U.K, 1985.

T2 McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.

T3 Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th Edition, Prentice Hall,

REFERENCE BOOKS:

R1 Coulson, J.M and J.F. Richardson. Chemical Engineering. Volume I to V. The Pergamon Press. New York, 1999..

R2 Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press LLC, Florida, 2003..

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech.	22AG3252	SURVEYING AND LEVELLING	2	0	2	3

Course Objective

1. To gain knowledge on basic principle and concepts of different surveying methods.
2. To learn how to use compass to carryout land surveying.
3. To learn the basics of leveling and its applications.
4. To explore the types and characteristics of contours.
5. To understand the concepts of Theodolite survey in linear and angular measurements

Unit	Description	Instructional Hours
I	**FUNDAMENTALS AND CHAIN SURVEYING** Definition- Classifications - Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles - computation of cross sectional areas (Simpon's rule and Trapezoidal rule) **Aligning, Ranging and Chaining** **Computation of area of the plot using Chain traversing**	9
II	**COMPASS AND PLANE TABLE SURVEYING** Compass – Basic principles - Types - Bearing systems and conversions – Sources of Errors - Local attraction - applications - Plane table and its accessories - Merits and demerits. Computation of included angle between stations using Compass Traversing **Plane table Surveying - Radiation Method** **Plane table Surveying – Intersection Method**	9
III	**LEVELLING** Levelling- Principles and theory of Levelling - Datum - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling - Sources of errors in Levelling **Fly levelling using Dumpy Level (Height of Instrument and Rise & Fall method)**	9
IV	**CONTOURING** Contouring - Methods – Characteristics and uses of contours - Plotting – Methods of interpolating contours – Earthwork calculations - Capacity of reservoirs - Mass haul diagrams. Grid Contouring.	9
V	**THEODOLITE AND MODERN SURVEYING** Theodolite – components of theodolite - Temporary and permanent adjustments - Heights and distances by single plane and double method. **Computation of area by Theodolite Traverse** **Computation of area of an agricultural farmland using Total Station** **Using Global Positioning System (GPS) Technology for Tree marking in an agricultural farmland**	9
	Total Instructional Hours	**45**

COURSE OUTCOMES

At the end of the study the student will have knowledge on

CO1: Carryout preliminary surveying to prepare a layout of a given area.
CO2: Apply compass surveying and plane table surveying.
CO3: Understand the basics of leveling and measure the elevations.
CO4: Plot contours and also calculate the capacity of reservoirs.
CO5: To carry out linear and angular measurements using theodolite

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22AG3001	SOIL TECHNOLOGY LABORATORY	0	0	4	2

Course Objective

1. Students will able to impart the knowledge of basic properties of soil
2. Students should be able to verify various quality aspects of soil and water studied in theory by performing experiments in lab.
3. Students will able to investigate soil characteristics
4. Students will able to understand soil and properties for a multitude of objectives
5. Be able to evaluate soils for their sensitivity to impacts related to natural environmental changes and those influenced by man.

S.NO	LIST OF EXPERIMENTS
1	Identification of rocks and minerals
2	Collection and processing of soil samples
3	Determination of Ph and Electrical conductivity of soil
4	Determination of particle and bulk density of soil
5	Specific gravity determination by Pycnometer
6	Soil Compaction Test by using Standard Proctor
7	Textural analysis of soil by International Pipette method
8	Determination of particle size distribution
9	Determination of soil Organic matter
10	Determination of major available nutrients
11	Study the working principles of Agricultural sensors
12	Study on microwave plasma atomic emission spectrometer

Total Instructional Hours 30

Course Outcome

The students completing the course will have

CO1: Students will be able to describe the various mineral and organic components of soils, including how changes in various quantities affect soil physical and chemical properties

CO2: Students will understand pedogenesis and how different parent materials create soils with varying properties.

CO3: Students will understand water retention and movement in soils, especially as it relates to plant water availability

CO4: Students will develop a basic understanding of soil chemistry, including pH and CEC, especially how they relate to nutrient availability and, when feasible, adjustments, such as liming, that can improve conditions for plant growth.

CO5: Students will develop an introductory understanding of soil taxonomy, including the favorable traits and limitations of the various soil orders.

REFERENCE BOOKS

R1 Punmia, B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publishers, New Delhi. 2007

R2 "Laboratory Manual" Centre for Water Resources, Anna University, Chennai.2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech.	22AG3072	Basic Electrical, Electronics and Instrumentation Engineering	3	0	0	2

Course Objective

To introduce the basics of electric circuits and analysis
To impart knowledge in domestic wiring
To impart knowledge in the basics of working principles and application of electrical machines
To introduce analog devices and their characteristics
To introduce the functional elements and working of sensors and transducers.

Unit	Description	Instructional Hours
	ELECTRICAL CIRCUITS	
I	DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources .	9
	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	
II	Magnetic circuits- definitions- MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductance-simple problems.	9
	ELECTRICAL MACHINES	
III	Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications.	9
	ANALOG ELECTRONICS	
IV	Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications.	9
	SENSORS AND TRANSDUCERS	
V	Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electron-pneumatic systems- proximity sensors.	9
	Total Instructional Hours	45

Course Outcome

After completing this course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestics wiring and protective devices
CO3: Explain the working principle and applications of electrical machines.

CO4: Analyze the characteristics of analog electronic devices

CO5: Explain the types and operating principles of sensors and transducers

TEXT BOOKS:

T1 D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020

T2 A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

T3 S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019

T4 James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

REFERENCE BOOKS:

R1 John Bird, "Electrical Circuit theory and technology", Routledge; 2017.

R2 Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.

R3 Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017

R4 Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition.,Cengage India, 2019.

R5 H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

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HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.

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UNDERGRADUATE PROGRAMMES

B.E AGRICULTURE ENGINEERING (UG)

REGULATION-2019 (Revised on July 2021)

(For the students admitted during the academic year 2021-2025 and onwards)

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	3	0	0	3	25	75	100
2	21HE1001	Language Competency Enhancement Course-I	HS	3	1	0	4	25	75	100
3	21MA1102	Calculus and Linear Algebra	BS	3	0	0	3	25	75	100
4	21ME1101	Basics of civil and Mechanical Engineering	HS	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
6	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
7	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
MANDATORY COURSES										
9	21HE1072	**Career Guidance Level – I** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
			Total :	**16**	**1**	**10**	**22**	**350**	**450**	**800**

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SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CI A	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	3	0	0	3	25	75	100
2	21HE2001	Language Competency Enhancement Course-II	HS	3	1	0	4	25	75	100
3	21MA2101	Differential Equations and Complex Variables	BS	3	0	0	3	25	75	100
4	21AG2104	Principles of Food Science	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	21PH2151	Material Science	BS	2	0	2	3	50	50	100
6	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
7	21IT2151	Programming in C	ES	2	0	2	3	50	50	100
PRACTICAL										
8	21ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
MANDATORY COURSES										
9	21HE2072	**Career Guidance Level** – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	-	100
			Total :	**16**	**1**	**10**	**22**	**500**	**500**	**1000**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTA L
THEORY										
1	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2	21AG3201	Soil Science and Engineering	PC	3	0	0	3	25	75	100
3	21AG3202	Fluid Mechanics and Hydraulics	PC	3	1	0	4	25	75	100
4	21AG3203	Principles and practices of Crop Production	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	21AG3251	Unit Operations in Agricultural Processing	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21AG3001	Field Crop Production Practical	PC	0	0	3	1.5	50	50	100

7	21AG3002	Soil Science Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	21MC3191	Indian Constitution	AC	2	0	0	0	100	0	100
9	21HE3072	**Career Guidance Level – III** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	-	100
			Total	**16**	**2**	**8**	**20**	**550**	**450**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG4201	Farm Tractors	PC	2	1	0	3	25	75	100
2	21AG4202	Thermodynamics	PC	3	0	0	3	25	75	100
3	21AG4203	Irrigation and Drainage Engineering	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	21MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
5	21AG4251	Bio-Energy Resource Technology	PC	2	0	2	3	50	50	100
6	21AG4252	Surveying and Leveling	PC	2	0	2	3	50	50	100
PRACTICAL										
7	21AG4001	Irrigation Field Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	21AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100	0	100
9	21HE4072	**Career Guidance Level – IV** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE4073	Ideation Skills	EEC	1	0	0	0	100	-	100
			Total	**17**	**0**	**10**	**21**	**575**	**425**	**1000**

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG5201	Farm Machinery and Equipment	PC	3	0	0	3	25	75	100
2	21AG5202	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
3	21AG5203	Theory of Machines	PC	3	0	0	3	25	75	100
4	21AG53XX	Professional Elective-I	PE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	21AG5251	Groundwater and Well Engineering	PC	2	0	2	3	50	50	100
6	21AG5252	Soil and Water Conservation Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21AG5001	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5	50	50	100
8	21AG5002	CAD for Agricultural Engineering	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
			Total	**16**	**1**	**10**	**22**	**350**	**650**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG6201	Hydrology and Water Resources Engineering	PC	3	0	0	3	25	75	100
2	21AG6202	Solar and Wind Energy Engineering	PC	3	1	0	4	25	75	100
3	21AG6181	Professional Ethics	HS	3	0	0	3	25	75	100
4	21AG63XX	Professional Elective-II	PE	3	0	0	3	25	75	100
5	21XX64XX	Open Elective-I	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										

6	21AG6251	Food and Dairy Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21AG6252	ICT in Agricultural Engineering	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	21AG6701	Industrial Training	EEC	0	0	0	1	0	100	100
9	21HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	25	75	100
			Total	**17**	**1**	**6**	**22**	**275**	**725**	**1000**

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG7201	Agricultural Extension	PC	3	0	0	3	25	75	100
2	21AG7202	Remote Sensing and Geographical Information System	PC	3	0	0	3	25	75	100
3	21AG73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
4	21XX74XX	Open Elective-II	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										
5	21AG7251	Precision Farming and Protected Cultivation	PC	2	0	2	3	50	50	100
PRACTICALS										
6	21AG7001	Renewable Energy Laboratory	PC	0	0	3	1.5	50	50	100
7	21AG7002	GIS Laboratory for Agricultural Engineers	PC	0	0	3	1.5	50	50	100
INNOVATION PROJECT										
8	21AG7901	Innovative Project	EEC	0	0	4	2	50	50	100
			Total	**14**	**0**	**12**	**20**	**300**	**500**	**800**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG83XX	Professional Elective-IV	PE	3	0	0	3	25	75	100
2	21AG83XX	Professional Elective-V	PE	3	0	0	3	25	75	100
PROJECT WORK										
3	21AG8901	Project work	EEC	0	0	16	8	100	100	200
			Total	**6**	**0**	**16**	**14**	**150**	**250**	**400**

TOTAL NUMBER OF CREDITS: 165

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21AG5301	Systems Analysis and Soft Computing in Agricultural Engineering	PC	3	0	0	3	25	75	100
2	21AG5302	Sustainable Agriculture and Food Security	PC	3	0	0	3	25	75	100
3	21AG5303	CDM and Carbon Trading Technology	PC	3	0	0	3	25	75	100
4	21AG5304	IOT in Agricultural Systems	PC	3	0	0	3	25	75	100
5	21AG5305	Ergonomics and Safety in Agricultural Engineering	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	21AG6301	Climate change and adaptation	PC	3	0	0	3	25	75	100
2	21AG6302	Heat and Mass Transfers for Agricultural Engineers	PC	3	0	0	3	25	75	100
3	21AG6303	Disaster Management	PC	3	0	0	3	25	75	100
4	21AG6304	Horticultural Crop Processing	PC	3	0	0	3	25	75	100
5	21AG6305	Organic Farming Technologies	PC	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE III										
1	21AG7301	Post-Harvest Technology	PC	3	0	0	3	25	75	100
2	21AG7302	Dairy Process Technology	PC	3	0	0	3	25	75	100
3	21AG7303	Storage and Packaging Technology	PC	3	0	0	3	25	75	100
4	21AG7304	Process Engineering of Fruits and Vegetables	PC	3	0	0	3	25	75	100
5	21AG7305	Fat and Oil Processing	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV										
1	21AG8301	Agricultural Business Management and Entrepreneurship	PC	3	0	0	3	25	75	100
2	21AG8302	On-Farm Water Management	PC	3	0	0	3	25	75	100
3	21AG8303	Application of Drone and robotics Technology in Agriculture	PC	3	0	0	3	25	75	100
4	21AG8304	Agricultural Waste Management	PC	3	0	0	3	25	75	100
5	21AG8305	Energy Conservation in Agro based Industry	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE V										
1	21AG8306	Special Farm Equipment's	PC	3	0	0	3	25	75	100
2	21AG8307	Mechanics of Tillage and Traction	PC	3	0	0	3	25	75	100
3	21AG8308	Watershed Hydrology and Management	PC	3	0	0	3	25	75	100
4	21AG8309	Micro Irrigation System	PC	3	0	0	3	25	75	100
5	21AG8310	Agriculture Economics and Farm Management	PC	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES										
AGRICULTURE ENGINEERING										
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	21AG6401	Research Methodology	OE	3	0	0	3	25	75	100
AGRICULTURE ENGINEERING										

2	21AG7401	Urban Agriculture and organic farming	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
3	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
4	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
5	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
6	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
7	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100
NCC COURSES (Only for the students' who have opted NCC subjects in Semester I, II, III & IV are eligible)										
9	21HEZ401	NCC Course level -1	OE	3	0	0	3	25	75	100
10	21HEZ401	NCC Course level -2	OE	3	0	0	3	25	75	100

ADDITIONAL CREDIT COURSE FOR NCC CADETS

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1	21HE1074	NCC General and National Integration	VA	1	0	0	1	100	-	100
2	21HE2074	Social services and community development	VA	1	0	0	1	100	-	100
3	21HE3074	Leadership Qualities and camp activities	VA	1	0	0	1	100	-	100
4	21HE4074	General awareness, communication and Aero engines	VA	1	0	0	1	100	-	100

(Note: Z Stands for semester, students can't choose twice the course)

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CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	22	22	20	18	165

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Chairman - BoS
AGRI - HiCET

Dean - Academics

Dean (Academics)
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Principal

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5201	FARM MACHINERY AND EQUIPMENT	3	0	0	3

Course Objective

1. To introduce the students to the working principles of farm Machinery tillage implements.
2. To get thorough knowledge about the feasibility of primary and secondary tillage implements.
3. To gain knowledge about the sowing and fertilizer application methodologies
4. To acquire basic knowledge in the field of Weeding and Harvesting.
5. To expose the students to farm mechanization prospects and constraints alongside Cooperative Farming for shared usage of machinery.

Unit	Description	Instructional Hours
I	**FARM MECHANIZATION** Farm mechanization – objectives and level of mechanization in India- Materials of construction and Heat Treatment of farm equipment's- Selection of Farm Machines- Types of farm implements – trailed, mounted and self-propelled. Field capacity, efficiency, economics of machinery use with numerical / problems.	5
II	**PRIMARY TILLAGE IMPLEMENTS** Tillage - objectives - methods and terminology – classification of primary & secondary tillage equipment. Primary Tillage: objective- types – Mould board plough-accessories, adjustments, operation and material of construction. Disc plough-standard and vertical -principle of operation, adjustments and accessories. Sub-soiler and chisel plough: types, working and construction. Earth moving equipment-Bulldozer, Trencher, Elevator.	10
III	**SECONDARY AND MISCELLANEOUS TILLAGE IMPLEMENTS** Secondary tillage: objective- types -Construction and working of Disc harrows, Spike-tooth and spring-tine harrows- cultivator –Levelers-Ridger-Bund former. Miscellaneous tillage tools: rotary tillage tools, rotavators, stirring plough, auger plough, rotary hoes, Oscillating tools - Forces acting upon tillage tool/ implement – Hitching System	10
IV	**SOWING ,FERTILIZING APPLICATION, WEEDING AND PLANT PROTECTION EQUIPMENT** Methods of Crop planting/sowing – Types of seed drills and planters – calibration-fertilizer metering devices - seed cum fertilizer drills – paddy trans planters – nursery tray machines. Weeding equipment – dry land star weeder – wet land cono weeder and rotary weeder –Power Operated weeder: Engine/tractor/Battery- Sprayers –types-classification – methods of atomization, spray application rate, droplet size determination –drift control.	10
V	**HARVESTING TOOLS AND MACHINERY** Harvesting and Threshing Terminology- Principals and Type of Cutting Mechanism-Types of Harvesting Machinery: Mowers and Windrowers- Grain Combines and Straw Combines- Root Crop Harvesting Equipment - Fruit and Vegetable Harvesting Tools and Machines.	10
	Total Instructional Hours	45

Course Outcome

CO1: The students will be able to perceive the role and significance of mechanization in sustaining agricultural production

CO2: The students will get acquainted the contextual usage of various equipment used in the farm for different field operations.

CO3: The students will able to understand the working principle of every equipments used from sowing to harvesting.

CO4: The students will equip with technical knowledge and skills required for the operation, maintenance and evaluation of Tillage, Sowing and intercultural operational machinery needed for agricultural farms.

CO5: To develop skills in the students required to develop and modification of indigenous farm machines as per the need of the area and farmers

TEXT BOOKS

T1 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors

T2 Jain S. C. and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi

T3 Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi

T4 Yadav, R., and Solanki, H. B. 2009.Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture.New India Publishing Agency, New Delhi.

T5 Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributers Pvt. Ltd, New Delhi

REFERENCE BOOKS

R1 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.

R2 Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi.,1996.

R3 Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990

R4 Singh, S., and Verma, S. R. 2009.Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi

R5 Kirpal Singh. 2013. Automobile Engineering Vol. I. Standard Publishers Distributors, Delhi

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5202	REFRIGERATION AND COLD CHAIN MANAGEMENT	3	0	0	3

Course Objectives

- To understand the principles of unit operations involved in different Refrigeration and cold storage systems and its components.
- To impart the concept of the basic principles, working, scientific analysis and system components of different types of refrigeration and air conditioning systems
- To impart basic knowledge on design and maintenance aspects related to cold storage systems.
- To impart the knowledge of various types of refrigerants, their properties, selection criteria and environmental aspects.
- To acquire the basic knowledge about various aspects of cold chain management

Unit	Description	Instructional Hours
I	**REFRIGERATION PRINCIPLES** Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - refrigeration components – compressor, condenser Expansion device and evaporators – types, construction and working	9
II	**REFRIGERANTS, VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE** Refrigerants – properties – classification – comparison and advantages – chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants· Simple vapour compression cycle – T-S diagram – P-H chart - application of refrigeration. Vapour absorption cycle – theoretical - deviation in practice - Electrolux refrigerator and Lithium bromide refrigeration– construction and principles.	9
III	**PSYCHROMETRIC PROCESS AND COOLING LOAD CALCULATION** Representation of various psychometric processes on psychometric chart and their Analysis sensible heating, sensible cooling, humidification and dehumidification, by-pass factor, Thermal comfort; Cooling load- components, sensible heat gain, latent heat gain- calculations..	9
IV	**AIR CONDITIONING SYSTEM AND COLD STORAGE DESIGN** Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year- round air conditioning system-unitary and central air conditioning system. Cold storage- types- design consideration, insulation materials properties.	9
V	**SHELF – LIFE & COLD CHAIN MANAGEMENT** Defining overall shelf-life, importance of shelf- life; cold chain-optimum temperature, cold chain equipment- Chilling and freezing-methods; Storage of frozen foods; quality changes during freezing and frozen storage-Chilling injury; cold – shortening.	9
	Total Instructional Hours	45

Course Outcomes

CO1: Introduction of basic principle of different refrigerating systems

CO2: Students will able to understand the effect of different components on there frigerating machines.

CO3: Upon completion of this course, the students will be able to demonstrate the operations in different Refrigeration & cold storage systems

CO4: They will also able to design Refrigeration & Cold storage systems to increase the shelflife of different agricultural commodities.

CO5: Students will able to understand various aspects of cold chain management and able to rectify chilling injuries.

TEXT BOOKS

T1 Anand, M.L. " Refrigeration& Air-Conditioning". Asian Books Pvt., Ltd., 2002.

T2 Sun, Da-Wen. " Advances in Food Refrigeration". Leatherhead Publishing, 2001.

T3 Kennedy, Christopher J. "Managing Frozen Foods". CRC / Woodhead Publishing, 2000.

T4 Ballney P. L. 1994. Thermal Engineering. Khanna Publishers, New Delhi.

T5 Khurmi R S. 1992. Engineering Thermodynamics. S Chand and Co. Ltd., Ram Nagar, New Delhi.

REFERENCE BOOKS

R1 Evans, Judith. "Frozen Food Science and Technology". Wiley-Blackwell , 2008.

R2 Hui, Y.H. etal., " Handbook of Frozen Foods". Marcel Dekker, 2004.

R3 James, S.J. and C. James. " Meat Refrigeration". CRC / Woodhead Publishing, 2002.

R4 Stringer, Mike and C. Dennis. "Chilled Foods: A Comprehensive Guide". 2nd Edition, CRC / Woodhead Publishing, 2002.

R5 Nag P K.1995. Engineering Thermodynamics. Tata McGraw Hill Publishing Co.Ltd., 12/4 Asaf Ali Raod, New Delhi.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5203	THEORY OF MACHINES	3	0	0	3

Course Objective

1. To understand the purpose of kinematics, Kinematic joint and mechanism.
2. To study the relative motion of parts in a machine without taking into consideration the forces involved.
3. To understand the theories and applications of cams and Flywheels.
4. To understand applications of different types of gears and gear profiles and its efficiency and gear trains.
5. To know principles of governors.

Unit	Description	Instructional Hours
	BASICS OF MECHANISMS	
I	Introduction - Links - Pairs - Chain - Mechanism - Machine structure - Degrees of freedom - Four bar chains - Terminology and definition - Planar, Spherical and Spatial Mechanisms - Grashoff's law - Kutzback criterion - Grubler's criterion for plane mechanism. Inversion of mechanisms - Four bar, single slider crank and double slider crank mechanisms.	12
II	**CAM AND FLYWHEEL**	9
	Types of cams and followers - Follower motion - Uniform, Parabolic, SHM and cycloidal. Cam terminology - Cam profiles construction for roller, flat faced and knife edge follower - Functions of fly wheel -Types of fly wheels-Flywheels of engines and punching press- Turning moment diagrams – Fluctuation of energy, speed.	
	GEARS AND GEAR TRAINS	
III	Law of toothed gearing – Involutes and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio – Interference and undercutting – Non–standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears – Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials – Automobile gear box.	9
	FRICTION AND FRICTION DRIVES	
IV	Surface contacts –Friction in screw threads -Friction clutches -Belt and rope drives, Friction aspects in Brakes.	9
	GOVERNORS AND BALANCING	
V	Governors - Types - Centrifugal governors – Porter & Proell governor, Hartnell, Hartung – Characteristics-Need of balancing-Concept of static and dynamic balancing Balancing of rotating mass by another mass in the same plane- Concept of reference plane.	6
	Total Instructional Hours	45

Course Outcome	CO1: Classify mechanisms and inversions and determine mobility of a mechanism. CO2: Construct cam profiles for various followers and turning moment diagram for flywheel. CO3: Transmission through Gears: mechanism, gear trains, classification and analysis, familiarity with gear standardization. CO4: Power transmission through belts and chains, mechanisms, materials CO5: Evaluate the sensitivity of governor.

TEXT BOOKS

T1 Rattan S B. 1993.Theory of Machines.Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.

T2 Bevan Thomas. 1984. Theory of Machines. CBS Publishers and Distributors, Delhi.

T3 Ballaney P L. 1985. Theory of Machines.Khanna Publishers, 2-B Nath Market, NaiSarak, New Delhi.

T4 Khurmi R S and Gupta J K. 1994.Theory of Machines. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.

T5 LalJagdish. 1991. Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 NetajiSubashMarg, New Delhi..

REFERENCE BOOKS

R1 Shigley.J.E, and Uicker.J.J, "Theory of Machines and Mechanisms", McGraw Hill, 1995.

R2 Ghosh.A, and Mallick.A.K, "Theory of Mechanisms and Machines", Affiliated East-West Pvt Ltd., New Delhi, 1988.

R3 Rao.J.S, and Dukkipati.R.V, " Mechanism and Machine Theory" , Wiley-Eastern Ltd., New Delhi, 1995

R4 Khurmi R.S., "Theory of Machines" Khanna Publishers, Delhi, 2006.

R5 Sadhu Singh "Theory of Machines: Kinematics and Dynamics", Pearson; 3rd edition (12 December 2011).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5251	GROUNDWATER AND WELL ENGINEERING	2	0	2	3

Course Objective

1. To understand the theories and applications of groundwater dynamics
2. To study the analysis of well hydraulics
3. To understand about groundwater exploration and recharge.
4. To study about construction of wells
5. To understand the Groundwater quality criteria.

Unit	Description	Instructional Hours
	GROUNDWATER DYNAMICS	
I	Ground water development and potential in India – Groundwater theory - Types of Aquifers: Unconfined (Water Table) Aquifer – Phreatic Surface - Confined (Artesian) Aquifer – Piezometric Surface - Perched Aquifer – Aquiclude, Aquitard and Aquifuge - Leaky Aquifers - Aquifer properties : Permeability, Specific Yield, Specific Retention, Porosity – Aquifer Constants : Transmissibility and Storage coefficient – Seepage and Flow net Analysis.	9
	WELL HYDRAULICS	
II	Pumping Tests – Drawdown – Cone of Depression – Hydraulic Gradient - Darcy's Law - Groundwater Flow Equations –Dupuit- Forcheimer Assumptions – Steady state radial flow – Thiem's Equation – Unsteady state radial flow – Theis method – Chow's Method - Cooper-Jacob method – Recuperation Tests – Theis Recovery Method - Image well theory – Partial penetration of wells.	9
	GROUNDWATER EXPLORATION AND RECHARGE	
III	Water Divining - Geophysical techniques – Electrical resistivity survey – Schlumberger and Wenner Electrode arrangements - Artificial Recharge Techniques – Subterranean Rainwater Harvesting - Infiltration Basins – Percolation Pits – Recharge Shafts – Sea water Intrusion	9
	DESIGN OF WELLS	
IV	Types of wells - Open (Dug)Wells and Bore (Tube) Wells - Design characteristics for wells - Well diameter, depth and Well screen design – Materials for well screens – Well casing – Design of collector wells and Infiltration gallery	9
	CONSTRUCTION AND MAINTENANCE OF WELLS	
V	Well drilling - Boring, Jetting – Rotary drilling, Hammer drilling - Construction – Installation of pipes and screens - Well development, Completion and disinfection – Well maintenance – Well performance test – Well effectiveness – Well losses – Pumping equipment – Rehabilitation of open wells and bore wells- groundwater quality analysis.	9
	Total Instructional Hours	45

Course Outcome

CO1: Students' knowledge base gets enriched with the technical aspects of groundwater, its availability, assessment and utilization

CO2: Student get nourished with the knowledge of well hydraulics in different types of aquifers

CO3: Students will get a thorough idea about different types of wells.

CO4: Students will gain notion about construction of well

CO5: Better exposure to the theory behind well design, construction and water quality management is ensured.

TEXT BOOKS

T1 Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.

T2 Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.

T3 Tang Y, Zhou J, Yang P, Yan J, Zhou N. Groundwater engineering. Springer Singapore; 2017.

T4 Delleur JW, editor. The handbook of groundwater engineering. CRC press; 2006 Nov 16.

T5 Cushman JH, Tartakovsky DM, editors. The handbook of groundwater engineering. CRC Press; 2016 Nov 25.

REFERENCE BOOKS

R1 Rastogi,A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008

R2 David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007

R3 Fletcher.G.Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987

R4 Walton WC. Principles of groundwater engineering. CRC press; 2020 Jul 24.

R5 Howsam P, editor. Water Wells-Monitoring, Maintenance, Rehabilitation: Proceedings of the International Groundwater Engineering Conference, Cranfield Institute of Technology, UK. CRC Press; 1990 Aug 30.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5252	SOIL AND WATER CONSERVATION ENGINEERING	2	0	2	3

Course Objective

1. To impart a thorough knowledge and understanding of the basic concepts of soil erosion
2. To get a basic idea about the relevant mitigation strategies.
3. To enable the students to design appropriate watershed based soil conservation structures
4. To grab knowledge about the applicability of rainwater harvesting systems.
5. To study about design of sediment detention tanks

Unit	Description	Instructional Hours
	MECHANICS OF WATER AND WIND EROSION	
I	Soil Erosion – Agents-Causes and Conservation status in India -Mechanics of water erosion – Factors of Erosion - types of water erosion-– Classification of Gully – Special forms of Erosion – Wind	5
	ESTIMATION OF SOIL LOSS	
II	Rainfall and Runoff Erosivity – Soil Erodibility - Runoff computation for soil conservation: SCS-CN method –Rational Formula - Universal Soil Loss Equation (USLE) – standard plot – Modified Universal Soil Loss Equation (MUSLE) – Revised Universal Soil Loss Equation (RUSLE)- Tolerance limit (T Value) of soil loss– Land use capability classification - Wind drift losses. Soil loss measurement devices – Runoff Plots, Multislot Divisor, Coshocton wheel silt sampler	9
	WATERSHED BASED SOIL CONSERVATION	
III	Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Mechanical Measures – Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways – Contour, Graded and Compartmental Bunding – Bench Terracing for hill slopes – Broad based Terracing – Grassed waterways: Location, construction and maintenance — wind breaks and shelter belts-Landslide control measures – Afforestation.	13
	RAINWATER HARVESTING	
IV	Rainfall Frequency Analysis In-situ soil moisture conservation : Micro catchments, - Continuous Contour Trenching – Staggered Trenching – Random Tie Ridging – Crescent bunds - Farm ponds- Hydrologic, Hydraulic and Structural designs – Construction and Protection – Check dams - Earthen dam – Retaining wall.	9
	SEDIMENT TRANSPORT	
V	Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Suspension, Saltation and surface Creep- Estimation of bed load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks.	9
	Total Instructional Hours	45

Course Outcome

CO1: The students will be able to gain fundamental knowledge on the concepts of erosion.

CO2: Students will obtain the knowledge of estimating soil erosion.

CO3: They get enriched with knowledge on Hydrologic, Hydraulic and Structural designs of soil and water conservation measures

CO4: Students can able to design Rainwater harvesting systems.

CO5: Students will receive concepts of sedimentation and detention tanks.

TEXT BOOKS

T1 Suresh, R., "Soil and Water Conservation Engineering", Standard Publication, New Delhi, 2007.

T2 Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

T3 "Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.

T4 Troeh FR, Hobbs JA, Donahue RL. Soil and water conservation for productivity and environmental protection. Prentice-Hall, Inc.; 1980.

T5 Pierce FJ. Advances in soil and water conservation. CRC Press; 1998 Feb 1.

REFERENCE BOOKS:

R1 Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.

R2 Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.

R3 Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002

R4 Sidle RC, Pearce AJ, O'Loughlin CL. Hillslope stability and land use. American geophysical union; 1985.

R5 Ohlig CP, editor. Integrated Land and Water Resources Management in History: Proceedings of the Special Session on History, May 16th, 2005. BoD–Books on Demand; 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5001	OPERATION AND MAINTENANCE OF FARM MACHINERY LABORATORY	0	0	3	1.5

Course Objective

The students will be introduced to the practice of different farm machinery in the field on

1. Tillage, sowing, plant protection, harvesting and threshing
2. Care and maintenance; lubrication
3. Fits and tolerances and replacements
4. Adjustments of farm machines
5. Dismantling and reassembling of a disc harrow, seed-cum fertilizer drill, and sprayer and engine pumps.

S.NO	LIST OF EXPERIMENTS	Instructional Hours
1	Identification of major systems of a tractor and general guidelines on preliminary check measures.	
2	Identification of components of power tiller and general guidelines on preliminary check measures.	
3	Field operation and adjustments of ploughs	
4	Field operation of seed cum fertilizer drill and calibration	
5	Field operation of plant protection equipment	
6	Field operation on weeder and mowers	
7	Studies on methods of repair, maintenance and off-season storage of farm equipment	
8	To measure Draft and wheel slip with load and no-load condition.	
9	Hitching of agricultural implements and trailers	
10	Study and calculate harvesting losses of combine harvester and thrasher	
11	Study and operation of bulldozer/laser leveler and its roll in agriculture practices	
	Total Instructional Hours	30

Course Outcome

During this course, students have an ability

CO1: To identify farm equipment
CO2: To calculate and predict the actual field problem during the operation.
CO3: To trained to do adjustments of farm implements and Hitching of agricultural implements and trailers.
CO4: To give care and maintenance to the farm machinery implements.
CO5: To dismantle and assemble various machineries used in agriculture.

S.NO	LIST OF EQUIPMENTS	REQUIRED QUANTITY
1	Tractor	1
2	Power tiller	1

3	Disc plough	1
4	Disc harrow	1
5	Multi tyne cultivator	1
6	Paddy Transplanter	1
7	Seed drill	1
8	Sprayer	1
9	Mower	1
10	Weeder	1
11	Combine harvester (optional) – can be had as demonstration	1

TEXT BOOKS

T1 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors

T2 Jain S. C. and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi

T3 Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi

T4 Yadav, R., and Solanki, H. B. 2009.Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture.New India Publishing Agency, New Delhi.

T5 Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributers Pvt. Ltd, New Delhi

REFERENCES

R1 Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard publishers and Distributors, New Delhi, 1999.

R2 Herbert L.Nichols Sr., Moving the Earth, D. Van Nostrand company Inc. Princeton, 1959.

R3 John A Havers and Frank W Stubbs, Hand book of Heavy Construction, McGraw – Hill book Company, New York, 1971.

R4 Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.

R5 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5002	CAD FOR AGRICULTURAL ENGINEERING	0	0	4	2

Course Objective To draft the agricultural engineering related machineries and structures manually and also by computer aided methods.

S.NO	LIST OF EXPERIMENTS
1	Study on Basics of engineering drawing (Scale, Views and Projections)
2	Study on Basics of AUTOCAD
3	Creating 2D drawings with general steps of simple machines
4	Drawing of objects in 3D with general steps
5	Drawing of shafts, bearing, bolt and nut, keys and hubs.
6	Drawing of shaft coupling, Gears and connecting road.
7	Preparation of assemblies in 3D
8	Design and Drawing of Underground pipeline system
9	Design and Drawing of Check dam
10	Design and Drawing of Mould board plough, Disk plough and sprayers
11	Design and Drawing of Biogas plant.
12	Draw a simple building in 2D and 3D.

Course Outcome

CO1: Understand of basic of engineering drawing and software usage
CO2:The students also will be able to design and draw the components using computer aided methods.
CO3 The student will be able to understand the plan and layout of underground pipes, farm implements
CO4: Practicing to draw internal components of farm implements
CO5: Practice to draw farm shed in 2 D and 3 D view

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Computers	30
2	Licensed Software like CAD, Solid work and Pro E	1

REFERENCES

R1 Michael, A.M. "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.

R2 Rai, G.D. "Nonconventional Sources of Energy", Khanna publishers, New Delhi, 1995.

R3 Srivastava, A.C."Elements of Farm Machinery", Oxford and IBH Publications Co., New Delhi, 1990.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5301	SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING	3	0	0	3

Course Objective

- To introduce the students to the application of systems concept to agricultural engineering problems, planning and management.
- To provide in depth knowledge of various techniques in Operations Research which are widely used in agricultural engineering.
- Soft computing techniques for modeling different problems in the field agricultural engineering.
- To acquire basic knowledge on concepts of Artificial Neural Networking.
- To grab basic ideas of fuzzy logic for solving problems in the field of Agriculture

Unit	Description	Instructional Hours
	SYSTEM CONCEPTS	
I	Definition, classification, and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.	9
	LINEAR PROGRAMMING & DYNAMIC PROGRAMMING	
II	Introduction to operations research – Linear programming, problem formulation, graphical solution, solution by simplex method – Sensitivity analysis – application – Bellman's optimality criteria, problem formulation and solutions – application.	9
	SIMULATION	
III	Basic principles and concepts – Random variate and random process – Monte Carlo techniques – Model development – Inputs and outputs – Deterministic and stochastic simulation – Irrigation Scheduling - application.	9
	NEURAL NETWORKS	
IV	Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory- Architecture: model, solution, single layer and multilayer perception model; back propagation learning methods, applications.	9
	FUZZY LOGIC AND GENETIC ALGORITHM	
V	Basic concepts of fuzzy logic, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic, Fuzzy implications and Fuzzy algorithms, Fuzzy Controller, Industrial applications. Genetic Algorithm (GA) - Basic concepts, working principle, procedures, flow chart, Genetic representations, encoding, Initialization and selection, Genetic operators, Mutation – applications.	9
	Total Instructional Hours	45

Course Outcome Upon completion of the course,

CO 1:Student will aquire the knowledge on system concepts

CO2: Students will be able to apply the optimization techniques like LP & DP.

CO3: Students will get knowledge about how to simulate various natural processes. CO4: Students can simulate various natural processes by using ANN.

CO5: Students can able to solve various problems in the field of Agriculture Engineering by using fuzzy logic.

TEXT BOOKS

T1 Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.

T2 Robert M Peart and W David Shoup, Agricultural Systems Management – Optimizing efficiency and performance, CRC Press, 2013.

T3 Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.

T4 Razmjooy, Navid, and Vania Vieira Estrela, eds. *Applications of image processing and soft computing systems in agriculture*. IGI Global, 2019.

T5 Ram, Mangey, and Suraj B. Singh. *Soft Computing: Techniques in Engineering Sciences (Volume 1)*. De Gruyter, 2020.

REFERENCE BOOKS

R1 Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1997.

R2 Taha, H.A., "Operations Research", McMillan Publication Co., New York, 1995.

R3 Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi, 1992.

R4 Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

R5 S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.

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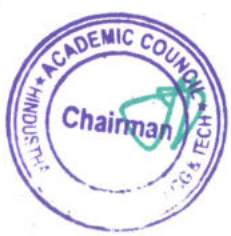
Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5302	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	3	0	0	3

Course Objective

- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.
- To study various practices to conserve soil and water in a sustainable way
- To inculcate the habit of sustainable farming in both rural and urban areas
- To get a basic idea about importance of science, food security and ecological balance
- To know about various policies and schemes in order to encourage sustainable agriculture and maintain food security

Unit	Description	Instructional Hours
	POTENTIAL LAND RESOURCES	
I	Land Resources of India - Population and land - Land utilization Patterns - Net Area Sown - changes in cropping pattern - land degradation – delineation of Agricultural Lands – Lands for non-agricultural purposes – Usable Waste Lands – Industrial Zones – Sand dunes and Deserts – Urban space for Greenery and crop production – Terrace Cultivation prospects – Heat Island effects.	9
	SUSTAINABLE WATER RESOURCES	
II	Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall Analysis - Lands with buffer zones for Surface water resources - Drought and production instability – Irrigation potential – Availability, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future – Augmentation of Groundwater.	9
	SUSTAINABLE RURAL AND URBAN FARMING	
III	Agro-ecosystems - Impact of climate change on crop yield & Soil fertility – Food grain production at State Level – Indicators of Sustainable food Availability – Indicators of food production sustenance – Natural Rural Farming principles – Sustainability in rainfed farming – organic farming – Urban Farming – Protected Cultivation Structures – Terrace and Kitchen Gardening – Hydroponics and Aquaponics - domestic food processing units	9
	CROP PRODUCTION AND FOOD SECURITY	
IV	Performance of Major Food Crops over the past decades – trends in food production – Decline in total factor productivity growth – Demand and supply projections – Impact of market force – Rural Land Market – Emerging Water market – Vertical farming - Sustainable food security indicators and index – Indicator of sustainability of food Security – Path to sustainable development.	9
	POLICIES AND PROGRAMMES	
V	Food and Crop Production polices – Agricultural credit Policy – Crop insurance – Policies of Natural Resources Use – Policies for sustainable Livelihoods – Virtual water and trade - Sustainable food Security Action Plan – Regulations of Terrace Gardening product Market	9
	Total Instructional Hours	45



Course Outcome

CO1: Upon completion of this course, the students will gain knowledge on the need for sustainable agriculture

CO2: They will be able to comprehend the need for food security on global level and the Nutritional Security.

CO3: The students will be able to demonstrate how ecological balance is required for sustainability of agriculture.

CO4: The students will be capable of understanding the applicability of rural and urban farming.

CO5: The students will be able to identify various policies and programmes related to sustainable agriculture and food security.

TEXT BOOKS

T1 M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.

T2 B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.

T3 Dhanarajan, Arulbalachandran, ed. Sustainable Agriculture Towards Food Security. Springer Singapore, 2017.

T4 Hatfield, Jerry L., David D. Songstad, and Dwight Thomas Tomes. Convergence of food security, energy security and sustainable agriculture. Springer, 2014.

T5 Campanhola, Clayton, and Shivaji Pandey, eds. Sustainable food and agriculture: an integrated approach. Academic Press, 2018.

REFERENCE BOOKS

R1 Swarna S.Vepa etal., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.

R2 Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.

R3 Tanji, K. K., and Yaron, B. Management of water use in agriculture, Springer Verlag, Berlin, Germany, 1994.

R4 Earles, Richard, and Paul Williams. Sustainable Agriculture an Introduction. ATTRA, 2005.

R5 Shetty, P. K., S. Ayyappan, and Monkombu Sambasivan Swaminathan. Climate change and sustainable food security (NIAS Books and Special Publications No. SP4-2013). NIAS; ICAR, 2013.

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Program	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5303	CDM AND CARBON TRADING TECHNOLOGY	3	0	0	3

Course Objective

1. To grab the basic idea about impact of green house effect in environment.
2. To acquire knowledge about various policies and programmes related to reduce the impacts of greenhouse effect.
3. To know the basics, importance of clean development mechanism (CDM)
4. To know the concept of carbon trading
5. To introduce the alternatives for reducing the green house effect.

Unit	Description	Instructional Hours
	GREEN HOUSE GASES AND ENVIRONMENTAL CHANGE	
I	Global Environmental changes-United nations framework convention on climate change-United (UNFCC)-ozone layer depletion -land degradation-air and water pollution-sea-level rise-loss of biodiversity-climatic change problem GHG emissions by different countries-developing country responsibilities - India's Greenhouse gas emissions - The conference of parties.	9
	KYOTO PROTOCOL AND CDM PROJECTS	
II	Kyoto protocol and clean development mechanism-CDM and cooperative mechanism-CDM overview administration -participation-CDM institutions-procedures CDM project cycle-project design and formulation - eligibility-additionally. Approval of (DNA) Designated National Authority. Validation and registration-monitoring-validation and certification through the source of Certified Emission Reduction (CER).	9
	TYPES AND FEATURES OF CDM	
III	Types of CDM-topology -project activity -small scale CDM project categories-access station and cater station projects. PDO- project design document -General description of project activity-baseline methodology-monitoring methodology-auditing period-technical aspects.	9
	MONITORING OF CDM	
IV	Monitoring and verification-verification process principles of verification-report preparation-pitfalls. Joint implementation (JI)-institutions and procedures-guidelines-JI or small scale projects-JI Land Use, Land Use Change and Forestry (LULUCF) projects.	9
	SUSTAINABLE ENERGY DEVELOPMENT	
V	Low carbon technologies-low carbon building-alternative approaches-energy efficiency projects- sustainable energy policy concepts-mitigating energy related GHG emissions through renewable energy- carbon trading.	9
	Total Instructional Hours	45

Course Outcome

CO1: Examine the effects of greenhouse gas emission and explain the responsibilities of countries in GHG emission.

CO2: Outline the KYOTO PROTOCOL and develop clean development mechanism (CDM) projects.

CO3: Explain the features of CDM and employ monitoring and auditing techniques on CDM projects.

CO4: Develop guidelines for small scale and Land Use, Land Use Change and Forestry (LULUCF) CDM projects.

CO5: Compare the alternate techniques for lowering carbon emission.

TEXT BOOKS

T1 MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book-Vol.1, UNEP publication, 2005

T2 Myungkyoon Lee, Information and Guide Book - the UNEP project CD4CDM-UNEP publication, June 2004.

T3 Yamin F. Climate change and carbon markets: A handbook of emissions reduction mechanisms. Routledge; 2012 Apr 27.

T4 Platonova-Oquab A, Spors F, Gadde H, Godin J, Oppermann K, Bosi M. CDM Reform: Improving the efficiency and outreach of the Clean Development Mechanism through standardization. World Bank; 2012.

T5 Hillebrand J. Carbon Credits and Global Emissions Trading: A Viable Concept for the Future?. GRIN Verlag; 2008 Sep 22.

REFERENCE BOOKS

R1 Manual for project developers and policy makers-UNFCCC Publication, 2007

R2 Aukland L, Bass S, Hug S, Landell Mals N, Tipper R, Laying the Foundations for clean Development, Preparing the Land use sector London, 2002

R3 Carbon sequestration in dryland soils, World Soil Resources report No.102, Food and Agriculture Organization, Rome, 2004.

R4 Lokey E. Renewable energy project development under the clean development mechanism: a guide for Latin America. Routledge; 2012 May 16.

R5 Chevallier J. Econometric analysis of carbon markets: the European Union emissions trading scheme and the clean development mechanism. Springer Science & Business Media; 2011 Sep 21.

Chairman - BoS
AGRI - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Program	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5304	IOT IN AGRICULTURAL SYSTEMS	3	0	0	3

Course Objective

1. To impart the knowledge of electronic devices for the purpose automation in agricultural practice.
2. To get a basic idea about precision farming
3. To develop AI to control agricultural system and its management.
4. To acquire knowledge about system engineering in Agriculture
5. To know about e-governance in Agriculture Systems.

Unit	Description	Instructional Hours
I	**BASIC ELECTRONICS CIRCUITS** Passive devices -semi conductor devices - transistors - diode circuits - amplifier circuits- oscillator circuits- thyristor circuits-Integrated circuits and operational amplifier - logic gates - flip flop – counters digital to analog - analog to digital converters microprocessor introduction	9
II	**PRECISION FARMING** Precision agriculture and agricultural management-Ground based sensors, Remote sensing, GPS, GIS and mapping software -Yield mapping systems, Crop production modeling.	9
III	**ENVIRONMENT CONTROL SYSTEM** Artificial light systems - management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse - models of plant production and expert systems in horticulture. Understanding and predicting world's climate system.	9
IV	**AGRICULTURAL SYSTEMS MANAGEMENT** Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources - Linear programming, Project scheduling - Artificial intelligence and decision support systems.	9
V	**E-GOVERNANCE IN AGRICULTURAL SYSTEMS** Concept of Information Technology (IT) and its application potential - Role of IT in natural resources management - Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications - Technology enhanced learning systems and solutions, e-learning, Rural development and information society - Internet application tools and web technology.	9
	Total Instructional Hours	45

Course Outcome

During this course, students will be trained :

CO1: To know the Basic of Electric Circuits

CO2: To understand the importance of Precision Farming.

CO3: To manage the favourable conditions required for every crops separately

CO4: To solve the problems related to agriculture engineering by providing optimal conditions.

CO5: Understand about e-governance and agricultural systems management.

TEXT BOOKS

T1 Hammer, G.L., Nicholls, N., and Mitchell, C., Applications of Seasonal Climate, Springer, Germany, 20

T2 Peart, R.M., and Shoup, W. D., Agricultural Systems Management, Marcel Dekker, New York, 2004.

T3 Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.

T4 Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

T5 Pierce FJ, Clay DE, editors. GIS applications in agriculture. New York: CRC Press; 2007 Feb 13.

REFERENCE BOOKS

R1 National Research Council, Precision Agriculture in the 21st Century, National Academies Press, Canada, 1997.

R2 H. Krug, Liebig, H.P. International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation, 1989.

R3 Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.

R4 Srinivasan A, editor. Handbook of precision agriculture: principles and applications. CRC press; 2006 Sep 6.

R5 Clay DE, Clay SA, Bruggeman SA. Practical mathematics for precision farming. John Wiley & Sons; 2020 Jan 22.

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Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG5305	ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	3	0	0	3

Course Objective

1. To impart basic knowledge in ergonomics by understanding the fundamental concepts
2. To train with the ergonomic aspects in the design of agricultural machinery for improve field performance and safety of human beings.

Unit	Description	Instructional Hours
I	**ERGONOMICS AND ITS APPLICATION** Ergonomics -Human metabolism- Basal metabolism and work metabolism- application of ergonomics in farm implement and machinery design.	9
II	**ASSESSMENT OF ENERGY EXPENDITURE** Direct calorimetry- Indirect calorimetry- Assessment of energy expenditure byTechniques of measuring oxygen consumption- heart rate and calibration- subjective rating-Overall discomfort score and BPDS.	9
III	**ANTHROPOMETRY** Anthropometry- types of anthropometric data and measurement techniques- Analysis of anthropometric data and use of percentiles.	9
IV	**BIOMECHANICS OF MOTION.** Introduction-Vibration-hand arm vibration and whole-body vibration- physiological effects-Noise and its physiological effects.	9
V	**DESIGN CONSIDERATION AND SAFETY** Anthropometric consideration in tool/ equipment design-displays and controls – tractor seat design and location of controls in tractor.	9
	Total Instructional Hours	**45**

Course Outcome

By the end of the course student will be able

CO1: Understand role of human metabolism in design of agricultural implements.

CO2: To assessment of energy expenditure through various measuring techniques.

CO3: Understand the types of anthropometric data and its application in tool design

CO4: Understand the physiological effects of vibration and noise in work station.

CO5: To improve the performance of the farm systems by enlightening the human - machine interaction with safetymeasures.

TEXT BOOKS:

T1 Mark S.Senders,ErnestJ.Mccormick (1975) human factors in Engineering Design.

T2 McGraw Hill Book co., New York 2. Wesley E.Woodson (1981),Human factors design hand book,

T3 Gite LP. 2009. Anthropometric and strength data of Indian Agricultural Workers for farm equipment design. AICRP on ESA. CIAE, Bhopal.

T4 Astrand, P.O and Rodahl, K.1977. Text book of work physiology, McGraw Hill, New York

T5 Dul J and Weerdmeester B.1993.Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.

T6 Kroemer, K.H.E., Kroemer,H.J. and K.E.Kroemer-Elbert. 1997. Engineering Physiology: bases of human factors/ergonomics, VAN NOSTRAND REINHOLD, New York.

REFERENCE BOOKS:

R1 Robert W.Bailey (1992).Human performance Engineering .PTR Prentice Hall, Englewood cliffs, New Jersey.07632.

R2 Bridger, R.S,1995. Introduction to Ergonomics, McGraw Hill, New York

R3 Rodal, K.1989.The Physiology of work, Taylor and Francis, London.

R4 K.U.E. Kroemer and E. Grandjean. 2001. Fitting the Task to the Human: A textbook of Occupational Ergonomics. Taylor and Francis.

R5 Mark S. Sanders and Ernest James McCormick,1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.

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CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E AGRICULTURE ENGINEERING (UG)

REGULATION-2019 (Revised on Feb 2022)

(For the students admitted during the academic year 2020-2024)

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	3	0	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
3	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
5	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
6	19CS1151	Python programming and practices	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1001	Language competency enhancement course - I	HS	0	0	1	1	100	-	100
			Total :	**15**	**1**	**6**	**20**			**700**
As per AICTE 3 weeks Induction programme is Added in the First Semester as an Audit Course										

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	3	0	0	3	25	75	100

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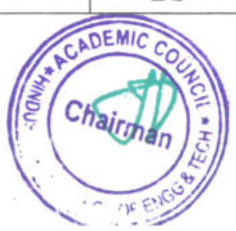
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3	19AG2104	Principles of Food Science	ES	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	19PH2151	Material Science	BS	2	0	2	3	50	50	100
5	19CY2151	Environmental studies	BS	2	0	2	3	50	50	100
6	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2001	Language Competency Enhancement Course-II	HS	0	0	1	1	100	-	100
			Total :	**15**	**1**	**11**	**22**	**375**	**425**	**800**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2	19AG3201	Soil Science and Engineering	PC	3	0	0	3	25	75	100
3	19AG3202	Fluid Mechanics and Hydraulics	PC	3	1	0	4	25	75	100
4	19AG3203	Principles and practices of Crop Production	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG3251	Unit Operations in Agricultural Processing	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AG3001	Field Crop Production Practical	PC	0	0	3	1.5	50	50	100
7	19AG3002	Soil Science Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC3191	Indian Constitution		2	0	0	0	100		100
			Total:	**16**	**2**	**8**	**20**	**350**	**450**	**800**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG4201	Farm Tractors	PC	2	1	0	3	25	75	100
2	19AG4202	Thermodynamics	PC	3	0	0	3	25	75	100
3	19AG4203	Irrigation and Drainage Engineering	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	19MA4152	Statistics and Numerical	BS	3	0	2	4	50	50	100



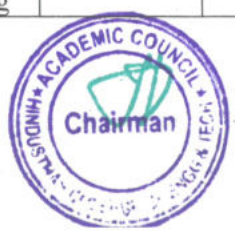
		Methods								
5	19AG4251	Bio-Energy Resource Technology	PC	2	0	2	3	50	50	100
6	19AG4252	Surveying and Leveling	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19AG4001	Irrigation Field Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	19AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100		100
			Total	**17**	**1**	**10**	**21**	**375**	**425**	**800**

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG5201	Farm Machinery and Equipment	PC	3	0	0	3	25	75	100
2	19AG5202	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
3	19AG5203	Theory of Machines	PC	3	0	0	3	25	75	100
4	19AG53XX	Professional Elective-I	PE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG5251	Groundwater and Well Engineering	PC	2	0	2	3	50	50	100
6	19AG5252	Soil and Water Conservation Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19AG5001	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5	50	50	100
8	19AG5002	CAD for Agricultural Engineering	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
			Total	**18**	**1**	**10**	**24**	**350**	**650**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG6201	Hydrology and Water Resources Engineering	PC	3	0	0	3	25	75	100



2	19AG6202	Solar and Wind Energy Engineering	PC	3	1	0	4	25	75	100
3	19AG6181	Professional Ethics	HS	3	0	0	3	25	75	100
4	19AG63XX	Professional Elective-II	PE	3	0	0	3	25	75	100
5	19XX64XX	Open Elective-I	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										
6	19AG6251	Food and Dairy Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19AG6252	ICT in Agricultural Engineering	PC	0	0	4	2	50	50	100
8	19AG6701	Industrial Training	EEC	0	0	0	1	0	100	100
MANDATORY COURSES										
9	19HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	25	75	100
			Total	**19**	**1**	**6**	**24**	**275**	**725**	**1000**

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG7201	Agricultural Extension	PC	3	0	0	3	25	75	100
2	19AG7202	Remote Sensing and Geographical Information System	PC	3	0	0	3	25	75	100
3	19AG73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
4	19XX74XX	Open Elective-II	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG7251	Precision Farming and Protected Cultivation	PC	2	0	2	3	50	50	100
PRACTICALS										
6	19AG7001R	Renewable Energy Laboratory	PC	0	0	3	1.5	50	50	100
7	19AG7002R	Remote Sensing and GIS Laboratory for Agricultural Engineers	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8	19AG7901	Innovative Project	EEC	0	0	4	2	50	50	100
			Total	**14**	**0**	**12**	**20**	**300**	**500**	**800**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG83XX	Professional Elective-IV	PE	3	0	0	3	25	75	100
2	19AG83XX	Professional Elective-V	PE	3	0	0	3	25	75	100
PROJECT WORK										
3	19AG8901	Project work	EEC	0	0	16	8	100	100	200
			Total	**6**	**0**	**16**	**14**	**150**	**250**	**400**

TOTAL NO OF CREDITS: 165

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19AG5301	Systems Analysis and Soft Computing in Agricultural Engineering	PC	3	0	0	3	25	75	100
2	19AG5302	Sustainable Agriculture and Food Security	PC	3	0	0	3	25	75	100
3	19AG5303	CDM and Carbon Trading Technology	PC	3	0	0	3	25	75	100
4	19AG5304	IOT in Agricultural Systems	PC	3	0	0	3	25	75	100
5	19AG5305	Ergonomics and Safety in Agricultural Engineering	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	19AG6301	Climate change and adaptation	PC	3	0	0	3	25	75	100
2	19AG6302	Heat and Mass Transfers for Agricultural Engineers	PC	3	0	0	3	25	75	100
3	19AG6303	Disaster Management	PC	3	0	0	3	25	75	100
4	19AG6304	Horticultural Crop Processing	PC	3	0	0	3	25	75	100
5	19AG6305	Organic Farming Technologies	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE III										
1	19AG7301	Post-Harvest Technology	PC	3	0	0	3	25	75	100
2	19AG7302	Dairy Process Technology	PC	3	0	0	3	25	75	100
3	19AG7303	Storage and Packaging Technology	PC	3	0	0	3	25	75	100

4	19AG7304R	Process Engineering of Fruits and Vegetables	PC	3	0	0	3	25	75	100
5	19AG7305	Fat and Oil Processing	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV										
1	19AG8301	Agricultural Business Management and Entrepreneurship	PC	3	0	0	3	25	75	100
2	19AG8302	On-Farm Water Management	PC	3	0	0	3	25	75	100
3	19AG8303	Intellectual Property Rights	PC	3	0	0	3	25	75	100
4	19AG8304	Agricultural Waste Management	PC	3	0	0	3	25	75	100
5	19AG8305	Energy Conservation in Agro based Industry	PC	3	0	0	3	25	75	100
6	19AG8306	Cooling Technology: Why and How utilized in Food	MOOC (NPTEL-	3	0	0	3	25	75	100
7	19AG8307	Novel Technologies for Food Processing and Self life	MOOC (NPTEL-	3	0	0	3	25	75	100
8	19AG8308	Machine Learning for soil and crop management	MOOC (NPTEL-	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE V										
1	19AG8309	Special Farm Equipment's	PC	3	0	0	3	25	75	100
2	19AG8310	Mechanics of Tillage and Traction	PC	3	0	0	3	25	75	100
3	19AG8311	Watershed Hydrology and Management	PC	3	0	0	3	25	75	100
4	19AG8312	Micro Irrigation System	PC	3	0	0	3	25	75	100
5	19AG8313	Agriculture Economics and Farm Management	PC	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES										
AGRICULTURE ENGINEERING										
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	19AG6401	Modern Agricultural Practices	OE	3	0	0	3	25	75	100
AGRICULTURE ENGINEERING										
2	19AG7401	Urban Agriculture and organic farming	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
3	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
4	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
5	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100

6	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
7	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

Category	SEM I	SEM II	SEM III	SEM IV	SEM V	SEM VI	SEM VII	SEM VIII	Total credit
Total	20	22	20	21	24	24	20	14	165

*** Student can earn extra credit 35 over and above the total credits**

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Chairman - BoS
AGRI - HiCET

Dean - Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

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SEMESTER VII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7201	AGRICULTURAL EXTENSION	3	0	0	3

Course Objective

- To explain the extension functionaries on the latest developments in the field of agricultural extension
- To equip the extension functionaries in latest tools and techniques for participatory decision making
- To develop an insight into various extension models to enrich the agri - value chain

Unit	Description	Instructional Hours
I	**Principles of Extension** Extension Education – Meaning, objectives, concepts, principles and philosophy– Extension teaching methods and factors influencing the selection of teaching.	9
II	**Methods of contact** Individual contact-Group contact Exhibition-campaign and public speaking -Field trips and tours -purpose procedure, advantage and limitations	9
III	**Methods of communication** Mass contact -written communication, circular letter, leaflet, folder, pamphlet and newspaper-purpose procedure advantages and limitations. Organizing youth club -farmer club mahila mandal purpose and procedure.	9
IV	**Visual communication** Audio -visual aids-definition, importance, selection, use and factors influencing selection, merits and demerits-Electronic media -radio, television and video procedure – advantage and limitations.	9
V	**Current Approaches in Extension** Decentralised Decision Making-Bottom up Planning-Farming System Approach, Farming Situation Based Extension- Market – Led – Extension.	9
	Total Instructional Hours	**45**

Course Outcome

By the end of the course student will be able

CO1: To critically analyze different Agricultural Extension approaches.

CO2: Understand Agricultural Knowledge Information System

CO3: New trends in agriculture extension: privatization extension.

CO4: Monitoring and evaluation – concept and definition, monitoring, and evaluation of Extension programmes, Transfer of Technology- Concept and models

CO5:To expose with various Rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis.

TEXT BOOKS

T1 Annamalai, R., M. Manoharan, S.Somasundarm and K.N.Krishnakumar, 1987;Extension methods and their principles. Palaniappa printers, Tirunelveli.

T2 Berlo,1970; Process of communication. Holt Rinehart Winston Inc. Newyork.

T3 Dahama,O.P. and O.P.Bhatnagar,1985; Education and communication for development, Oxford and IBH publishing Co.,New Delhi.

T4 Gallagher K. 1999. Farmers Field School (FFS) – A Group Extension Process based on Non-Formal Education Methods. Global EPM Facility, FAO.

T5 Jalihal KA & Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept, Publ. Khan.

T6 Grover I, Kaushik S, Yadav L & Varma SK. 2002. Communication and Instructional Technology. Agrotech Publ. Academy.

REFERENCE BOOKS

R1 Directorate of extension, 1968; Extension education in community development, Ministry of food and agriculture, Government of India, New Delhi

R2 Ray G.L.1971;Extension communication and management, Naya Prakash, Kolkata

R3 Rogers E. 1985; Diffusion of innovation, Collier McMillan publishers, London.

R4 Dimensions of agriculture extension - TNAU

R5 Extension communication and management- G. L. Ray

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7202R	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	3	0	0	3

Course Objective

To introduce the basic principles and concepts of Remote Sensing and GIS as applicable to the multi-facets of Agricultural Engineering
To introduce the spatial data models, analysis and presentation techniques.
To introduce the methods of image enhancement and classification techniques
To describe various aspects of possible applications of Remote Sensing techniques in Agriculture.

Unit	Description	Instructional Hours
	CONCEPTS OF REMOTE SENSING AND SATELLITES	
I	Introduction to Remote Sensing- Energy Sources and Interaction- Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT, SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution	9
	DATA PRODUCTS AND IMAGE ANALYSIS	
II	Data products –based on level of processing- o/p – scale – area/coverage – data availability – data ordering- data price - Image interpretation – Visual interpretation elements – interpretation key. Digital image processing – Image enhancement – image classification – Supervised and unsupervised – Vegetation Indices.	9
	CONCEPTS OF GIS	
III	Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data –Definition – Components – Hardware and Software - GIS tools.	9
	DATA INPUT AND ANALYSIS	
IV	Data – Spatial, Non-Spatial – Database models – Hierarchical network, Relational and Object-Oriented Data Models – Raster and Vector – Methods of Data input – Data Editing – Files and formats – Data structure – Data compression. Introduction to analysis – Measurements – Queries– Reclassification – Simple spatial analysis – Buffering – Neighboring functions – Map overlay –Vector and raster – Spatial interpolation – Modelling in GIS – Digital Elevation Modelling – Expert systems.	9
	APPLICATION OF RS AND GIS	
V	Application in Precision Agriculture - Monitor Crop Health -. Estimation of Crop Water Requirement – Crop condition - Soil mapping– classification of soil with digital numbers – soil erosion mapping- reservoir sedimentation using image processing - Inventory of water resources – water quality assessment- Management Decision Support Systems	9
	Total Instructional Hours	45

Course Outcome

CO1: The students will understand the remote sensing principles, remote sensing systems satellite data processing and available data products.

CO2: Describe the process of data acquisition of satellite images and their characteristics

CO3: Compute an image visually and digitally with digital image processing techniques.

CO4:The students will understand decision making process using DBMS and utilization of these advanced techniques in addressing the real world problems

CO5: Compute knowledge of remote sensing and GIS in different agriculture engineering application

TEXT BOOKS:

T1 Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderbad, 2001

T2 Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.

T3 Bhatta, B., 2010, Remote Sensing and GIS, Oxford University Press, New Delhi, pp. 7-8, 64-96.

T4 Liu, J.G., and Mason, P.J. (2009). Mason P.J, Essential Image Processing and GIS For Remote Sensing; Imperial college, London, UK

T5 Lillesand, T. M., Kiefer, R. W., 2002, Remote Sensing and Image Interpretation. Fourth Edition, pp. 310-319.

REFERENCE BOOKS:

R1 Bettinger, P., and Michael, G.W., "Geographical Information System: Applications in Forestry and Natural Resources Management," Tata McGraw–Hill Higher Education, New Delhi, 2003

R2 Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.

R3 Jeffery Star and John Estes, "Geographical Information System – An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.

R4 Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers, Jodhpur 1992

R5 www.isro.org/satellites/earthobservationsatellites.aspx; July 27, 2012

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7251	PRECISION FARMING AND PROTECTED CULTIVATION	2	0	2	3

Course Objective

1. To impart knowledge on the protected all season confined space cultivation strategies for vegetables, fruits and flower crops
2. To sensitize the students on hi-tech production technology under open field Precision Farming applications.

Unit	Description	Instructional Hours
I	**PROTECTED CULTIVATION FEATURES** Conceptual features of protected cultivation in horticultural crops - Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, polyhouse, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture growing media and nutrients – canopy management – micro irrigation and fertigation systems.	9
II	**PROTECTED CULTIVATION OF VEGETABLE CROPS** Protected cultivation technology for vegetable crops - Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.	9
III	**PROTECTED CULTIVATION OF FLOWER CROPS** Protected cultivation technology for flower crops - Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliages and fillers – integrated pest and disease management – postharvest handling.	9
IV	**PRECISION FARMING TECHNIQUES** Concept and introduction of precision farming – Importance, definition, principles and concepts – Role of GIS and GPS - Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation – georeferencing and photometric correction –Sensors for information gathering – UAV - geostatistics – robotics in horticulture – postharvest process management (PPM) – Remote sensing.	9
V	**PRECISION FARMING OF HORTICULTURAL CROPS** Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.	9
	Total Instructional Hours	45

Course Outcome	CO1:The students will be able to appreciate the different methods of protected cultivation practices available for vegetable crops and flowers. CO2:A clear understanding of precision farming techniques and its application to horticultural crops is possible. CO3: The students will be able to assess the technology available for vegetable crops CO4: The students will be able to assess precision farming techniques using sensors and Geographic information systems for the crops CO5: The students will be able to assess the technology available for horticulture crops

TEXT BOOKS:

T1 Joe.J.Hanan, "Green houses: Advanced Technology for Protected Horticulture", CRC Press, LLC. Florida. 1998

T2 Paul V. Nelson.," Green house operation and management". Ball publishing USA,1991.

REFERENCE BOOKS:

R1 Lyn. Malone, Anita M. Palmer, Christine L. VIoghat Jach Dangeermond, "Mapping out world: GIS lessons for Education". ESRI press.2002.

R2 David Reed, "Waer, media and nutrition for green house crops", Ball publishing USA.1996

R3 Adams, C.R. K.M. Bandford and M.P. Early, "Principles of Horticulture", CBS publishers and distributors. Darya ganj, New Delhi,1996.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	**19AG7001R**	**RENEWABLE ENERGY LABORATORY**	**0**	**0**	**3**	**1.5**

Course Objective

- To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of renewable energy.
- To develop managerial skills to our students for assess feasibility of alternative approaches and drive strategies regarding renewable energy.

S.NO	Description	Instructional Hours
1	Characterization of biomass – proximate analysis	3
2	Determination of caloric value of fuels – solids and gases	3
3	Design of KVIC / Deenbandhu model biogas plant	3
4	Determine composition of biogas	3
5	Testing of engine performance.	3
6	Study on briquetting and Stoichiometric calculations	3
7	Analysis of wind data and prediction	3
8	Testing of solar water heater	3
9	Testing of natural convection solar dryer	3
10	Study on Solar power and I-V Characteristics	3
11	Testing of solar photovoltaic water pumping system	3
	Total Instructional Hours	**33**

Course Outcome

On completion of the lab course, the students will be familiarized to;

CO1: Identifying categories of renewable energy sources and their application.
CO2: Design of floating drum and fixed doom type Bio-gass plant
CO3: Analysis gas composition like CH_4, CO2 and CO and H_2S through orsat apparatus
CO4: Understand the Stoichiometric calculations, weather station I-V Characteristics.
CO5: Testing of engines and solar water heater, dryer and Photovoltaic system and identifying performance of system.

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Hot air oven	1
2	Muffle furnace	1
3	Junkers gas calorimeter	1
4	Bomb calorimeter	1

5	Model of Biogas and Deenabandhu biogas plant	1
6	Biogas scrubbing unit	1
7	Gasifier - Lab Scale	1
8	Pyrolysis unit	1
9	Biogas/ Producer gas dual fuel Engine	1
10	Briquetting Machine - Lab Scale	1
11	Automatic weather station.	1
12	Solar water heater	1
13	Solar dryer	1
14	Solar PV training kit-	1
15	Solar PV water pumping system	1

The equipment's includes the basic requirements like petri plates, silica crucible with lid, weighing balance, tongs, gloves, solarimeter, hand held anemometer, temperature and humidity sensor.

REFERENCES

R1 Khandelwal, K.C. and Mahdi, S.S. "Biogas Technology". Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 1986.

R2 Nijaguna, B. T. "Biogas Technology" New Age International Pvt. Ltd., New Delhi, 2006.

R3 Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi, 2000.

R4 Solanki, C.S. "Solar Photovotaics – Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., New Delhi, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7002R	REMOTE SENSING AND GIS LABORATORY FOR AGRICULTURAL ENGINEERS	0	0	3	1.5

Course Objective

To introduce the principles and basic concepts of Remote Sensing and GIS through intensive hands on training.

S.NO	Description	Instructional Hours
1	Introduction to QGIS and SAGA	3
2	Projection by using QGIS	3
3	Georefrencing by Using QGIS	3
4	Image Registration	3
5	Digitization of a Toposheet	3
6	Map Preparation using QGIS	3
7	Visual Interpretation of Images by Using Saga	3
8	Mosaicking and Subsetting Images using SAGA	3
9	Supervised and Unsupervised Classification using SAGA	3
10	Terrain Analysis and Change Detection using SAGA	3
11	Watershed Delineation and Calculating Brightness temperature using Landsat-8	3
Total Instructional Hours		**33**

Course Outcome

CO1: Understand the process of data acquisition of satellite images and their characteristics
CO2: Understand the Image enhancement, Supervised and Unsupervised classification of image.
CO3: Understand the Database Management Systems of GIS application in agriculture.
CO4: Understand the DEM usage in watershed analysis, rainfall -runoff and erosion modelling
CO5: The students will have adequate knowledge in application of RS and GIS in various fields of agricultural engineering.

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Computers	30
2	Licensed software like GIS	1

REFERENCES

R1 Lillesand, T.M. and Kiefer, R.W. 2005. "Remote Sensing and Image Interpretation ", II edition. John Wiley & sons.

R2 Heywood, I., Cornelius. S., Carver. S 2002. An Introduction to Geographical Information Systems. Addison Wesley Longman, New York.

R3 Floyd F.Sabins. 2005. "Remote Sensing: Principles and Interpretation", III edition. Freeman and Company New York.

R4 Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote Sensing Perspective". Prentice – Hall. New Jersey.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7901	INNOVATION PROJECT	0	0	4	2

Course Objective

1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2. To train the students in preparing project reports and to face reviews and viva voce examination.
3. Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
4. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department.
5. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

Course Outcome

.CO1: Understand the current need of technology to improve agriculture production.

CO2: To learn mechanical component, sensors and software's application in agricultural machineries.

CO2: Understand the variables involved in process sequence and optimization.

CO3: To analyze the research problem and formulate methodology to find a solution.

CO4: On completion of the innovation project work, students will be in a position to take up any challenging practical problem and find solution by formulating proper methodology

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Professional Elective-III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7301	POST HARVEST TECHNOLOGY	3	0	0	3

Course Objective

- The students would be exposed to fundamental knowledge in engineering properties of agricultural materials, different Post Harvest operations and processing methods of harvested crops and storage of produces.

Unit	Description	Instructional Hours
	BASICS OF POST HARVEST OPERATIONS	
I	Postharvest technology – introduction –objectives –post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content – measurement –direct and indirect methods – moisture meters – equilibrium moisture content.	9
	PSYCHROMETRY AND DRYING	
II	Psychrometry – importance – Psychrometric charts – Drying – principles and theory of drying – Moisture Content expressions - thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers.	9
	CLEANING AND GRADING	
III	Principles of Cleaning - air screen cleaners – adjustments - cylinder separator - spiral separator – magnetic separator - colour sorter - inclined belt separator – length separators - effectiveness of separation and performance index.	9
	SHELLING AND HANDLING	
IV	Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator –castor sheller – material handling – belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.	9
	CROP PROCESSING	
V	Paddy processing – parboiling of paddy – methods – merits and demerits dehusking of paddy –methods – merits and demerits – rice polishers –types – constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing – millets processing.	9
	Total Instructional Hours	45

COURSE OUTCOMES

CO1: At the end of the study the student will have knowledge on material handling and processing equipment's
CO2: Different Post Harvest operations and processing methods of harvested crops.
CO3: Fundamentals of various unit operations of Agricultural Processing.
CO4: Understand the principles and theory of drying
CO5: To learn layout of modern industries

TEXT BOOKS

T1 Chakraverty, A.Post harvest technology for Cereals, Pulses and oilseeds. Oxford & IBH publication Pvt Ltd, New Delhi, Third Edition, 2000.

T2 Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi, 1994.

REFERENCE BOOKS

R1 Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.

R2 Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7302	DAIRY PROCESS TECHNOLOGY	3	0	0	3

Course Objective

To describe the chemical-physico-thermal properties and their applications

To illustrate the technologies involved in processing of dairy products.

Unit	Description	Instructional Hours
I	**CHEMISTRY OF MILK** Milk definition, composition and variation; Structure of milk - fat globules, casein micelles, globular proteins, lipoprotein particles and their properties and grading of milk; Milk proteins - Introduction, definition and nomenclature of milk proteins, milk proteins classification and its importance, Protein denaturation and hydrolysis; Enzymes in milk, Carbohydrates and Lipids in milk, Salt composition in milk.	9
II	**SEPARATION EQUIPMENT** Mechanical Separation: Fundamentals involved in separation - Gas-Solid Seperations, Liquid-Solid Separations; Principle Involved in filtration, Types, Rates of filtration, Pressure drop Calculations; Gravity setting, Sedimentation, Principles of centrifugal separation, Different types of centrifuges, application in dairy industry; Clarifies, Tri-Processors, Cream Separator, Self-De sludging centrifuge, Bacto –Fuge; Care And Maintenance Of Separators and Clarifiers.	9
III	**HOMOGENIZERS, PASTEURIZERS AND STERILIZERS** Homogenization: classification, single stage and two stage homogenizer pumps, Power requirement for homogenization, Care and maintenance of homogenizers, Aseptic Homogenizers; Pasteurization: Batch, Flash And Continuous (HTST) Pasteurization, Care and maintenance of pasteurizer; Sterilizer - Different types Of Sterilizer, In Bottle Sterilizers, Autoclaves Continuous sterilization plant, UHT Sterilization, Care And Maintenance Of Sterilizers.	9
IV	**MECHANIZATION IN MANUFACTURE OF INDIGENOUS DAIRY PRODUCTS** Butter Making Machines - Introduction, Batch Butter Churns - Rotating Churns, Batch Method Using Rotating Churns, Continuous Churns, Continuous Butter Making; Ghee Making Machines – Introduction, Ghee making equipments; Ice-Cream Making Equipment - Introduction, types, controls and automation; Cheese Making Equipments.	9
V	**PACKAGING MACHINES FOR MILK & MILK PRODUCTS** Packaging machines for Milk – Introduction, Sequence of operation, Controls; UHT Milk Packing Machine; Package Terminologies; Tetra Brik Filling Machines; Packaging Machines For Milk Products - Cheese Packing Machine Types, Aseptic packaging and equipment, Vacuum Packaging.	9
	Total Instructional Hours	45

Course Outcome	CO1: Acquire the basic knowledge in dairy Technology CO2: The ability to use the acquired knowledge during dairy processing CO3: Students will learn about technologies to handle physical aspects of fluid-based process. CO4: Understand the working principles of mordant equipment's which involves in dairy technology. CO5: Understand the Sequence of operation during the packing process.

TEXT BOOKS:

T1 Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.

T2 Walstra. P., Jan T. M. Wouters., Tom J. Geurts "Dairy Science and Technology", CRC press, 2005.

T3 Kurmann, J. A., Rasic, J. L. and Kroger, M. (1992). Encyclopedia of Fermented Fresh Milk Products: An International Inventory of Fermented Milk, Cream, Buttermilk, Whey and Related Products: CBS Publications, New Delhi.

T4 Fox, P. F. and McSweeney, P. L. H. (1998). Dairy Chemistry and Biochemistry: Kluwer Academic, New York.

T5 Kutty, C. I. and Khamer, S. (2004). Milk Production and Processing: Daya, Delhi.

REFERENCE BOOKS

R1 Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.

R2 Toledo, R.T., "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 1997.

R3 Dairy Science and Technology Handbook, Volumes 1-3, John Wiley & Sons,1993.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7303	STORAGE AND PACKAGING TECHNOLOGY	3	0	0	3

Course Objective

1. To explain food material damage and control measure of losses in storage and estimation of losses
2. To explain different types of packaging materials and their forms used in food industries.
3. To describe package performance and various testing of packaging materials
4. To explain importance of storage of food materials .

Unit	Description	Instructional Hours
I	**SPOILAGE AND STORAGE** Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.	9
II	**FUNCTIONS OF PACKAGING MATERIALS** Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables construction operation and maintenance of CA storage facilities.	9
III	**STORAGE METHODS** Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.	9
IV	**FOOD PACKAGING MATERIALS AND TESTING** Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.	9
V	**SPECIAL PACKAGING TECHNIQUES** Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.	9
	Total Instructional Hours	45

Course Outcome

The students will have a clear

CO1: Understand about different methods of food material damage and storage losses and estimation.

CO2: Understand the packaging strategies for various environment in food industries.

CO3: Understand different types of packaging material and their properties and apply the knowledge in packaging various food materials.

CO4: Understand the selection of packages for specific food & agricultural commodities and advancement in food packaging

CO5: Understand the working principles of special packing equipment and its role emerging food industries.

TEXT BOOKS:

T1 Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.

T2 Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.

T3 Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.

T4 Robertson G.L." Food Packaging: Principles and Practice"

T5 Mahadeviah M. and Gowramma R.V." Food Packaging Materials"

REFERENCE BOOKS:

R1 Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.

R2 Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.

R3 Alexandru Grumezescu Alina Maria Holban"Food Packaging and Preservation"

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7304R	PROCESS ENGINEERING OF FRUITS AND VEGETABLES				

Course Objective

1. To understand the basics of Post Harvest Technology of fruits and vegetables through their structure and composition
2. To study the different methods of processing and preservation of fruits and vegetables including drying and dehydration
3. To learn the latest methods of storage of fruits and vegetables.

Unit	Description	Instructional Hours
I	**STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE** Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage - Climatic and non-climatic fruits - Maturity indices for fruits.	9
II	**CLEANING, GRADING AND ON-FARM PROCESSING** Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipment's – construction and working – pre-cooling – importance, methods, pretreatments and advantages - Transportation and handling of fruits and vegetables – controlled atmosphere and modified atmosphere process.	9
III	**PRESERVATION OF FRUITS AND VEGETABLES** Thermal and non-thermal process of preservation of fruits and vegetables – canning of fruits and vegetables – process – methods – Advantage – Disadvantages – Drying and dehydration – freezing – Application – Methods quality parameters.	9
IV	**DRYING AND DEHYDRATION** Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.	9
V	**STORAGE** Storage of fruits and vegetables – storage under ambient conditions, low temperature storage, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage – concept and methods –modified atmosphere packaging – gas composition, quality of storage – waxing of fruits – types of wax, equipment and advantages.	9
	Total Instructional Hours	45

Course Outcome	CO1:Understand the Importance of post harvest technologies and preventions of post harvesting losses. CO2:Understand the basic of cleaning, grading and on-farm processing for increasing the self-life of food grains CO3:Understand the thermal and non-thermal techniques for preservation of fruits and vegetables CO4:Understand the working principles of drying technologies and dehydration of fruits and vegetables CO5:Understand the current storage technologies and its role in agriculture commodities

TEXT BOOKS:

T1 Fellows. P. 2000. Food Processing Technology – Principles and Practice, second edition, CRC Press, Woodland Publishing Limited, Cambridge, England.

T2 Sudheer K. P. and V. Indra.2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi.

T3 L.R.Verma and V.K.Joshi. 2000. Post Harvest Technology of Fruits and Vegetables – handling, Processing, Fermentation and waste management. Indus Publishing company, New Delhi.

REFERENCE BOOKS:

R1 Heid,J.L. and M.A.Joslyn. 1983. Food processing operations. Vol. II. AVI Publishing Co. Inc. Westport, Connecticut.

R2 Potter, N.N.1976. Food science. AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition.

R3 Sivetz Michael and N.W.Desrosier. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport, Connecticut.

R4 Humberto vega and Gustavo v Barbosa. 1996. Dehydration of foods. Springer Science, Business Media, Chapman&Hall Publishers, U.K.

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HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7305	FAT AND OIL PROCESSING	3	0	0	3

Course Objective

To study the Composition, Analysis and Processing of oils and fats.

To study technologies in oilseed processing and lipid deterioration

To study Chemical modification and Hydrogenation in oil processing

Unit	Description	Instructional Hours
I	**Physico-chemical aspects of fats and oils** Present status and future prospects of oilseeds, Morphology of oilseeds; Classification and types of oilseeds, Chemical composition, nutritional value and anti-nutritional compounds in oilseeds, Methods of removal of anti- nutritional compounds, Physical properties, Factors affecting physical properties.	9
II	**Oil seed milling** Oil seed milling, Ghanis, hydraulic presses, expellers, solvent extraction methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in oil milling industry; Desolventization; Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls; Hydrogenation of oils.	9
III	**Processing of fats and oils** Introduction, extraction, refining, bleaching, deodorization, storage & handling; Modification of fats and oils - Physical modification - Fractionation, winterisation; Chemical modification - Hydrogenation, esterification; Blending, Emulsification, Interesterification, Votation; Fats and oils products - vegetable oils, vegetable fats, animal oils, animal fats, fat substitutes.	9
IV	**Analysis of fats and oils** Composition and identity, Tests for adulteration, Lipids, functional foods and nutraceuticals, Distinction between functional and nutraceutical, Omega-e polyunsaturated fatty acids; Stability of fats & oils. Quality assessment, assurance and measurement- Iodine value, Peroxide value, Acid value and saponification value, Antioxidants: Use and application of antioxidants.	9
V	**New technologies in oilseed processing and lipid deterioration** New technologies in oilseed processing; Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition. Lipid deterioration – Lypolysis, Factors affecting oxidation, thermal oxidation of fats and oils, photosensitised oxidation, Auto oxidation, Role of lipids in food flavour, Nutritional aspects, Fats and oils functionality, Palatability, Satiety.	9
	Total Instructional Hours	45

Course Outcome	CO1: The student will be familiarized with the composition, analysis and processing of oil seeds.
	CO2: Understand the Chemical composition and nutritional value of oil seed
	CO3: Understand the Physical and chemical modification of oil seed at end the process
	CO4: Understand the Role of lipids in food flavor
	CO5: Effective utilization of New technologies in oilseed processing

TEXT BOOKS

T1 Chakraverty, A. Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2000.

T2 Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.

REFERENCE BOOKS

R1 Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.

R2 Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955. 3. Mohsenin, N.N. Physical Properties of Plant and Animal Materials Gordon and Breach Publishers, Ludhiana, 1970.

Chairman - BoS
AGRI - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ACADEMIC COUNCIL Chairman

Dean (Academics)
HiCET

Open Elective-II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7401	URBAN AGRICULTURE AND ORGANIC FARMING	3	0	0	3

Course Objective

- To impart knowledge to students on the importance of gardening and organic farming
- To impart theoretical and practical knowledge on layout of different types of gardens and their maintenance.

Unit	Description	Instructional Hours
I	Urban Agriculture History, importance and scope of gardening; principles of gardening; types of gardens. special types of gardens - roof garden vertical garden, terrace garden.	9
II	**Professional Skills** Usage and maintenance of equipment's for gardening- Planting suitable varieties to suit different types of gardens- Install and maintenance of water fountains- design consideration and construction of roof garden.	9
III	**Importance of Organic farming** Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.	9
IV	**Certification process** Choice of crops and varieties in organic farming; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.	9
V	**Business Opportunity** Business Opportunity Identification- Market Survey and Business Plan Development-Import and Export certification - Planning and Risk Assessment.	9
	Total Instructional Hours	45

Course Outcome

- Effectively manage roof gardening as a small agri-business enterprise.
- Will have gained all round knowledge of roof gardening and organic farming as an agri-business enterprise rather than as a community profession.

TEXT BOOKS:

T1 David (Ed) Fletcher, Rooftop Garden Design, Images Publishing Group Pty Ltd. ,(1 October 2015), ISBN-10 : 1864706465

REFERENCE BOOKS:

R1 http://ecoursesonline.iasri.res.in/course/view.php?id=152

R2 http://www.asci-india.com/BooksPDF/Gardener.pdf

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AGRI - HiCET

ACADEMIC COUNCIL * HNCE * HNCE COLLEGE OF ENGINEERING * Chairman

Dean (Academics)
HiCET

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

CBCS PATTERN

UNDERGRADUATE PROGRAMMES B.E

AGRICULTURE ENGINEERING (UG)

REGULATION-2022

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	I	22MA1101 & Matrices and Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2
		22ME1201 & Engineering Drawing	3	2	2.6	-	2	-	-	-	-	2.2	-	1	2	1.8
		22PH1151 & Physics for Non-Circuit Engineering	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4
		22HE1151 & English for Engineers	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2
		22IT1151 & Python programming and practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2
I	II	22MA2102 & Differential Equations and Complex Variables	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2
		22CY2101 & Environmental Studies	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-
		22PH2101 & Basics of Material Science	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

		22CY2151 & Chemistry For Biological Sciences	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**
		22AG2252 & Principles and Practices of Crop Production	**1**	**1.6**	**1.5**	**1**	**1.2**	**1.6**	**1**	**-**	**1**	**-**	**-**	**-**	**1.6**	**2**
		22HE2151 & Effective Technical Communication	**1.6**	**1.6**	**1**	**1**	**1.2**	**2**	**1.8**	**1.8**	**2.2**	**3**	**1**	**2.8**	**1**	**1**
		22ME2001 & Engineering Practices	**3**	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**2**
II	**III**	**22MA3109 & Laplace Transform, Fourier Series and Transforms**	**3**	**2.8**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**	**1.8**	**1.8**
		22AG3201 & Soil Technology	**2**	**4**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**
		22AG3202 & Fluid Mechanics and Pumps	**3**	**3**	**3**	**2.6**	**2.8**	**2.6**	**2.2**	**1**	**1.3**	**1.5**	**1.8**	**1**	**3**	**2**
		22AG3203 & Engineering Thermodynamics	**3**	**2.6**	**2**	**2**	**1**	**2.4**	**2.4**	**-**	**2.6**	**1**	**1**	**2.4**	**2.4**	**2.6**
		22AG3251 & Unit Operations in Agricultural Processing	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**1**	**1**	**2**	**1**	**1**	**2**
		22AG3252 & Surveying and Levelling	**3**	**3**	**2.6**	**2.4**	**1.8**	**1.2**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**
		22AG3001 & Soil Technology Laboratory	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

CBCS PATTERN

UNDERGRADUATE PROGRAMMES B.E

AGRICULTURE ENGINEERING (UG)

REGULATION-2019

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	I	19HE1101 & Technical English	1	1	1	1	1	1	1	1	2	3	1	2	2	2
		19MA1102 & Calculus and Linear Algebra	3	3	3	3	3	-	-	-	-	-	-	2	2	2
		19ME1101 & Basics of Civil and Mechanical Engineering	3	1	1	-	-	1	-	-	-	-	-	1	3	2
		19PH1151 & Applied Physics	3	2	2	2	2	1	-	-	-	-	-	1	2	2
		19CY1151 & Chemistry for Engineers	3	2	2	2	2	1	1	-	-	-	-	1	1	1
		19CS1151 & Python programming and practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2
I	II	19HE2101 & Business English for Engineers	2	2	1	1	1	2	2	2	2	3	1	3	1	1
		19MA2101 & Differential Equations and Complex Variables	3	3	3	2	2	-	-	-	-	-	-	2	2	2
		19AG2104 & Principles of Food Science	1	1	1	1	1	1	1	-	1	-	-	-	1	2

		19PH2151 & Material Science	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**2**
		19CY2151 & Environmental studies	**2**	**1**	**1**	**-**	**-**	**1**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**
		19IT2151 & Programming in C	**2**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**
		19ME2001 & Engineering Practices	**3**	**-**	**3**		**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**2**
II	**III**	**19MA3102 & Fourier Analysis and Transforms**	**3**	**3**	**3**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**
		19AG3201 & Soil Science and Engineering	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**1**
		19AG3202 & Fluid Mechanics and Hydraulics	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**1**	**2**	**1**
		19AG3203 & Principles and practices of Crop Production	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**2**	**2**	**2**
		19AG3251 & Unit Operations in Agricultural Processing	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**
		19AG3001 & Field Crop Production Practical	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**2**	**2**	**2**
		19AG3002 & Soil Science Laboratory	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**
II	**IV**	**19AG4201 & Farm Tractors**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**1**	**2**
		19AG4202 & Thermodynamics	**3**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
		19AG4203 & Irrigation and Drainage Engineering	**2**	**1**	**2**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**3**	**1**	**1**	**2**
		19AG4251 & Bio-Energy Resource Technology	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**2**	**3**	**2**
		19AG4252 & Surveying	**3**	**1**	**2**	**2**	**2**	**3**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**1**

		and Leveling														
		19AG4001 & Irrigation Field Laboratory	**2**	**2**	**2**	**3**	**0**	**0**	**1**	**0**	**3**	**0**	**3**	**1**	**2**	**2**
III	**V**	**19AG5201 & Farm Machinery and Equipment**	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**0**	**0**	**1**	**3**	**2**	**3**
		19AG5202 & Refrigeration and Cold Chain Management	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**2**	**3**	**2**
		19AG5203 & Theory of Machines	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
		19AG5301 & Systems Analysis and Soft Computing in Agricultural Engineering	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
		19AG5302 & Sustainable Agriculture and Food Security	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
		19AG5303 & CDM and Carbon Trading Technology	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
		19AG5304 & IOT in Agricultural Systems	**2**	**1**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**2**
		19AG5305 & Ergonomics and Safety in Agricultural Engineering	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
		19AG5251 & Groundwater and Well Engineering	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**3**
		19AG5252 & Soil and Water Conservation Engineering	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**3**	**2**
		19AG5001 & Operation and Maintenance	**2**	**2**	**2**	**3**	**2**	**-**	**1**	**0**	**3**	**0**	**3**	**2**	**2**	**2**

		of Farm Machinery Laboratory														
		19AG5002 & CAD for Agricultural Engineering	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**				**2**	**2**	**2**
III	**VI**	**19AG6201 Hydrology and Water Resources Engineering**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**3**
		19AG6202 Solar and Wind Energy Engineering	**2**	**2**	**2**	**3**	**-**	**1**	**2**	**1**	**-**	**-**	**1**	**2**	**2**	**2**
		19AG6181 Professional Ethics	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**-**	**2**	**1**	**1**	**2**	**3**	**2**
		19AG6301 Climate change and adaptation	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
		19AG6302 Heat and Mass Transfers for Agricultural Engineers	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**
		19AG6251 Food and Dairy Engineering	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**
		19AG6252 ICT in Agricultural Engineering	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**-**	**1**	**2**	**2**	**2**	**2**	**2**
		19AG6701 Industrial Training	**3**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
		19AG6303 Disaster Management	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
		19AG6304 Horticultural Crop Processing	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**
		19AG6305 Organic Farming Technologies	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**
		19AG6401 Modern Agricultural Practices	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**3**
IV	**VII**	**19AG7201 Agricultural Extension**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**1**	**1**

		19AG7202R Remote Sensing and Geographical Information System	**2.2**	**2.6**	**2.2**	**1.4**	**2**	**1**	**1.5**	**1**	**1.5**	**1.6**	**1.4**	**2.2**	**3**	**2**
		19AG7251 Precision Farming and Protected Cultivation	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**
		19AG7001R Renewable Energy Laboratory	**2**	**3**	**2**	**1**	**2**	**2**	**2**	**0**	**2**	**1**	**1**	**2**	**2**	**2**
		19AG7002R Remote Sensing and GIS Laboratory for Agricultural Engineers	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**2**	**3**	**2**
		19AG7901 Innovative Project	**1**	**1.2**	**1**	**-**	**1.2**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
		19AG7301 Post-Harvest Technology	**2.4**	**2**	**1.75**	**4**	**1.5**	**2**	**2**	**1.6**	**1.6**	**1.75**	**1.75**	**1.6**	**1.6**	**1.6**
		19AG7302 Dairy Process Technology	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**1**
		19AG7303 Storage and Packaging Technology	**3**	**2**	**1**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
		19AG7304 Process Engineering of Fruits and Vegetables	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**
		19AG7305 Fat and Oil Processing	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**1**
		19AG7401 Urban Agriculture and organic farming	1	1	1	1	1	1	1	0	1	-	-	2	1	2
IV	**VIII**	**19AG8901 Project work**	**1**	**2**	**1**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
		19AG8301 Agricultural Business Management and Entrepreneurship	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**

		19AG8302 On-Farm Water Management	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**1**
		19AG8303 Intellectual Property Rights	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**3**	**1**	**2**
		19AG8304 Agricultural Waste Management	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**
		19AG8305 Energy Conservation in Agro based Industry	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**1**
		19AG8306 Special Farm Equipment's	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
		19AG8307 Mechanics of Tillage and Traction	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**3**	**1**	**2**
		19AG8308 Watershed Hydrology and Management	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**1**
		19AG8309 Micro Irrigation System	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**3**
		19AG8310 Agriculture Economics and Farm Management	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**