KIT - Kalaignarkarunanidhi Institute of Technology

(An Autonomous Institution)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' GRADE & NBA (CSE, ECE, EEE, MECH & MBA)
An ISO 9001 : 2015 Certified Institution

Coimbatore - 641 402.

REGULATIONS, CURRICULUM & SYLLABUS - 2023

(For Students admitted from the Academic Year 2023-24 and onwards)

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

Vision and Mission of the Department

Vision

○	To achieve the highest caliber in Agriculture Engineering Teaching, Research and Training and to develop intellectual leaders for the betterment of the society, environmental protection and modern technological needs for the agriculture sector.

Mission

○	To provide high quality education to students through advanced skill based learning and value added programmes.
○	To establish the state of art laboratories in farm machinery, soil water conservation, food and agricultural processing, value addition and renewable energy.
○	To develop the affordable technologies in various areas of agricultural engineering with linkages of industries and institutions.
○	To impart various awareness campaign, training programmes and demonstrations on latest techniques to the farmers, officials and entrepreneurs for maximizing returns from agriculture

Program Educational Objectives (PEO's)

PEO 1	Graduates will have a successful professional career in the field of Agricultural Engineering and related disciplines.
PEO 2	Graduates will formulate, analyse and provide solution to the real world problems faced by the farmers through applying the knowledge in the field of Agricultural Engineering.
PEO 3	Graduates will have commitment to life long learning with mechanization knowledge and apply their career for flourishing the farming community.

Programme Outcomes (PO's)

Engineering Graduates will be able to

PO 1	**Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering in agriculture.
PO 2	**Problem Analysis :** Ability to design and conduct experiments, analyze and interpret data to prepare farm specific report.
PO 3	**Design / Development of Solutions :** Ability to design an irrigation system to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, and sustainability.

PO 4	**Conduct Investigations of Complex Problems :** Ability to think creatively, to formulate problem statements, to communicate effectively, to synthesize information, and to evaluate agricultural systems.
PO 5	**Modern Tool Usage :** Ability to function in interdisciplinary teams within the institute and also with other organizations at National/International level while planning the research projects.
PO 6	**The Engineer and Society :** Ability to use techniques, skills and modern engineering tools necessary for Agricultural engineering practice.
PO 7	**Environment and Sustainability :** Will develop competencies in computer and automatic control system, information system, mechanical systems, natural resource systems to solve engineering problems.
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.
PO 10	**Communication :** Graduates will be able to express themselves clearly in oral and verbal communication needs.
PO 11	**Project Management and Finance :** Ability to devise a strategy or action plan to utilize the acquired knowledge in increasing water-use efficiency, farm mechanization and post harvest technology etc.
PO 12	**Lifelong Learning :** Graduates will be capable of self-education in emerging problems and understand the value of lifelong learning in food technology, Farm machinery and Food processing.

Program Specific Outcome (PSO's)	
PSO 1	Apply the agricultural engineering design and concepts, methodologies and techniques for effective and efficient agricultural production.
PSO 2	Analyze the real time agriculture problems and to provide solutions by applying appropriate technology.
PSO 3	Develop employment and entrepreneurial ability in different disciplines of agricultural engineering.

BoS Chairman

Curriculum

Curriculum and Scheme of Assessment

(For Students admitted from the Academic Year 2023-24 and onwards)

Semester I											
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23IPT101	Induction Programme	**HS**	-	-	-	-	**0**	-	-	-
Theory / Theory with Practical										
B23MAT101	Matrices and Differential Calculus	**BS**	4	3	1	0	**4**	40	60	100
B23HST101	தமிழர்மரபு / Heritage of Tamils	**HS**	1	1	0	0	**1**	40	60	100
B23MET101	Engineering Graphics	**ES**	4	2	2	0	**4**	40	60	100
B23ENI101	Professional Communication	**HS**	5	3	0	2	**4**	50	50	100
B23CHI101	Engineering Chemistry	**BS**	5	3	0	2	**4**	50	50	100
B23CSI102	Problem Solving and Python Programming	**ES**	5	3	0	2	**4**	50	50	100
Practical										
B23MEP101	Engineering Practices Laboratory	**ES**	4	0	0	4	**2**	60	40	100
Total credits to be earned							**23**			

Semester II										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23ENT101	Professional English	**HS**	2	2	0	0	**2**	40	60	100
B23MAT201	Integral Calculus and Complex Analysis	**BS**	4	3	1	0	**4**	40	60	100
B23HST201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	**1**	40	60	100
B23MET201	Engineering Mechanics	**ES**	4	3	1	0	**4**	40	60	100
B23AGT201	Principles and Practices of Crop Production	**PC**	3	3	0	0	**3**	40	60	100
B23PHI101	Engineering Physics	**BS**	5	3	0	2	**4**	50	50	100
Practical										
B23CEP201	Soft Skills	**CEC**	2	2	0	0	**NC**	100	-	100
B23AGP201	Crop Husbandry Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CEP202	Application Design and Development	**CEC**	2	0	0	2	**NC**	100	-	100
Total credits to be earned							**20**			

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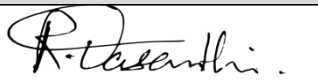

Semester III										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23MAT301	Transforms and Partial Differential Equations	**BS**	4	3	1	0	**4**	40	60	100
B23AGT301	Surveying and Levelling	**PC**	3	3	0	0	**3**	40	60	100
B23AGT302	Thermodynamics and Heat Transfer	**ES**	3	3	0	0	**3**	40	60	100
B23MET304	Theory of Machines	**PC**	3	3	0	0	**3**	40	60	100
B23AGI301	Principles of Soil Physics and Mechanics	**PC**	5	3	0	2	**4**	50	50	100
B23EEI202	Basic Electrical and Electronics Engineering	**ES**	5	3	0	2	**4**	50	50	100
Practical										
B23AGP301	Surveying and Levelling Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CEP301	Professional Certificate Course	**CEC**	2	0	0	2	**1**	100	-	100
Total credits to be earned							**24**			

Semester IV										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory										
B23MAT404	Probability and Statistics	**BS**	4	3	1	0	**4**	40	60	100
B23AGI401	Fluid Mechanics and Hydraulics	**PC**	5	3	0	2	**4**	50	50	100
B23AGI402	Strength of Materials for Agricultural Engineering	**ES**	5	3	0	2	**4**	50	50	100
B23AGT401	Post Harvest Technology	**PC**	3	3	0	0	**3**	40	60	100
B23AGT402	Engineering Materials, Construction, Estimation and Costing	**PC**	3	3	0	0	**3**	40	60	100
B23AGT403	Unit Operations in Agricultural Processing	**PC**	3	3	0	0	**3**	40	60	100
B23MCP401	Product Development Course	**MC**	0	0	0	2	**1***	100	-	100
Practical										
B23AGP401	Post Harvest Engineering Laboratory	**PC**	4	0	0	4	**2**	60	40	100
Total credits to be earned							**24**			

Summer Internship - Duration 15 days (Review will be conducted in first week of Semester V and its credit will be included in Semester V)

* The grades earned by the students will be recorded in the marksheet, however the same shall not be considered for the computation of CGPA.

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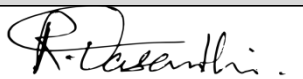

Semester V										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory										
B23AGT501	Farm Tractors and Engines	**PC**	3	3	0	0	**3**	40	60	100
B23AGT502	Soil and Water Conservation Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23AGT503	IoT in Agricultural Engineering and its applications	**PC**	3	3	0	0	**3**	40	60	100
B23AGI501	Food and Dairy Processing	**PC**	5	3	0	2	**4**	50	50	100
B23AGExxx	Professional Elective I	**PE**	3	3	0	0	**3**	40	60	100
	Open Elective I	**OE**	3	3	0	0	**3**	40	60	100
B23MCT50X	Mandatory course I	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT505	Holistic insight into UN SDG's	**MC**	2	2	0	0	**NC**	100	-	100
Practical										
B23AGP501	Design and Drawing of Farm Structures	**PC**	4	0	0	4	**2**	60	40	100
B23AGP502	ICT Laboratory for Agricultural Engineers (Team Teaching)	**PC**	4	0	0	4	**2**	60	40	100
B23CEP501	Summer Internship	**CEC**	-	-	-	-	**1**	100	-	100
Total credits to be earned							**24**			

Semester VI										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory										
B23AGT601	Irrigation and Drainage Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23AGT602	Design of Farm Machine Elements	**PC**	3	3	0	0	**3**	40	60	100
B23AGI601	Farm Machinery and Equipments	**PC**	5	3	0	2	**4**	50	50	100
B23AGT603	Agricultural Business Management	**PC**	3	3	0	0	**3**	40	60	100
B23MCT60X	Mandatory course II	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT605	Cyber Safety Concepts	**MC**	2	2	0	0	**NC**	100	-	100
B23AGExxx	Professional Elective – II	**PE**	3	3	0	0	**3**	40	60	100
	Open Elective – II	**OE**	3	3	0	0	**3**	40	60	100
Practical										
B23AGP601	Irrigation Systems Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGP602	Innovative Design Practice	**PW**	4	0	0	4	**2**	40	60	100

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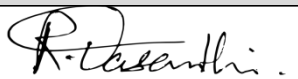

Total credits to be earned	23	
RAWE - Duration 10 days (Review will be conducted in first week of Semester VII and its credit will be included in Semester VII)		

Semester VII										
Course Code	**Course Name**	**CT**	**Instructional Hours**					**Assessment**		
			CP	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**
Theory										
B23AGT701	Solar, Wind and Bio-Energy Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23AGT702	Remote Sensing and Geographical Information System	**PC**	3	3	0	0	**3**	40	60	100
B23AGExxx	Professional Elective – III	**PE**	3	3	0	0	**3**	40	60	100
B23AGExxx	Professional Elective – IV	**PE**	3	3	0	0	**3**	40	60	100
B23HST701	Universal Human Values	**HS**	2	2	0	0	**2**	40	60	100
Practical										
B23AGP701	Renewable Energy Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGP702	Remote Sensing and GIS Laboratory for Agricultural Engineers	**PC**	4	0	0	4	**2**	60	40	100
B23CEP701	Rural Agricultural Engineering Work Experience	**CEC**	2	0	0	2	**1**	100	-	100
B23AGP702	Project Work – Phase I	**PW**	8	0	0	8	**4**	40	60	100
Total credits to be earned							**23**			

Semester VIII										
Course Code	**Course Name**	**CT**	**Instructional Hours**					**Assessment**		
			CP	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**
Practical										
B23AGP801	Project Work - Phase II	**PW**	16	0	0	16	**8**	40	60	100
Total credits to be earned							**8**			

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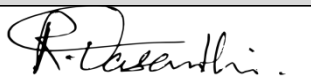

HUMANITIES AND SOCIAL SCIENCES (HS)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23IPP101	Induction Programme	**HS**	-	-	-	-	**0**	-	-	-
B23ENI101	Professional Communication	**HS**	5	3	0	2	**4**	50	50	100
B23HST101	தமிழர் மரபு /Heritage of Tamils	**HS**	1	1	0	0	**1**	40	60	100
B23HST201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	**1**	100	-	100
B23ENT101	Professional English	**HS**	2	2	0	0	**2**	50	50	100
B23HST701	Universal Human Values	**HS**	2	2	0	0	**2**	40	60	100

BASIC SCIENCES (BS)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MAT101	Matrices and Differential Calculus	**BS**	4	3	1	0	**4**	40	60	100
B23CHI101	Engineering Chemistry	**BS**	5	3	0	2	**4**	50	50	100
B23MAT201	Integral Calculus and Complex Analysis	**BS**	4	3	1	0	**4**	40	60	100
B23PHI101	Engineering Physics	**BS**	5	3	0	2	**4**	50	50	100
B23MAT301	Transforms and Partial Differential Equations	**BS**	4	3	1	0	**4**	40	60	100
B23MAT404	Probability and Statistics	**BS**	4	3	1	0	**4**	40	60	100

ENGINEERING SCIENCES (ES)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MET101	Engineering Graphics	**ES**	5	3	2	0	**4**	40	60	100
B23CSI102	Problem Solving and Python Programming	**ES**	5	3	0	2	**4**	50	50	100
B23MEP101	Basic Workshop Practices Laboratory	**ES**	4	0	0	4	**2**	60	40	100
B23MET201	Engineering Mechanics	**ES**	4	3	1	0	**4**	40	60	100
B23AGT302	Thermodynamics and Heat Transfer	**ES**	3	3	0	0	**3**	40	60	100
B23EEI202	Basic Electrical and Electronics Engineering	**ES**	5	3	0	2	**4**	50	50	100
B23AGI402	Strength of Materials for Agricultural Engineering	**ES**	5	3	0	2	**4**	50	50	100

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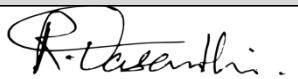

PROFESSIONAL CORE (PC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGT201	Principles and Practices of Crop Production	**PC**	3	3	0	0	**3**	40	60	100
B23AGP201	Crop Husbandry Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGP202	Application Design and Development	**PC**	2	2	0	0	**NC**	100	-	100
B23AGT301	Surveying and Levelling	**PC**	3	3	0	0	**3**	40	60	100
B23AGI301	Principles of Soil Physics and Mechanics	**PC**	5	3	0	2	**4**	50	50	100
B23AGP301	Surveying and Levelling Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23MET304	Theory of Machines	**PC**	3	3	0	0	**3**	40	60	100
B23AGI401	Fluid Mechanics and Hydraulics	**PC**	3	3	0	0	**3**	50	50	100
B23AGT401	Post Harvest Technology	**PC**	3	3	0	0	**3**	40	60	100
B23AGP401	Post Harvest Engineering Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGT402	Engineering Materials, Construction, Estimation and Costing	**PC**	3	3	0	0	**3**	40	60	100
B23AGT403	Unit Operations in Agricultural Processing	**PC**	3	3	0	0	**3**	40	60	100
B23AGP401	Post Harvest Engineering Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGT501	Farm Tractors and Engines	**PC**	3	3	0	0	**3**	40	60	100
B23AGT502	Soil and Water Conservation Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23AGI501	Food and Dairy Processing	**PC**	5	3	0	2	**4**	50	50	100
B23AGT503	IoT in Agricultural Engineering and its applications	**PC**	3	3	0	0	**3**	40	60	100
B23AGP501	Design and Drawing of Farm Structures	**PC**	4	0	0	4	**2**	60	40	100
B23AGP502	ICT Laboratory for Agricultural Engineers (Team Teaching)	**PC**	4	0	0	4	**2**	60	40	100
B23AGT601	Irrigation and Drainage Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23AGT602	Design of Farm Machine Elements	**PC**	3	3	0	0	**3**	40	60	100
B23AGT603	Agricultural Business Management	**PC**	3	3	0	0	**3**	40	60	100
B23AGI601	Farm Machinery and Equipments	**PC**	3	3	0	0	**3**	40	60	100
B23AGP601	Irrigation Systems Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AGT701	Remote Sensing and Geographical Information System	**PC**	3	3	0	0	**3**	40	60	100
B23AGT701	Solar, Wind and Bio-Energy Engineering	**PC**	3	3	0	0	**3**	50	50	100
B23AGP701	Remote Sensing and GIS Laboratory for Agricultural Engineers	**PC**	4	0	0	4	**2**	60	40	100

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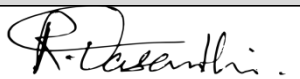

PROFESSIONAL ELECTIVE (PE)										
VERTICAL I - Farm Machinery										
Course Code	**Course Name**	**CT**	**Instructional Hours**					**Assessment**		
			CP	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**
B23AGE901	Ergonomics and safety in Agricultural Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23AGE902	Tillage Mechanics and Traction	**PE**	3	3	0	0	**3**	40	60	100
B23AGE903	Farm Power and Machinery Management	**PE**	3	3	0	0	**3**	40	60	100
B23AGE904	Testing and evaluation of farm machinery	**PE**	3	3	0	0	**3**	40	60	100
B23AGE905	Farm Machinery Design and Production	**PE**	3	3	0	0	**3**	40	60	100
B23AGE906	Precision Farming Equipments	**PE**	3	3	0	0	**3**	40	60	100
B23AGE907	Special Farm Equipments	**PE**	3	3	0	0	**3**	40	60	100

VERTICAL II - Land and Water Resources Management										
Course Code	**Course Name**	**CT**	**Instructional Hours**					**Assessment**		
			CP	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**
B23AGE908	Hydrology and Water Resources Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23AGE909	Groundwater and Well Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23AGE910	Watershed Planning and Management	**PE**	3	3	0	0	**3**	40	60	100
B23AGE911	On farm Water Management	**PE**	3	3	0	0	**3**	40	60	100
B23AGE912	Integrated Farming System	**PE**	3	3	0	0	**3**	40	60	100
B23AGE913	Climate Change and Adaptation	**PE**	3	3	0	0	**3**	40	60	100
B23AGE914	Rural Water Supply and Sanitation Engineering	**PE**	3	3	0	0	**3**	40	60	100

VERTICAL - III Food and Agricultural Processing										
Course Code	**Course Name**	**CT**	**Instructional Hours**					**Assessment**		
			CP	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**
B23AGE915	Refrigeration and Cold Storage	**PE**	3	3	0	0	**3**	40	60	100
B23AGE916	Principles of Agricultural Economics	**PE**	3	3	0	0	**3**	40	60	100
B23AGE917	Process Engineering of Fruits and Vegetables	**PE**	3	3	0	0	**3**	40	60	100
B23AGE918	Storage and Packaging Technology	**PE**	3	3	0	0	**3**	40	60	100
B23AGE919	Food Process Equipment and Design	**PE**	3	3	0	0	**3**	40	60	100
B23AGE920	Emerging Technologies in Food Processing	**PE**	3	3	0	0	**3**	40	60	100
B23AGE921	Sustainable Agriculture and Food security	**PE**	3	3	0	0	**3**	40	60	100

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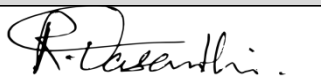

VERTICAL IV - Precision Agriculture Systems										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGE922	Machine Learning for Soil And Crop Management	**PE**	3	3	0	0	**3**	40	60	100
B23AGE923	Protected Cultivation	**PE**	3	3	0	0	**3**	40	60	100
B23AGE924	IT in Agricultural Systems	**PE**	3	3	0	0	**3**	40	60	100
B23AGE925	UAV Application in Agriculture	**PE**	3	3	0	0	**3**	40	60	100
B23AGE926	IoT Concepts and Applications in Agriculture Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23AGE927	Systems Analysis in Agricultural Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23AGE928	Mulching Technology for crop production	**PE**	3	3	0	0	**3**	40	60	100

VERTICAL V - Renewable Energy Applications in Agriculture										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGE929	Biochemical and Thermo Chemical conversion of Biomass	**PE**	3	3	0	0	**3**	40	60	100
B23AGE930	Waste and By Product Utilization	**PE**	3	3	0	0	**3**	40	60	100
B23AGE931	Energy Requirement in Agricultural Crops and Farms	**PE**	3	3	0	0	**3**	40	60	100
B23AGE932	Energy Conservation in Agro Industrial Utilities	**PE**	3	3	0	0	**3**	40	60	100
B23AGE933	Farm Level Energy Auditing	**PE**	3	3	0	0	**3**	40	60	100
B23AGE934	Energy Management and Environment Utilities	**PE**	3	3	0	0	**3**	40	60	100
B23AGE935	Waste conservation into Energy	**PE**	3	3	0	0	**3**	40	60	100

VERTICAL VI - Hydraulics of Surface Irrigation System										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGE936	Design of Micro Irrigation System	**PE**	3	3	0	0	**3**	40	60	100
B23AGE937	Irrigation Water Quality and Waste Water Management	**PE**	3	3	0	0	**3**	40	60	100
B23AGE938	Command Area Development	**PE**	3	3	0	0	**3**	40	60	100
B23AGE939	Design of Agricultural Drainage Systems	**PE**	3	3	0	0	**3**	40	60	100
B23AGE940	Hydrodynamics of Pressurized Irrigation System	**PE**	3	3	0	0	**3**	40	60	100
B23AGE941	Irrigation Automation	**PE**	3	3	0	0	**3**	40	60	100
B23AGE942	Hydraulic structures	**PE**	3	3	0	0	**3**	40	60	100

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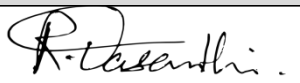

PROFESSIONAL ELECTIVES COURSES: VERTICALS					
Vertical I Farm Machinery	**Vertical II Land and Water Resources Management**	**Vertical III Food and Agricultural Processing**	**Vertical IV Precision Agriculture Systems**	**Vertical V Renewable Energy Applications in Agriculture**	**Vertical VI Hydraulics of Surface Irrigation System**
Ergonomics and safety in Agricultural Engineering	Hydrology and Water Resources Engineering	Refrigeration and Cold Storage	Machine Learning for Soil And Crop Management	Biochemical and Thermo Chemical conversion of Biomass	Design of Micro Irrigation System
Tillage Mechanics and Traction	Groundwater and Well Engineering	Principles of Agricultural Economics	Protected Cultivation	Waste and By Product Utilization	Irrigation Water Quality and Waste Water Management
Farm Power and Machinery Management	Watershed Planning and Management	Process Engineering of Fruits and Vegetables	IT in Agricultural Systems	Energy Requirement in Agricultural Crops and Farms	Command Area Development
Testing and evaluation of farm machinery	On farm Water Management	Storage and Packaging Technology	UAV Application in Agriculture	Energy Conservation in Agro Industrial Utilities	Design of Agricultural Drainage Systems
Farm Machinery Design and Production	Integrated Farming System	Food Process Equipment and Design	IoT Concepts and Applications in Agriculture Engineering	Farm Level Energy Auditing	Hydrodynamics of Pressurized Irrigation System
Precision Farming Equipments	Climate Change and Adaptation	Emerging Technologies in Food Processing	Systems Analysis in Agricultural Engineering	Energy Management and Environment Utilities	Irrigation Automation
Special Farm Equipments	Rural Water Supply and Sanitation Engineering	Sustainable Agriculture and Food security	Mulching Technology for crop production	Waste conservation into Energy	Hydraulic structures

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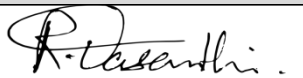

PROJECT WORK (PW)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGP602	Innovative Design Practice	PW	4	0	0	4	2	40	60	100
B23AGP702	Project Work – Phase I	PW	4	0	0	4	4	40	60	100
B23AGP801	Project Work - Phase II	PW	16	0	0	16	8	40	60	100

CAREER ENHANCEMENT COURSE (CEC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B19CEP201	Soft Skills	CEC	2	2	0	0	NC	100	-	100
B23CEP301	Professional Certificate Course	CEC	2	0	0	2	1	100	-	100
B23CEP501	Summer Internship	CEC	-	-	-	-	1	100	-	100
B23CEP701	Rural Agricultural Engineering Work Experience	CEC	-	-	-	-	1	100	-	100

MANDATORY COURSE (MC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MCP401	Professional Development Course	MC	0	0	0	2	1*	100	-	100
B23MCT501	Environmental Sustainability	MC	2	2	0	0	NC	100	-	100
B23MCT502	Elements of Literature	MC	2	2	0	0	NC	100	-	100
B23MCT503	Foundations of Yoga	MC	2	2	0	0	NC	100	-	100
B23MCT504	Export Import Management	MC	2	2	0	0	NC	100	-	100
B23MCT505	Holistic insight into UN SDG's	MC	2	2	0	0	NC	100	-	100
B23MCT601	Education Psychology	MC	2	2	0	0	NC	100	-	100
B23MCT602	Life Style Education	MC	2	2	0	0	NC	100	-	100
B23MCT603	Startup and Venture Funding	MC	2	2	0	0	NC	100	-	100
B23MCT604	Indian Knowledge System	MC	2	2	0	0	NC	100	-	100
B23MCT605	Cyber Safety concepts	MC	2	2	0	0	NC	100	-	100

OPEN ELECTIVE COURSES-OFFERED BY DEPARTMENT OF AGRICULTURAL ENGINEERING										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23AGO501	Farm Automation	OE	3	3	0	0	3	40	60	100
B23AGO601	Environmental Management in Agriculture	OE	3	3	0	0	3	40	60	100

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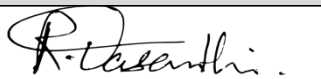

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

VERTICALS FOR MINOR DEGREE (In addition to all the verticals of other programmes)

Agricultural Engineering Specialization

AGRICULTURAL ENGINEERING MINOR VERTICALS
B23AGM901 - Fundamentals of Modern Agricultural Technology
B23AGM902 – Internet of Things (IoT) and Smart Farming
B23AGM903 – Smart Irrigation Systems Design and Management
B23AGM904 - Renewable Energy Applications in Agriculture
B23AGM905 – Industrial Food Processing and Packaging Techniques
B23AGM906 – Regenerative and Climate Smart Agriculture
B23AGM907 – Smart Farm Machinery and Automation Technologies
B23AGM908 - Farm Enterprise Planning And Business Strategy

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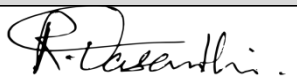

SUMMARY

S.No.	Subject Area	Credits As per Semester								Credit Points
		I	II	III	IV	V	VI	VII	VIII	
1.	**HS**	5	3					2		**10**
2.	**BS**	8	8	4	4					**24**
3.	**ES**	10	4	7	4					**25**
4.	**PC**		5	12	15	18	15	10		**74**
5.	**PE**					3	3	6		**12**
6.	**OE**					3	3			**06**
7.	**PW**						2	4	8	**14**
8.	**CEC**			1		1		1		**03**
9.	**MC (Non Credit)**				✓	✓	✓			
	Total	**23**	**20**	**24**	**23**	**24**	**23**	**23**	**8**	**168**

Approved by BoS Chairman

R. Tamilselvi

Semester - I

B.E. / B.Tech.	B23MAT101 - MATRICES AND DIFFERENTIAL CALCULUS (Common to all Branches)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To develop the use of matrices that is needed by engineers for practical applications.
2.	To understand the concept of functions of several variables.
3.	To recognize and classify ordinary differential equations.
4.	To apply the concept of ordinary differential equations in engineering disciplines.
5.	To learn the applications of Laplace transforms in engineering.

UNIT - I	MATRICES	12

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley Hamilton theorem – Quadratic form: Nature, Reduction to canonical form by orthogonal transformation.

UNIT - II	FUNCTIONS OF SEVERAL VARIABLES	12

Partial differentiation –Total derivative – Jacobians – Taylor‘s series expansion for functions of two variables – Maxima and minima of functions of two variables – Lagrange‘s method of undetermined multipliers.

UNIT - III	ORDINARY DIFFERENTIAL EQUATIONS	12

Higher order linear ordinary differential equations with constant coefficients - Method of variation of parameters - Simultaneous differential equations.

UNIT - IV	APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS	12

Solution of specified differential equations connected with electric circuits - Law of Natural growth and decay - Simple harmonic motion (Differential equations and associated conditions need to be given)

UNIT - V	LAPLACE TRANSFORMS	12

Existence conditions - Properties (excluding proofs) - Transform of standard functions -Transforms of derivatives and integrals - Inverse Laplace transform - Applications to solution of linear second order ordinary differential equations with constant coefficients.

Total Instructional hours : 60

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Course Outcomes	
CO1	Make use of Eigen values and Eigen vectors to reduce the quadratic form into canonical form and to find the powers of a square matrix.
CO2	Identify the maxima and minima problems.
CO3	Solve differential equations which existing in different engineering disciplines.
CO4	Develop the applications of differential equations in various engineering field.
CO5	Apply Laplace transform and inverse transform to solve differential equations with constant coefficients.

Text Books	
1.	Grewal B.S.,"Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2.	Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2015.
3.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2015.
4.	George B. Thomas, Joel Hass, Christopher Heil, Maurice D. Weir, "Thomas' Calculus", Pearson, 14th Edition, 2018.

Reference Books	
1.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2019.
2.	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
3.	Ramana B V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company, New Delhi, 2017.
4.	Veerarajan T., "Engineering Mathematics for Semester I and II", Tata Mc Graw Hill Publishing Company, New Delhi, 2019.
5.	Gean Duffy., "Advanced Engineering Mathematics with MATLAB", A CRC Press Company, Boca Raton London, New York Washington, D.C, 2nd edition 2009. (Free e-book downloaded from www.EasyEngineering.net.pdf).

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B.E / B.Tech	B23MET101 – ENGINEERING GRAPHICS (COMMON TO ALL)	L	T	P	C
		2	2	0	4

Course Objectives	
1.	Understand the conventions and method of Engineering drawing.
2.	Construct and interpret the basic Engineering drawings.
3.	Improve their visualization skills so that they can apply these skills in new product development.
4.	Enhance their technical communication skill in the form of communicative drawings.
5.	Comprehend the theory of projection.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)	2
Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	

UNIT - I	PLANE CURVES AND FREE HANDSKETCHING	14
Basic Geometrical constructions, Curves used in Engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views - Free hand sketching of multiple views from pictorial views of objects.		

UNIT - II	PROJECTION OF POINTS, LINES AND PLANE SURFACE	14
Orthographic projection - principles - Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		

UNIT - III	PROJECTION OF SOLIDS	14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.		

UNIT - IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	14
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		

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UNIT - V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	14
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-prisms, pyramids and cylinders by visual ray method.		

COMPUTER AIDED DRAFTING	3
Introduction to drafting packages and demonstration of their use Basic Geometrical constructions using AUTOCAD	
Total Instructional hours : 75	

Course Outcomes : Students will be able to	
CO1	Construct the basic engineering curves and freehand sketching of basic geometrical constructions and multiple views of objects.
CO2	Solve problems related to projections of points, straight lines and planes
CO3	Build the projection of simple solids.
CO4	Apply the knowledge acquired on practical applications of sectioning and development of solids.
CO5	Construct simple solids and its sections in isometric view and projections, and also to draw its perspective views.

Text Books	
1.	K.V.Natarajan, “A text book of Engineering Graphics”, 28th Edition, Dhana Lakshmi Publishers, Chennai, 2015.
2.	N.D. Bhatt and V.M. Panchal, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.

Reference Books	
1.	K. Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International Publishers, 2017.
2.	K.R.Gopalakrishna., “Engineering Drawing” (Vol. I & II combined) Subhas Publications, Bangalore, 2018.
3.	N.S Parthasarathy and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015.

BoS Chairman

B.E / B.Tech	B23HST101 - HERITAGE OF TAMILS (COMMON TO ALL BRANCHES)	L	T	P	C
		1	0	0	1

UNIT - I	LANGUAGE AND LITERATURE	3

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT - II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE	3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT - III	FOLK AND MARTIAL ARTS	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT - IV	THINAI CONCEPT OF TAMILS	3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT - V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total Instructional hours : 15

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B.E. / B.Tech. (Except CSBS)	B23ENI101 – PROFESSIONAL COMMUNICATION	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To enhance listening and reading ability of learners to comprehend various forms of speech or conversations.
2.	To develop learners' verbal ability through complex texts and speak effectively in real life and workplace context.
3.	To make use of grammatical knowledge to enhance fluency.
4.	To foster learners' ability to write convincing job applications and effective reports.
5.	To develop learners language proficiency through LSRW skills.

UNIT - I	9
Listening	Listening for general information - specific details - conversation - Audio / video (formal & informal); Telephone conversation
Speaking	Self-Introduction; Introducing a friend; - politeness strategies - making polite requests & polite offers
Reading	Introduction to technical texts, scientific texts
Writing	Extended definitions, Writing checklists, Recommendation
Language development	Gerunds, Infinitives
Vocabulary development	Technical vocabulary, abbreviations, British & American spelling

UNIT - II	9
Listening	Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities
Speaking	Narrating personal experiences / Talking about events and situations
Reading	Reading longer technical texts, Summarizing
Writing	Interpreting graphical representations, Writing dialogues about formal and informal contexts
Language development	Use of conjunctions and prepositions
Vocabulary development	Numerical adjectives, Transitional device

BoS Chairman

UNIT - III	9
Listening	Listen to a classroom lecture; listening to advertisements about products
Speaking	Picture description - describing locations in workplace, Presenting product, describing shape, size and weight - talking about quantities - talking about precautions, discussing advantages and disadvantages - making comparisons
Reading	Cause & effect texts, practice in speed reading
Writing	Process writing, Use of sequence words, Analytical and issue based essays
Language development	Subject verb agreement, Pronoun concord / pronoun antecedent
Vocabulary development	Sequence words, Misspelled words, Content v/s Function words

UNIT - IV	9
Listening	Listening to TED Talks, Educational videos and completing exercises based on them
Speaking	Short speech (Just A Minute) - Extempore and persuasive speech, discussing and making plans-talking about tasks-talking about progress
Reading	Reading for details in personal and professional emails
Writing	Drafting personal and professional emails, job application - cover letter, résumé preparation, Internship letter
Language development	Clauses, if conditionals
Vocabulary development	Finding suitable synonyms, Paraphrasing

UNIT - V	9
Listening	Listening to debates/ discussions and panel discussions, listening to interviews
Speaking	Making predictions - talking about a given topic, giving opinions & facts, describing a process, discussing safety issues (making recommendations)
Reading	Reading and understanding technical articles
Writing	Writing reports, Minutes of meeting, Writing feasibility, survey and industrial reports
Language development	Reported speech, Active and Passive voice, Impersonal passive, Idioms
Vocabulary development	Verbal analogies, Purpose statements
	Total Theory Instructional hours : 45 **Total Lab Instructional hours : 30**

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Course Outcomes : Students will be able to	
CO1	Develop listening skills to respond appropriately in general and academic purposes.
CO2	Develop strategies and skills to enhance their ability to read and comprehend.
CO3	Apply vocabulary skills to improve their language skills.
CO4	Build writing skills with specific reference to technical writing.
CO5	Demonstrate language proficiency through LSRW skills.

Text Books	
1.	Board of Editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad : 2016
2.	Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

Reference Books	
1.	Raman, Meenakshi and Sharma, Sangeetha “Technical Communication Principles and Practice” Oxford University Press: New Delhi, 2014.
2.	Kumar, Suresh. E. “Engineering English” Orient Blackswan: Hyderabad, 2015.
3.	Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4.	Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
5.	Communicative English for Engineers and Professionals- Nitin Bhatnagar & Mamta Bhatnagar.
6.	Skills for Success. Listening and Speaking. Level 4- Margret Brooks.
7.	Grammar F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press : Oxford, 2011.

Exercises for Batch of 30 Students

1. Listening Comprehension
2. Self- introduction
3. Short presentation
4. Group Discussion

BoS Chairman

B.E / B.Tech	B23CHI101 - ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To make the students conversant with boiler feed water requirements, related problems, water treatment and inculcate practical skills in the water quality analysis.
2.	To make the students conversant with basics of polymer chemistry.
3.	To make the students conversant with basic of electrochemical reactions, corrosion and induce experimental skills in the electro-analytical techniques.
4.	To make the student acquire sound knowledge of energy devices.
5.	To develop an understanding of the basic concepts of nano materials.

UNIT - I	WATER TECHNOLOGY	17

Hardness of water : Types, expression of hardness and their units, hardness problems, boiler troubles - scale and sludge, caustic embrittlement, boiler corrosion, priming and foaming

Treatment of Boiler feed water : Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning)

External treatment : Ion exchange process, Zeolite process

Desalination of brackish water : Reverse osmosis - municipal water treatment, break point chlorination

Determination of alkalinity in water sample, Determination of total, temporary & permanent hardness of water by EDTA method. Estimation of iron content of the water sample using spectrophotometer.

UNIT - II	POLYMERS	9

Polymers : Definition, polymerization, types - addition and condensation polymerization, free radical mechanism - tacticity – biodegradable polymer (PHBV) and conducting polymer (poly-aniline)

Plastics : Classification, preparation, properties and uses of PVC, teflon, nylon-6, 6 and epoxy resin

Rubber : Vulcanization of rubber, synthetic rubbers -n-butyl rubber and SBR

Moulding : Ingredients - compression and Injection

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UNIT - III	ELECTROCHEMISTRY AND CORROSION	16

Electrochemistry : Redox reaction, electrode potential - oxidation potential, reduction potential, Nernst equation (derivation) - measurement and applications - electrochemical series and its significance
Corrosion : causes - types-chemical and electrochemical corrosion (galvanic and differential aeration), corrosion control - electrochemical protection (sacrificial anodic method and impressed current cathodic method)
Estimation of iron content of the given solution using potentiometer, Conductometric titration of strong acid vs strong base, Estimation of copper in brass

UNIT - IV	ENERGY DEVICES	9

Batteries : Types of batteries – primary (alkaline battery) and secondary battery (lead acid battery, lithium-ion-battery), Fuel Cells (H2 - O2 fuel cell)
Super Capacitors : Principle, construction, working and applications
Photo voltaic cell : Solar cells - principle, construction, working and applications

UNIT - V	NANOCHEMISTRY	9

Basics : Distinction between molecules, nanoparticles and bulk materials- surface area to volume ratio
Synthesis : Top-down process (ball milling) - Bottom-up process (chemical vapour deposition and sol-gel method)
Properties of nano materials - Optical, electrical, thermal and mechanical
Applications of nano materials - Medicine, Industries, electronics and biomaterials

Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Explain the characterization of water and quantitative analysis of alkalinity, hardness and Iron
CO2	Develop the basics of polymer chemistry.
CO3	Illustrate the principles of electrochemical reactions, corrosion and estimation of copper in alloy.
CO4	Apply the concepts of energy devices and its engineering applications.
CO5	Organize the basics of nano chemistry and its applications.

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Text Books	
1.	Dara, S S and Umare, S S, “A Textbook of Engineering Chemistry”, Chand S & Company Ltd., New Delhi, 2015.
2.	Jain, P C and Monika Jain, “Engineering Chemistry” Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2015
3.	Vogel’s Textbook of Quantitative Chemical Analysis, 8th edition, 2014.

Reference Books	
1.	Friedrich Emich, “Engineering Chemistry”, Scientific International Pvt. Ltd., New Delhi, 2014.
2.	Prasanta Rath, “Engineering Chemistry”, Cengage Learning India Pvt. Ltd., Delhi, 2015.
3.	Shikha Agarwal, “Engineering Chemistry - Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.
4.	Charles P. Poole and Frank J. Owens, "Introduction to nanotechnology", John Wiley Sons, New Jersey, 2003.

Equipment Needed for 30 Students

1. Conductivity Meter - 10
2. Potentiometer - 10
3. Spectrophotometer - 02
4. Electronic Balance - 01

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B.E.	B23CSI102 - PROBLEM SOLVING AND PYTHON PROGRAMMING (COMMON TO AERO, AGRI, BT AND MECH)	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To develop python programs with conditional statements and loops.
2.	To learn how to use strings, functions and pass arguments in Python.
3.	To use python data structures such as lists, tuples, and dictionaries.
4.	To use file concepts and to build a package using Python modules for reusability.
5.	To learn the fundamentals of data manipulations with Python.

UNIT - I	INTRODUCTION TO PYTHON PROGRAMMING	9

Introduction : Python basics and its scripting modes – Variables, Operators - Control Structures : if, if - else, nested if, if – elif ladder statements - Iterative statements : while, for, Nested loops, else in loops, break, continue and pass statements.

UNIT - II	STRINGS AND FUNCTIONS	9

Strings : Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions. Regular expression: Matching the patterns, Search and replace. Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments.

UNIT - III	COLLECTIONS	9

List : Create, Access, Slicing, Negative Indices, List Methods, and comprehensions, Tuples : Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, and replace values, operations on dictionaries

UNIT - IV	SETS AND FILE HANDLING	9

Sets : Create and operations on set, Files : Manipulating files and directories, text files : reading / writing text and numbers from / to a file; creating and reading a formatted file (csv or tab separated)

UNIT - V	MODULES AND PACKAGES	9

Modules: Importing module, standard modules, executing modules. Packages: Importing Packages, simple programs using built-in functions of packages like pandas, jumpy, matplotlib

Total Instructional hours : 45

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List of Experiments		
Expt. No.		**Description of the Experiments**
1.	Programs Using Simple Statements	
	a.	Exchange the values of two variables,
	b.	Circulate the values of n variables,
	c.	Distance between two points.
2.	Programs Using Conditionals and Iterative Statements	
	a.	Number Series
	b.	Number Patterns
	c.	Pyramid Pattern
3.	Programs Using built-in and user defined Functions	
	a.	Factorial of a Number
	b.	Largest Number in a list
	c.	Area of Shape
4.	Programs using Strings	
	a.	Reversing a String
	b.	Checking Palindrome in a String
	c.	Counting Characters in a String
	d.	Replacing Characters in a String
5.	Operations of Lists	
	a.	Basic Operations (Insertion, Updating, deletion, accessing, List Comprehensions)
	b.	Implement linear search and binary search using list.
	c.	Matrix operations using Nested List.
	d.	Implement Merge, Bubble and Insertion sort
6.	Create a tuple and perform its operations for the following :	
	a.	Basic Operations (Insertion, Updating, deletion, accessing)
	b.	Items present in a library
	c.	Components of a car
	d.	Materials required for construction of a laboratory

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7.	Operations of Dictionaries	
	a.	Python program to create a dictionary with integer keys, and print the keys, values & key-value pairs
	b.	Python program to randomize (shuffle) values of dictionary
8.	Operations of Sets	
	a.	Basic operations of set (Membership, Operations and Modifications)
9.	Programs using File Handling	
	a.	Copy from one file to another.
	b.	Word count
	c.	Longest word
10.	Python programs using Time and Calendar related functions	
	a.	Print the current time using time module.
	b.	Display the calendar of given month of the year using calendar module.
11.	Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)	
Total Instructional hours: (45+15) = 60		

Course Outcomes : Students will be able to	
CO1	Outline the different problem-solving techniques.
CO2	Make use of various data types and control structures to solve a given problem.
CO3	Develop C programs with different types of arrays and string operations
CO4	Experiment with the usage of pointers and functions in C.
CO5	Build C Programs data using structures and unions

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of the Equipment	Quantity required (Nos.)
1.	HP Make, Core i5, 11th Generation, 16GB RAM PCs, Operating systems: Windows* 10 or later, macOS, and Linux. Python* version: 3.10.X	30

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Text Books	
1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Updated for Python 3, Shroff / O ‘Reilly Publishers, 2016
2.	Reema Thereja, “Python Programming using Problem Solving Approach”, 4th Impression, Oxford University Press, 2019.
3.	Python Course Data Analysis with Python by Bernd Klein, 2021.

Reference Books	
1.	John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press, 2013.
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python : An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd, 2016.
3.	Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd, 2015.
4.	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.

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B.E. / B.TECH	B23MEP101 – ENGINEERING PRACTICES LABORATORY (GROUP - A & B) (Common to all Branches)	L	T	P	C
		0	0	4	2

Course Objectives	
1.	Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work, sawing, planning, making joints in wood materials used in common household wood work.
2.	Welding various joints in steel plates using arc welding work; machining various simple processes like turning, drilling, tapping in parts; assembling simple mechanical assembly of common household equipments, making a tray out of metal sheet using sheet metal work.
3.	To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical Engineering.
4.	To provide exposure to the students with hands on experience on various basic Engineering practices in Electronics Engineering.

GROUP – A (CIVIL & MECHANICAL)		
I	**Civil Engineering Practices**	**12**
	Plumbing Works Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings	
Carpentry Preparation of wooden joints by sawing, planning and cutting		
1.	Planning & Polishing operation	
2.	Half lap joint	
3.	Cross lap joint	
II	**Mechanical Engineering Practices**	**18**
	Welding Workshop Study of welding tools and equipment's - Study of various welding methods - Instruction of BI standards and reading of welding drawings.	

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Exercise in arc welding for making	
1.	Lap joint
2.	Butt joint
3.	Demonstration of gas welding and cutting.
Machine Shop	
1.	Drilling and Tapping
2.	Lathe Exercise – Facing operation
3.	Lathe Exercise – Straight turning and Chamfering
Sheet metal	
Making of small parts using sheet metal	
1.	Making of Square Tray

GROUP – B (ELECTRICAL & ELECTRONICS)	**30**
Expt. No.	**Description of the Experiments**
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp and Stair case wiring.
3.	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
4.	Measurement of energy using single phase energy meter.
5.	Measurement of resistance to earth of an electrical equipment.
6.	Study of Electronic components and equipment's – Resistor color coding
7.	Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
8.	Study of logic gates AND, OR, EX-OR and NOT.
9.	Soldering & desoldering practices.
10.	Study of Fan, Iron Box, Emergency Lamp, Telephone and FM Radio.
	Total Instructional Hours: 60

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Course Outcomes : Students will be able to	
CO1	Explain the pipe connections and identify the various components used in plumbing.
CO2	Develop simple wooden joints using wood working tools and simple components using lathe and drilling machine.
CO3	Construct simple lap, butt and tee joints using arc welding equipment and simple parts using sheet metal.
CO4	Construct Residential house wiring, Fluorescent lamp wiring and Stair case wiring.
CO5	Measure electrical quantities such as voltage, current, power & power factor in RLC Circuit, resistance to earth, AC signal parameter (peak-peak, RMS period, frequency) and ripple factor.
CO6	Examine logic gates (AND, OR, EOR and NOT), Electronic components and equipment's.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS			
GROUP – A (CIVIL & MECHANICAL)			
Sl. No.	**Description of Equipment**		**Quantity required**
1.	Assorted components for plumbing, Consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.		15
2.	Carpentry vice (fitted to work bench)		15
3.	Standard woodworking tools		15
4.	Models of industrial trusses, door joints, furniture joints		5
5.	Power Tools :		
	(a)	Rotary Hammer	2
	(b)	Demolition Hammer	2
	(c)	Circular Saw	2
	(d)	Planer	2
	(e)	Hand Drilling Machine	2
	(f)	Jigsaw	2
6.	Arc welding transformer with cables and holders		5
7.	Welding booth with exhaust facility		5

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8.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	
9.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2
10.	Centre lathe	2
11.	Hearth furnace, anvil and smithy tools	2
12.	Moulding table, foundry tools	2
13.	Power Tool: Angle Grinder	2
14.	Study-purpose items: Centrifugal pump, Airconditioner	1

GROUP – B (ELECTRICAL & ELECTRONICS)		
Sl. No.	**Description of Equipment**	**Quantity required**
1.	Assorted Electrical Components for House Wiring	15 sets
2.	Electrical Measuring Instruments	10 sets
3.	Iron Box	1
4.	Fan and Regulator	1
5.	Emergency Lamp	1
6.	Megger	1
7.	Digital Live Wire Detector	2
8.	Soldering Guns	10
9.	Assorted Electronic Components for Making Circuits	50
10.	Multipurpose PCBs	10
11.	Multi Meters	10
12.	Telephone	2
13.	FM radio	2
14.	Regulated Power Supply	2
15.	CRO (30MHz)	2
16.	Bread board	10
17.	Digital IC types (IC 7432, IC 7408, IC 7400, IC 7404, IC 7402, IC 7486)	Each 10

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Semester - II

B.E. / B.Tech. (Except CSBS)	B23ENT101 – PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives	
1.	To develop the listening and reading skills of first year engineering and technology students.
2.	To help learners' develop vocabulary through reading skills.
3.	To enhance learners' grammatical knowledge.
4.	To enhance the learners' ability of writing different complex texts.
5.	To develop the competency of learners through LSRW skills.

UNIT - I		6
Listening	Listening to voicemail & messages; Listening and contextualizing.	
Speaking	Replying to polite requests and offers, understanding basic instructions.	
Reading	Short comprehension passages, practice in skimming & scanning.	
Writing	Writing Instructions.	
Language development	Parts of Speech, Wh - Questions, yes or no questions, Question tags.	
Vocabularydevelopment	Prefixes - suffixes.	

UNIT - II		6
Listening	Listening commentaries and announcements.	
Speaking	Role Play exercises based on workplace contexts.	
Reading	Comprehension questions including dialogues and conversations.	
Writing	Writing different types of Paragraph.	
Language development	Regular & Irregular Verbs, Tenses.	
Vocabularydevelopment	Understanding contextual meaning, Synonyms.	

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UNIT - III	6
Listening	Listening to a product launch-sensitizing leaners to the nuances of persuasive communication.
Speaking	Debate - discussion on current issues.
Reading	Short texts and longer passages - note making.
Writing	Understanding text structure, use of reference words and discourse markers, jumbled sentences.
Language development	Idioms and Phrases, Degrees of comparison.
Vocabularydevelopment	One word substitutes.

UNIT - IV	6
Listening	Listening to short academic videos.
Speaking	Making short presentation through short films.
Reading	Intensive and Extensive reading-reading different types of magazines.
Writing	Letter writing- formal and informal.
Language development	Direct / indirect questions.
Vocabularydevelopment	Phrasal verbs

UNIT - V	6
Listening	Listening to talks/lectures by specialists on specific topics.
Speaking	Discussion on general and current topics.
Reading	Longer texts - cloze reading.
Writing	Writing short essays, developing outline, identifying main and subordinate ideas, Dialogue writing.
Language development	Spelling and Punctuations, Modal verbs.
Vocabularydevelopment	Collocations
Total Instructional hours : 30	

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Course Outcomes : Students will be able to	
CO1	Develop listening and reading skills for effective communication
CO2	Develop vocabulary skills
CO3	Build grammatical understanding
CO4	Explain opinions efficiently in writing formal and informal contexts
CO5	Develop knowledge through LSRW skills.

Text Books	
1.	Board of Editors Using English, “A Course book for Undergraduate Engineers and Technologists”, Orient Black Swan Limited, Hyderabad : 2015.
2.	Richards, C. Jack,“ Interchange Students Book - 2”, New Delhi, CUP, 2015.

Reference Books	
1.	Bailey, Stephen, “A practical guide for students”, New York Rutledge, 2011.
2.	Raman, Meenakshi and Sharma, Sangeetha “Technical Communication Principles and Practice” Oxford University Press: New Delhi, 2014.
3.	Dutt P. Kiranmai and Rajeevan Geeta, “Basic Communication Skills”, Foundation Books, 2013.

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B.E. / B.TECH.	B23MAT201 - INTEGRAL CALCULUS AND COMPLEX ANALYSIS (Common to all Branches)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To recognize various techniques of integration.
2.	To apply integration techniques in evaluating area and volume of solids.
3.	To develop the use of Vector calculus in two and three dimensional spaces.
4.	To demonstrate understanding of the basic concepts of complex differentiation.
5.	To understand Cauchy theorem and Cauchy integral formulae and apply these to evaluate complex contour integrals.

UNIT - I	INTEGRAL CALCULUS	12

Riemann sum – Definite and Indefinite integrals - Substitution rule (Exponential, logarithmic, Trigonometric functions) – Integration by parts – Integration of Rational functions by Partial fraction.

UNIT - II	MULTIPLE INTEGRALS	12

Double integrals : Double integrals in Cartesian coordinates - Double integrals in Polar coordinates – Area enclosed by plane curves – Triple integrals: Evaluation of triple integrals - Volume as triple integral (Simple problems)

UNIT - III	VECTOR CALCULUS	12

Gradient and directional derivative - Divergence and curl - Solenoidal and Irrotational vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and applications (for cubes and rectangular parallellopipeds)

UNIT - IV	COMPLEX DIFFERENTIATION	12

Analytic functions - Cauchy - Riemann equations (excluding proof) – Properties of analytic function – Harmonic conjugate - Construction of analytic function by Milne Thomson method – Bilinear transformation.

UNIT - V	COMPLEX INTEGRATION	12

Cauchy's integral theorem – Cauchy's integral formula – residues - Cauchy's Residue theorem – Evaluation of real integrals – Stereographic projection – Use of circular contour and semicircular contour (excluding poles on real axis)

Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Develop Fundamental Theorem of Calculus, techniques of Integration such as substitution, partial fractions and integration by parts.
CO2	Make use of integration to compute multiple integrals, area, volume, integrals in polar coordinates
CO3	Apply the line, surface and volume integrals for verification of Green‘s, Gauss and Stokes theorems.
CO4	Construct Analytic function and develop Conformal Mapping
CO5	Identify infinite series of a complex function within the contour and types of the singularities, finding of complex integrals

Text Books	
1.	Grewal B.S.,”Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3.	George B. Thomas , Joel Hass , Christopher Heil , Maurice D. Weir, “Thomas' Calculus”, Pearson, 14th Edition, 2018.

Reference Books	
1.	Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2015.
2.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition 2019.
3.	O‘Neil, P.V.,”Advanced Engineering Mathematics”, Cengage Learning India Pvt. Ltd, New Delhi, 7th Edition 2017.
4.	Sastry, S.S, “Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5.	Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics”, (Tata McGraw Hill Education Pvt. Ltd), 6th Edition, New Delhi, 2012.
6.	Gean Duffy., “Advanced Engineering Mathematics with MATLAB”, A CRC Press Company, Boca Raton London, New York Washington, D.C, 2nd edition 2009. (Free e-book downloaded from www.EasyEngineering.net.pdf)

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B.E. / B.Tech.	B23HST201 - TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT - I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT - II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

UNIT - III	MANUFACTURING TECHNOLOGY	3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel - Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT - IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT - V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total Instructional hours : 15

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Text - Cum - Reference Books	
1.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
4.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
5.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6.	Studies in the Histroyb of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
7.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

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B.E. / B.Tech.	B23PHI101 - ENGINEERING PHYSICS (Common to all Branches)	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To gain knowledge on the basics of properties of matter, its applications and inculcate practical skills in the determination of elastic property of the materials.
2.	To acquire knowledge & experimental skills on the concepts of Photonics and their applications in fiber optics.
3.	To have adequate knowledge on the concepts of electrical, magnetic properties of materials and enhance the practical skills in determination of electrical properties of the materials.
4.	To get knowledge on advanced physics concepts of quantum theory and its applications in SEM, TEM and induce practical skills in microscope.
5.	To enhance the fundamental knowledge of students in Crystal Physics and its Applications relevant to various streams of Engineering and Technology.

UNIT - I	PROPERTIES OF MATTER	14

Elasticity - Modulus, types of modulii of elasticity, Stress - strain diagram and its uses - factors affecting elastic modulus and Twisting couple, torsion pendulum; theory and experiment

Bending of beams - Bending moment - uniform and non- uniform bending; theory and experiment - I - shaped girders and its applications

Determination of rigidity modulus - Torsion pendulum - Determination of Young's modulus by non-uniform bending method - Determination of Young's modulus by uniform bending method

UNIT - II	PHOTONICS AND FIBER OPTICS	12

Lasers ; properties of laser-spontaneous and stimulated emission-amplification of light by population inversion - Einstein's A and B coefficients - derivation – Types of laser; Nd. - YAG Laser, Semiconductor lasers; homojunction and heterojunction, Industrial and Medical Applications

Fiber Optics ; Principle, Numerical Aperture and Acceptance Angle - Types of optical fibres - Fiber optic communication System - Block diagram - Medical Applications - Endoscopy

Determination of wavelength of the Laser using grating- Determination of particle size using Laser - Determination of Numerical aperture and acceptance angle of an optical fiber

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UNIT - III	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	12

Classical free electron theory – Relaxation time and collision time - Expression for electrical conductivity – Thermal conductivity – Wiedemann - Franz law – Lorentz number - Drawbacks of classical theory - Quantum theory - Fermi - Dirac statistics – variation of Fermi level with temperature

Introduction to magnetic materials – Comparision of Dia, Para and Ferro magnetic materials – Domain theory of ferromagnetism - Hysteresis - Soft and Hard magnetic materials - Ferrites and its applications.

Determination of specific resistance of the wire using Carey Foster's Bridge

UNIT - IV	QUANTUM PHYSICS	12

Black body radiation; Planck's theory (derivation) - wave particle duality- debroglie's wavelength - concept of wave function and its physical significance

Wave equation ; Schroedinger's time independent and time dependent equations, particle in a one-dimensional rigid box. Applications; Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM)

Determination of thickness of a thin wire by using travelling microscope

UNIT - V	CRYSTAL PHYSICS	10

Crystal Structures; Single crystalline, polycrystalline and amorphous materials - unit cell - space lattice - crystal systems - Bravais lattices - Miller indices- inter - planar distances – coordination number and packing factor for SC, BCC, FCC and HCP structures

Crystal imperfections; Point and Line defects - Burger vector

Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Categorize the basics of properties of matter and its applications, classify the elastic properties of materials by using uniform, non-uniform bending method and torsional pendulum apparatus
CO2	Explain the basics of Laser, Fiber Optics and their applications, determination of Particle size, Wavelength of laser and acceptance angle, numerical aperture of optical fiber.
CO3	Justify the concepts of electrical, magnetic properties of materials, determination of Specific resistance of the material
CO4	Determine the thickness of thin sheet using travelling microscope and explain the basics of quantum theory
CO5	Classify and compare the different types of Crystals, their structures and its defects

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Text Books	
1.	Bhattacharya, D.K. & Poonam, T, “Engineering Physics”, Oxford University Press, 2015.
2.	Gaur, R.K. & Gupta, S.L. “Engineering Physics”, Dhanpat Rai Publishers, 2012.
3.	Pandey, B.K. & Chaturvedi, S. “Engineering Physics”, Cengage Learning India, 2012.
4.	Rajendran V, “Engineering Physics”, Tata McGraw Hill, Publishing Company, New Delhi, 2011.
5.	Wahab, M.A. - Solid State Physics: Structure and Properties of Materials, Narosa Publishing House, 2009.

Reference Books	
1.	Halliday, D., Resnick, R. & Walker, J. “Principles of Physics"", Wiley, 2015.
2.	Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”, Cengage Learning, 2010.
3.	Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
4.	Avadhanulu M.N, “Engineering Physics - Volume 1”, S.Chand & Company Ltd., New Delhi, 2010.
5.	Garcia, N. & Damask, A. - Physics for Computer Science Students. Springer - Verlag, 2012.
6.	Senthil Kumar, G. Physics Laboratory I & II, VRB publishers Pvt. Ltd., Chennai (2016).

Equipment Needed for 30 Students

1. Diode Laser (2 mS power) , He – Ne Laser source (2mW), Optical Fibre Kit - 06
2. Travelling Microscope ,Knife edge, Slotted weights - 19
3. Carey Foster Bridge - 06
4. Air Wedge Apparatus with Travelling Microscope - 06
5. Torsional Pendulum - 06

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B.E. / B.Tech.	B23CEP201 – SOFT SKILLS (Common to all Branches)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To identify personality using evaluation method.
2.	To encourage creative thinking by practice.
3.	To enrich interpersonal skills through integrated activities.
4.	To develop social and professional etiquette.
5.	To identify and apply employability skills for professional success.

UNIT - I	SELF EVALUATION	6
Introduction to soft skills, Familiarize oneself, Self-understanding, SWOT analysis, Goal Setting.		

UNIT - II	INNOVATIVE THINKING	6
Divergent thinking, Encourage curiosity, Writing a story, Poster making.		

UNIT - III	INTERPERSONAL SKILLS	6
Interpersonal skills - Need & Components – Understanding Intercultural Competence - Team Work-Problem Solving Skills - Conflict Management & Resolutions in Workplace, Leadership skills, Managerial skills.		

UNIT - IV	BUSINESS ETIQUETTE	6
Define Etiquette -Types and Importance of Workplace Etiquette - Basic Corporate Etiquette - Telephone Etiquette - Meeting & E-mail Etiquette - Customer Service Etiquette.		

UNIT - V	CORPORATE SKILLS	6
Work Ethics - Adaptability - Analytical Reasoning - Lateral Thinking - Stress & Time Management.		
Total Instructional hours : 30		

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Course Outcomes : Students will be able to	
CO1	Develop the Interpersonal Skills.
CO2	Show the creative skill in different aspects.
CO3	Explain their ideas through conversations.
CO4	Develop adequate Soft Skills required for the workplace.
CO5	Develop leadership qualities.

References	
1.	Butterfield, Jeff “Soft Skills for Everyone” Cengage Learning, New Delhi, 2015.
2.	S.Hariharanetal ”Soft Skills” MJP Publishers : Chennai, 2010.
3.	Peter, Francis “Soft Skills and Professional Communication” New Delhi : Tata McGraw Hill, 2012. Print.
4.	Meenakshi Raman, Shalini Upadhyay, ’Soft Skills’, Cengage Learning India Pvt. Ltd, Delhi, 2018.
5.	M.S. Rao, ‘Soft Skills Enhancing Employability’, I. K. International Publishing House Pvt. Ltd, New Delhi, 2010
6.	Sabina Pillai, Agna Fernandez, ‘Soft Skills and Employability Skills’, Cambridge University Press, 2018.
7.	John Peter.A, ‘Self – Development and Professional Excellence’, Cengage Learning India Pvt. Ltd, Delhi, 2019.

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B.E./ B.Tech	B23CEP202 - APPLICATION DESIGN AND DEVELOPMENT (Common to All UG Branches)	L	T	P	C
		2	0	0	NC

Course Objectives	
1.	To understand the basics concepts of SDLC and web development basics.
2.	To introduce the concepts of styling with CSS
3.	To understand the fundaments concepts of JavaScript
4.	To acquire the skills to manipulate the Document Object Model (DOM)
5.	To introduce version control concepts using Git and GitHub.

UNIT - I	SDLC and Web Development Basics	3

Introduction to Software Development Lifecycle (SDLC): Waterfall Model – Phases, Methods - Best Practices.

HTML Fundamentals: Introduction – Versions - HTML5 Standards - Tags - Semantic Elements – Forms - Media(Images, Audio, Video) – Tables - Lists

UNIT - II	Styling with CSS & Frameworks	3

CSS : Introduction – Selectors - Box Model (Margins, Padding, Borders) – Colors - Backgrounds – Frameworks: Introduction to Bootstrap - Tailwind CSS

UNIT - III	JavaScript Programming Essentials	3

JavaScript Basics - Variables - Data Types - Operators - Conditional Statements – Loops - Functions and events - Function Declarations - Event Handling.

UNIT - IV	DOM, Form Handling & Error Management	3

Document Object Model (DOM) Manipulation - Form Handling - Validation - Page Redirection - Error Handling – Exception handling in JavaScript.

UNIT - V	Version Control & Shell Scripting	3

Git & GitHub - Repositories - Branching – Merging – Remote Repositories - Advanced Git actions – Advanced Git Actions: Pull Requests- Issues - Contribution to Open Source

Approved by BoS Chairman

- Developer Communities: Google Developer – Group - Stack Overflow - Kaggle - Shell Scripting: Process Management - File Handling - User & Group Management.
Total Instructional hours: 15

Course Outcomes: Students will be able to	
CO1	Understand the phases and best practices of the Software Development Life Cycle (SDLC), and apply HTML5 features to structure web page
CO2	Construct visually appealing web pages by applying CSS styling techniques
CO3	Apply the use of JavaScript programming constructs
CO4	Build a JavaScript application by make use of client-side form validation, manage redirection, and handle exceptions and manipulate DOM.
CO5	Utilize version control systems like Git and GitHub for collaborative development.
Text Books	
1.	Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley & Sons, Inc, 2011.
2.	Marijn, Haverbeke, "Eloquent JavaScript: A Modern Introduction to Programming", 3rd Edition, William Pollock Publisher, 2019.
3.	Scott Chacon and Ben Straub, "Pro Git", 2 nd Edition, APress Publication, 2024

Reference Books	
1.	Jennifer Robbins, "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics", O'Reilly Media, Inc., 2012.
2.	Douglas Crockford, "JavaScript: The Good Parts", O'Reilly Publications, 2008
3.	Cameron Newham, "Learning the Bash Shell", 3rd Edition, O'Reilly Media, Inc,
4	https://www.freecodecamp.org/
5	https://developer.mozilla.org/en-US/docs/Web/JavaScript
6	https://www.codecademy.com/catalog/subject/web-development

B.TECH.	B23AGT201- PRINCIPLES AND PRACTICES OF CROP PRODUCTION	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn about the principles and production practices of agriculture and horticulture crops.
2. To study about the role of agricultural engineers with reference to various tillage practices and crop management including cropping systems.
3. To impart general techniques underlying in quality enhancement of crops.
4. To understand about maximizing crop productivity of important crops.
5. To gain wide knowledge on efficient production systems in horticulture.

UNIT I AGRICULTURE AND CROP PRODUCTION 9

Introduction to Agriculture – crop production sub sectors – horticulture crops

Factors affecting crop growth and production – Genetic (internal) and Environmental (external) factors - Crop management - adaptation of crops through cultural practices - environmental control structures (Protected cultivation)

UNIT II CROP SELECTION AND ESTABLISHMENT 9

Cropping Systems - Regional and seasonal selection of crops - Systems of crop production - Competition among crop plants - Spacing and arrangement of crop plants – Intercropping systems.

Tillage Systems - Field preparation for crops - Establishment of an adequate crop stand - seed and nursery preparation.

UNIT III CROP MANAGEMENT 9

Water and Nutrient management – Soil water plant relationship - Crop water Management - Crop nutrition management - need for supplementation to soil nutrients – sources - generalized recommendations - methods and timing of application of supplemental nutrients - fertigation scheduling.

Weed, Pest and Disease management - Crop protection including management of weeds, pests and pathogens - Integrated methods of managing water, nutrients and plant protection - Types and Methods of harvest.

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UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS 9

Cultivation practices for Cereal & millet crops - Generalized management - cultivation practices for important groups of field crops in Tamil Nadu: Cereal crops - Rice, Wheat and Maize

Cultivation practices for Pulses - Green gram, Black gram, Red gram, Cowpea, Bengal gram, Soyabean

Cultivation practices for oil seed crops – Coconut, Groundnut, Sesame, Sunflower, Safflower Cultivation practices for Commercial crops – Cotton, Sugarcane, Jute

Cultivation practices for special purpose crops - Green manure and Fodder.

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS 9

Cultivation practices for Fruit crops - important groups of horticultural crops - Mango, Banana, Guava, Citrus, Pomegranate, Apple

Cultivation practices Vegetable crops - Tomato, Onion, Cauliflower, Cabbage;

Cultivation practices Flowers - Rose, Chrysanthemum, Gerbera; Orchids - Lily, Jasmine, Tuberose

Cultivation practices of medicinal plants – Senna, Periwinkle, Tulsi, Aloe vera.

Total Instructional hours: 45

Course Outcomes:

Students will be able to

- **CO1:** Understand the concepts and principles of crop selection and crop production.
- **CO2:** Apply the different crop management practices of agricultural and horticultural crops with particular reference to tillage, seeds, weeds and nutrients.
- **CO3:** Classify the crop growth and water and fertilizer needs.
- **CO4:** Solve the management strategies to maximize yield and optimize quality in field crop production
- **CO5:** Distinguish about live cropping situations, principles and technologies that can be applied to in-crop situations to optimize returns within best practices in horticulture

Text Books :

1. Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, KrishiAnusandhanBhavan, Pusa, New Delhi, 2015.
2. Reddy T. Sankara G.H. YellamandaReddi, Principles of Agronomy, Kalyani Publishers,

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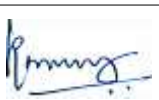
New Delhi, 2005.
3. Handbook of Agriculture. ICAR Publications, New Delhi, 2011.

Reference Books:

1. Bose T. K. and L.P.Yadav. “Commercial Flowers”, Naya Prakash,Calcutta.1989.
2. “Crop Production Guide”, Tamil Nadu Agricultural University Publication, Coimbatore, 2005
3. Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. “Introduction to spices, plantation crops, medicinal and aromatic plants”. Rajalakshmi Publications, Nagercoil, 1993.
4. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, 7th edition, 2015.
5. Shanmugavel, K.G. “Production Technology of Vegetable Crops”. Oxford India Publications, New Delhi,1989.



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B.TECH.	B23AGP201 CROP HUSBANDRY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To introduce the different crop production practices in wet land system
2. To understand about the different crop production practices in dry land system
3. To develop the different crop production practices in garden land system
4. To know the crop selection practices and management.
5. To identify about the plant protection measures.

List of Experiments:

Expt. No.	Description of the Experiments
1.	Field preparation methods
2.	Seed selection and seed treatment procedures
3.	Seed bed and nursery preparation
4.	Sowing /Transplanting techniques
5.	Biometric observation for crops
6.	Nutrient management studies
7.	Water management and irrigations scheduling
8.	Weed management studies
9.	Integrated Pest Management studies
10.	Harvesting methods

Total Instructional hours: 60

Course Outcomes:

Students will be able to

CO1: Infer required knowledge in the Wetland crop production

CO2: Understand the concepts and principles for Garden land crop production

CO3: Develop required skill in the Dry land crop production

CO4: Apply the knowledge on crop selection, crop production and crop management.

CO5: Determine suitable crop protection measures

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Text Books:

1. Rajendra Prasad, “Text Book of Field Crop Production”. Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.
2. “Handbook of Agriculture” ICAR Publications, New Delhi, 2011

Reference Books:

1. “Crop Production Guide”, Tamil Nadu Agricultural University Publication, Coimbatore, 2005
2. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, 7th edition, 2015.
3. Shanmugavel, K.G. “Production Technology of Vegetable Crops”. Oxford India Publications, New Delhi,1989.

List of Equipment Required:

Sl. No.	Description of Equipment	Quantity required (Nos)
1.	A wet land / garden land for a minimum of 5 cents area for each / group of students	1
2.	An open / bore well as water source to support cultivation	1

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Semester - III

B.E / B.TECH	B23MAT301 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to AERO, AGRI, ECE, EEE & MECH)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To introduce the basic concepts of PDE for solving standard partial differential equations
2.	To understand Fourier series analysis in representation of Periodic signals.
3.	To develop Fourier series techniques in solving wave and heat flow problems.
4.	To acquaint the student with Fourier transform techniques used in wide variety of situations.
5.	To develop the concept of Z transforms techniques for discrete time systems.

UNIT – I PARTIAL DIFFERENTIAL EQUATIONS	12
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of first order partial differential equations of the forms $f(p,q) = 0$, $z = px + qy + f(p,q)$ - Lagrange's linear equation - Linear homogeneous partial differential equations of second and higher order with constant coefficients.	

UNIT – II FOURIER SERIES	12
Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Parseval's identity – Harmonic analysis.	

UNIT – III BOUNDARY VALUE PROBLEM	12
Classification of second order linear PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction in Cartesian coordinates.	

UNIT – IV FOURIER TRANSFORMS	12
Fourier transform pair - Fourier sine and cosine transforms - Properties (without proof) - Transforms of simple functions - Convolution theorem (without proof) - Parseval's identity.	


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NIT – V Z-TRANSFORMS AND DIFFERENCE EQUATIONS	12
Z-transforms - Elementary properties - Inverse Z-transform (using partial fraction and residues) - Initial and final value theorems - Convolution theorem (without proof) - Formation of difference equations - Solution of difference equations using Z - transforms.	
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Apply the techniques to find solutions of standard Partial Differential Equations .
CO2	Solve differential equations using Fourier series analysis.
CO3	Apply Fourier series to solve boundary value problems.
CO4	Develop Fourier transforms techniques in engineering problems.
CO5	Make use of Z - transforms to solve difference equations.

Text Books	
1.	Grewal B.S., “Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2020.
2.	Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics" Volume III, S. Chand & Company Ltd., 2016

Reference Books	
1.	Ramana B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Erwin Kreyszig., “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition, New Delhi, 2018.
3.	Wylie C. Ray and Barrett Louis C.,“Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
4.	Peter V.O Neil., "Advanced Engineering Mathematics", Cengage, New Delhi, 2016.
5.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”,Narosa Publications, 5th Edition, New Delhi, 2017.

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B.Tech.	B23AGT301 – SURVEYING AND LEVELLING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles and methods of chain surveying and applications in Agricultural Engineering.
2.	To discuss the principles of compass surveying and possible sources of error.
3.	To demonstrate theodolite and its types, Total station and GPS technology.
4.	To categorise leveling methods and its errors.
5.	To create contour maps and assess the capacity of reservoir and earth work volume.

UNIT I	FUNDAMENTALS AND CHAIN SURVEYING	9

Definition - Classifications - Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting – Applications - Enlarging and reducing figures - Areas enclosed by straight lines – Irregular farm fields - Digital planimeter.

UNIT II	COMPASS AND PLANE TABLE SURVEYING	9

Compass – Basic principles - Types - Bearing – Systems and conversions – Sources of Errors - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation – Intersection- Resection – Traversing - sources of errors – applications.

UNIT III	THEODOLITE AND MODERN SURVEYING	9

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments – Heights and distances – Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale's table - Total Station - Global Positioning System (GPS) – Drone Surveying.

UNIT IV	LEVELLING	9

Level line - Horizontal line - Datum - Bench marks - Levels and staves - temporary and permanent adjustments – Methods of levelling - Fly levelling - Check levelling - Procedure in levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - sources of errors in levelling - Precise levelling - Types of instruments - Adjustments – Field procedure - Laser levelling.

UNIT V	LEVELLING APPLICATIONS	9
Longitudinal and Cross Section - Plotting - Contouring - Methods – Characteristics and uses of contours - Plotting – Methods of interpolating contours – computation of cross-sectional area and volumes - Earth work calculations - Capacity of reservoirs - Mass haul diagrams		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Demonstrate the equipment required for conducting the chain survey in Agricultural fields.
CO2	Explain the Compass and Plane table surveying.
CO3	Operate Theodolite and modern surveying equipments.
CO4	Examine various levelling methods and its errors.
CO5	Create the contour map and compute the area and volume of earth work.

Text Books	
1.	Punmia. B.C Surveying (Vol- I & Vol-II) Laxmi publications, New Delhi, Seventeeth Edition, 2016.
2.	Kanetkar, T.P. & Kulkarni, S.V., Surveying & leveling Part I, A.V.G. Prakashan, Poona 1984.

References	
1.	S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004
2.	Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.
3.	Basak. V.N..Surveying and Levelling, Tata McGraw hill publications, New Delhi, 1994.
4.	https://nptel.ac.in/courses/105/107/105107122

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B.Tech.	B23AGI301 – PRINCIPLES OF SOIL PHYSICS AND MECHANICS	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the soil physical parameters.
2.	To classify the soil and surveying techniques.
3.	To demonstrate soil phase relationship and soil compaction.
4.	To analyze the engineering properties of soil.
5.	To evaluate bearing capacity and slope stability of soil.

UNIT I	INTRODUCTION TO SOIL PHYSICS	9

Soil - definition - major components – Soil forming minerals and processes - soil profile - Physical properties - texture – density - porosity - consistency - colour - specific gravity - capillary and non-capillary porosity - plasticity. Soil air - soil temperature – Infiltration - soil water - classification of soil water - soil water movement - hydraulic conductivity. Soil colloids – organic and inorganic matter - Ion exchange - pH – Plant nutrient availability.

UNIT II	SOIL CLASSIFICATION AND SURVEY	9

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.

UNIT III	PHASE RELATIONSHIP AND SOIL COMPACTION	9

Phase relations - Gradation analysis - Atterberg Limits and Indices - Engineering Classification of soil – Soil compaction - factors affecting compaction - field and laboratory methods.

UNIT IV	ENGINEERING PROPERTIES OF SOIL	9

Shear strength of cohesive and cohesionless soil - 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 - flow net analysis - Compressibility.

UNIT V	BEARING CAPACITY AND SLOPE STABILITY	9

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.

Total Theory Hours: 45

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1	**EXPERIMENT 1**
	Identification of rocks and minerals.
2	**EXPERIMENT 2**
	Determination of soil moisture, EC, pH
3	**EXPERIMENT 3**
	Field Density determination by core cutter and sand replacement method
4	**EXPERIMENT 4**
	Specific gravity determination by pycnometer
5	**EXPERIMENT 5**
	Textural analysis of soil by International Pipette method
6	**EXPERIMENT 6**
	Grain size analysis by using Mechanical shaker
7	**EXPERIMENT 7**
	Determination of Organic Carbon
8	**EXPERIMENT 8**
	Determination of basic water quality parameters – EC, TDS, pH and SAR
9	**EXPERIMENT 9**
	Estimation of Gypsum requirement for sodic soils.
10	**EXPERIMENT 10**
	Determination of infiltration rate using double ring infiltrometer
11	**EXPERIMENT 11**
	Estimation of leaching requirement saline soils
	Total Practical Hours: 30

Total Instructional Hours: 45 + 30 = 75

COURSE OUTCOMES: Students will be able to	
CO1	Understand the different soil physical parameters.
CO2	Differentiate the soil types and survey techniques.
CO3	Illustrate soil phase relationship and soil compaction.
CO4	Infer about the engineering properties of soil.
CO5	Assess bearing capacity and slope stability of different soils.

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Text Books	
1.	K.R. Arora .,"Soil mechanics and Foundation Engineering" Standard Publishers Distributions,Delhi, 2020.
2.	Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008.
3..	Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

References	
1.	Edward J. Plaster., "Soil Science", Cengage Learning India Ltd, New Delhi, 2009.
2.	Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007.

List of Equipment's Required

Sl.No	Description of Equipment	Quantity
1	IgneousRock- (Any 4) Horneblende pegmatite, Horneblende granite, Serpentinite, Pink microceline granite, etc	1
2	Sedimentary Rock - (Any 4) Miocene limestone, Traverine, Sandstone, Shale, Limestone, etc	1
3	Metamorphic Rock-(Any 4) Calc silicate granulite, Marble, Garnet granulite, Garnet biotite gneiss, etc , Charnockite acidic with basic layering ,Hornblende biotite gneiss, Charnokite.	1
4	Minerals-(Any 4) Talc, Gypsum, Calcite. Fluorite, Apatite, Feldspar, Quartz, Topaz, Corundum, Pyrite, Asbestos, Chalk, Feldspar, Mica, Hornblende, etc	1
5	Khurpi, Spade or Augers , Plastic bowl , Scale, Wooden roller, Mortar and pestle Polythene/paper/cloth bags, Labels, Aluminum tray.	1
6	Sampling tube/auger, Moisture cans , Balance with weights , oven or Desicator	1
7	EC meter, potassium chloride, 100 ml beaker.	1
8	pH meter, buffer tablet pH 4.0, 7.0 or 9.2, 100 ml beaker.	1
9	Core sampler, aluminum tray, oven, balance upto 5 Kg, knife, spatula.	1
10	Sand pouring cylinder, Calibrating can, Metal tray with a central hole, Dry sand (passing through 600 micron sieve), Balance of capacity 15 kg, Moisture content bins, Glass plate, Metal tray, Scraper tool.	1
11.	A pycnometer, an analytical balance, filter paper, clean and dry cloth	1
12	ASTM Sieve-230 mm with lid, 2 mm sieve, sodium hexametaphosphate, 100 ml beaker 3nos, 1000 ml measuring cylinder, weighing balance of 0.01 g, glass rod and pipette 20 ml	1
13	A sieve shaker, complete set of I.S Sieve sizes generally 4.75 mm, 2.00mm, 1.18 mm, 425microns, 300microns, 150 microns and 75 microns along with a pan and a lid, Balance of 0.01 g sensitivity	1
14	500 ml conical flasks, Pipette, Burette, Potassium dichromate (K2Cr2O7), Ferrous sulfate heptahydrate (FeSO4.7 H2O), Sulfuric acid (H2SO4) concentrated, Diphenylamine indicator	1
15	Saturated calcum sulphate, Ammonium chloride-Ammonium hydroxide buffer, Erichrome black-T indicator, EDTA, mechanical shaker, whatman No. 3 filter paper,100 ml conical flasks, Pipette, Burette	1

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B.Tech.	B23AGT302 – THERMODYNAMICS AND HEAT TRANSFER	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basic principles of thermodynamics.
2.	To discuss the first and second laws of thermodynamics.
3.	To classify various engines and their characteristics.
4.	To analyse the heat transfer in conduction mode.
5.	To compare the heat transfer in convection and radiation method.

UNIT I	BASIC CONCEPTS OF THERMODYNAMICS	9

Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

UNIT II	FIRST AND SECOND LAW OF THERMODYNAMICS	9

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. Irreversibility I and II law - Efficiency.

UNIT III	HEAT ENGINES	9

Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine, Refrigeration Cycle – Vapour Compression &Vapour Absorption System – Air Conditioning.

UNIT IV	HEAT TRANSFER - CONDUCTION	9

General Differential equation of Heat Conduction - One Dimensional Steady State with and without internal Heat transfer – Extended Surfaces-Fin Efficiency-Fin Effectiveness.

UNIT V	HEAT TRANSFER - CONVECTION AND RADIATION	9

Free and Forced Convection during external flow over Plates, Heat Exchanger Types – Overall Heat Transfer Coefficient –Black body-Kirchhoff's Law- LMTD method – NTU method, Radiation – Condenser and Evaporators.

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the basic concepts and principles of thermodynamics
CO2	Compare the first and second law thermodynamics
CO3	Classify four stroke, two stroke engines and turbines.
CO4	Analyse the heat transfer with steady state conduction process.
CO5	Differentiate free, forced convection and also various types of heat exchangers, condenser and evaporators.

Text Books	
1.	K.Kannan, “Heat and Mass Transfer”, Anuradha publication,2020
2.	Yunus A. Cengel and Michael A. Boles, “Thermodynamics: An Engineering Approach”, Fourth Edition, Tata McGraw-Hill, 2004
3.	Michael J.Moran, Howard N.Shapiro, “Fundamentals of Engineering Thermodynamics”, Fourth Editon, John wiley & Sons, 2000
4.	Frank P. Incropera and David P. Dewitt, “Fundamentals of Heat and Mass Transfer”, John Wiley & Sons, 1998

References	
1.	R.K.Rajput, “A Text book of Engineering Thermodynamics”, Third Edition, Laxmi publication (P) Ltd., 2007
2.	Nag.P.K., “Engineering Thermodynamics”, Third Edition, Tata McGraw hill, 2005
3.	Domkundwar.S.,C.P.Kothandaraman “A course in Thermal engineering”, Fifth Edition, Dhanpatrai & co (p) Ltd, 2000
4.	Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998
5.	https://nptel.ac.in/courses/127/106/127106135/

BoS Chairman

B.Tech.	B23MET304 – THEORY OF MACHINES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand linkages, mechanisms and analyse the acceleration of links
2.	To discuss the effect and utilization of friction in clutches, belt, chain drives and brakes.
3.	To demonstrate the cam and different motion of follower.
4.	To apply the basics of toothed gearing and gear trains.
5.	To analyze the motion of fly wheel and balancing.

UNIT I	TERMINOLOGY	9

Definitions - Kinematic links - Pairs - Chain - Machines and mechanism - Types and uses - Kinematic inversion of four bar chain and slider crank mechanism. Velocity and acceleration in simple mechanisms - Vector polygon and Acceleration Polygon - Four bar, single slider and Toggle Mechanism.

UNIT II	FRICTION AND APPLICATIONS	9

Sliding and rolling friction - Friction in screw threads - Bearing and lubrication - Friction clutches - Belt drives - Chain drives - Friction aspects in brakes.

UNIT III	MOTION OF CAM AND FOLLOWER	9

Cam and follower - types - application - displacement diagrams - Profile layout for uniform velocity - Uniform acceleration and retardation - Simple harmonic and cycloidal motion.

UNIT IV	GEARS AND GEAR TRAINS	9

Gears - classification - terminology - law of gearing - tooth profile - interference between rack and pinion. Gear trains - simple, compound, reverted. simple epicyclic gear trains.

UNIT V	FLYWHEEL AND BALANCING	9

Inertia - turning moment - fluctuation of speed and energy - Balancing of rotating masses and reciprocating masses.

Total Instructional Hours: 45

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COURSE OUTCOMES: Students will be able to	
CO1	Compare the machine assembly for displacement, velocity and accerlation at any link
CO2	Understand the basic concepts of the effects of friction in machine components.
CO3	Demonstrate the cam mechanisms for specified output motions.
CO4	Employ the basic functional concepts of toothed gearing and gear trains.
CO5	Estimate the inertia and turning moment and analyse balancing of masses.

Text Books	
1.	Rattan, S.S, Theory of Machines, 5th Edition, Tata McGraw-Hill, 2019.
2.	Ramamurthi. V, “Mechanics of Machines”, Narosa Publishing House, 3rd edition 2019.
3.	Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, Oxford University Press, 2017.
4.	Khurmi, R.S. and Gupta, J.K, Theory of machines, 14th Edition, S.Chand Publication House, 2010.

References	
1.	Rao.J.S. and Dukkipati.R.V. “Mechanism and Machine Theory”, New Age International Pvt. Ltd., 2nd edition,2014.
2.	Vazirani. V.N, Ratwani. M.M, Duggal .S.K “Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1”, Khanna Publishers, New Delhi 2014.
3.	Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2013
4.	Thomas Beven, Theory of Machines, Pearson Education India, 2009.
5.	Ballaney, P.L, Theory of machines and Mechanisms, Khanna Publishers, New Delhi, 2003.
6.	https://nptel.ac.in/courses/115103115

B.E	**B23EEI202 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to AERO,AGRI and MECH)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Course Objectives	
1.	To analyse the electric circuit laws and theorems.
2.	To analyse the single and three phase circuits with different types of load.
3.	To understand the working principles and characteristics of electrical machines.
4.	To understand the working principle of various electronic devices.
5.	To understand the concept of electrical wiring and safety.

UNIT-I	ELECTRICAL CIRCUITS	9
Basic circuit components -Ohms Law - Kirchoff's Law – Instantaneous Power – Inductors- Capacitors — Independent and Dependent Sources. Steady state solution of DC circuits - Nodal analysis, Mesh analysis. Network Theorems-Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem- Superposition theorem.		

UNIT-II	AC CIRCUITS	9
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads.		

UNIT-III	ELECTRICAL MACHINES	9
Construction, working and characteristics of DC machines, single phase transformers, single phase and three phase induction motors, Introduction to special electrical machines (BLDC, PMSM).		

UNIT-IV	ELECTRONIC DEVICES AND CIRCUITS	9
Types of Materials – Silicon and Germanium- N type and P type materials – PN Junction - Forward and Reverse Bias –Semiconductor Diodes. Bipolar Junction Transistor - Characteristics – Field Effect Transistors – Transistor Biasing. Introduction to operational Amplifier – Inverting Amplifier – Non Inverting Amplifier.		

UNIT-V	ELECTRICAL WIRING AND SAFETY	9
Housing wiring, industrial wiring, materials of wiring — Hazards of electricity - Electrical safety equipment – safety procedures and methods – Grounding – safety requirements and standards - Human factors in electrical safety.		
		Total Instructional hours:45

LABORATORY CONTENT

Expt.No.	Description of the Experiments
1.	Verification of Circuit Laws.
2.	Verification of Circuit Theorems.
3.	Measurement of three phase power.
4.	Load test on DC shunt motor.
5.	Speed control of DC shunt motor.
6.	Load test on Single phase Transformer.
7.	Load test on single phase Induction motor.
8.	VI characteristics of Diode
9.	Characteristics of Common Emitter Configuration in NPN transistor.
	Total Practical hours:30

Total Instructional hours: 45+30 =75

Course Outcomes: Students will be able to	
CO1	Apply basic circuit laws and Theorems to analyze the electrical circuits.
CO2	Analyze the single and three phase circuit with different types of load.
CO3	Examine the performance of DC machines, transformers, induction motors and explain the construction and operation of special machines.
CO4	Analyze the characteristics of various semiconductor devices.
CO5	Outline the basic wiring materials, types of wiring and Safety practices.

Text Books	
1.	Leonard S Bobrow, Foundations of Electrical Engineering, Oxford University Press, 2013.
2.	Kothari.D.P and Nagarath.I.J,Electrical Machines —Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
3.	S.Salivahanan , N.Suresh Kumar, Electronic Devices and Circuits, McGraw Hill Education (India) Private Limited, 4th edition, 2017.
4.	E.G. Janardanan, “Special electrical machines”, PHI learning Private Limited, Delhi, 2014.
5.	John Cadick, P.E, “Electrical Safety Handbook”, 4th edition, McGraw Hill, 2012.

Reference Books	
1.	N K De, DipuSarkar, Basic Electrical Engineering, Universities Press (India) Pvt. Ltd, 2016.
2.	Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education, Second Edition New Delhi, 2015.
3.	John Bird, Electrical Circuit Theory and Technology, Elsevier, Fifth Edition, 2014.

BoS Chairman

B.Tech.	B23AGP301 – SURVEYING AND LEVELLING	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To develop the students for operating various Chain surveying instruments.
2.	To prepare the students to conduct compass surveying and measuring bearings and angles.
3.	To develop the students to conducting plane table surveying.
4.	To generate horizontal and vertical angles using theodolites.
5.	To compare various leveling techniques, demonstrate total station and DGPS and to generate contour maps.

Exp. No.	List of Experiments
1	**CHAIN SURVEYING** • Ranging, Chaining, and pacing in chain surveying • Plotting The Outline of The Given Field-Cross Staff Survey • Determination Of the Area of Closed Traverse
2	**COMPASS SURVEYING** • Compass Traversing – Measuring Bearings & arriving included angles
3	**PLANE TABLE SURVEYING** • Radiation, Intersection - Triangulation problem Plane table traversing
4	**THEODOLITE SURVEYING** • Measurement of horizontal & vertical angles Tangential & Stadia Tacheometry
5	**LEVELLING** • Fly levelling using Dumpy level • Fly levelling using Tilting level • Check levelling • Block levelling • Radial Contouring
6	**DEMONSTRATION OF TOTAL STATION AND DGPS**
	Total Instructional Hours: 30

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COURSE OUTCOMES: Students will be able to	
CO1	Acquire skills in chain surveying
CO2	Estimate bearings and angles with aid of compass surveying.
CO3	Appraise radiation, intersection and triangulation problem in plane table surveying.
CO4	Prepare horizontal and vertical angles, tangential & Stadia Tacheometry
CO5	Create contour maps and impart skills in interpolation methods.

References	
1.	Punmia. B.C Surveying (Vol- I & Vol-II) Laxmi publications, New Delhi, Seventeeth Edition 2016.
2.	Kanetkar, T.P. & Kulkarni, S.V., Surveying & levelling Part I, A.V.G. Prakashan, Poona 1984.
3.	A.M. Michael and T.P. Ojha Agricultural Engineering (Vol-II), New Delhi.

List of Equipment's Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	Total Station	1 No
2.	Theodolites	6 Nos
3.	Dumpy level / Filling level	6 Nos
4.	Pocket stereoscope	1 No
5.	Ranging rods	10 Nos
6.	Levelling staff	5 Nos
7.	Cross staff	5 Nos
8.	Chains	10 Nos
9.	Tapes	5 Nos
10.	Arrows	10Nos
11.	Prismatic Compass	10 Nos
12.	Surveyor Compass	5 Nos
13.	Survey grade or Hand-held GPS	1 No
14.	DGPS	1 No

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Semester - IV

B.Tech.	B23AGI401 – FLUID MECHANICS AND HYDRAULICS	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the properties of the fluids, behavior of fluids under static and dynamic conditions.
2.	To apply the conservation laws to fluid flows.
3.	To analyse the flow measurement with various measuring devices and computational methods.
4.	To compare different types of flow, forces and momentum under varying flow conditions.
5.	To perform dimensional analysis and classify pumps with their working principles.

UNIT I	PROPERTIES OF FLUIDS	9

Properties of fluids – definition – units of measurement - mass density – specific weight, specific volume – specific gravity - equation of state – perfect gas - viscosity – vapour pressure – compressibility and elasticity - surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure - Horizontal - vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principle – buoyancy, metacentre – metacentric height.

UNIT II	FLUID FLOW ANALYSIS	9

Types of fluid flow – velocity and acceleration of a fluid particle - Rotational – irrotational circulation and vorticity - Flow pattern – stream line – equipotential line – stream tube path line – streak line – flow net – velocity potential – stream function. Principles of conservation of mass – energy – momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion.

UNIT III	FLOW MEASUREMENT	9

Bernoulli's equation – applications - venturimeter – orifice meter – nozzle meter - rotameter – elbow meter - pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen- William's formula - Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves.

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UNIT IV	OPEN CHANNEL FLOW	9
Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. specific energy and critical depth - momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.		

UNIT V	DIMENSIONAL ANALYSIS AND PUMPS	9
Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh's method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers – Reynolds, Froude, Euler, Mach and Weber - Pump terminology – suction head, delivery head, discharge, water horse power – selection of pump - Centrifugal pumps – components – working – types of pumps and impellers - priming – cavitation – specific speed – characteristic curves. Turbine and Submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump - Hydraulic ram.		
		Total Theory Hours: 45

1	**EXPERIMENT 1**
	Flow Measurement i) Calibration of Rotameter ii) Flow through Venturimeter iii) Flow through a circular Orifice iv) Determination of mean velocity by Pitot tube v) Flow through a Triangular Notch (Field) vi) Flow through a Rectangular Notch (Field)
2	**EXPERIMENT 2**
	Losses in Pipes i) Determination of friction coefficient in pipes ii) Determination of losses due to bends, fittings and elbows
3	**EXPERIMENT 3**
	Pumps i) Characteristics of Centrifugal pump ii) Characteristics of Submersible pump iii) Characteristics of Reciprocating pump

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Total Practical Hours: 30

Total Instructional Hours: 45 + 30 = 75

COURSE OUTCOMES: Students will be able to	
CO1	Understand the fluids properties in static and dynamic conditions.
CO2	Utilize the knowledge of physical laws in addressing fluid flow problems.
CO3	Solve the problems related to flow measurement.
CO4	Differentiate various flow and measurement techniques in open channels.
CO5	Solve the dimensional analysis problems and classify different types of pumps.

Text Books	
1.	White M Frank and Xue Henry.,Fluid Mechanics, ninth edition, Tata McGraw Hill Co, New Delhi, 2022.
2.	Rajput , R.K., A Textbook of Fluid Mechanics, Revised Edition, S.Chand Publishing house, 2019.
3.	Modi, P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010
4.	Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003
5.	Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002
6.	Jagdish Lal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000

References	
1.	Yunus A. Cengel ; John M. Cimbala, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., 2014
2.	Subramanya, K. Fluid Mechanics and Hydraulic Machines, Tata McGraw- Hill Pub. Co., New Delhi, 2011
3.	Michael A.M. and S.D. Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co, New Delhi, 2005.
4.	Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002.
5.	Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004
6.	https://nptel.ac.in/courses/112/105/112105269/

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List of Equipment's Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	Rotameter, Venturimeter, Orificemeter, Pitot tube, Bernoulli"stherorem apparatus	1
2.	Triangular notch and Rectangular notch	1
3.	Coefficient of friction apparatus	1
4.	Pipe setup with bends, fittings and elbows for estimating minor losses	1
5.	Centrifugal pump, Reciprocating pump, Submersible pump, Jet pump, Collecting tank, Stop watch	1

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B.Tech.	B23AGI402 – STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.
2.	To analyse the shear force and bending moment in various beams.
3.	To calculate the different forces in plane trusses
4.	To distinguish stresses and deformation in shafts and helical springs.
5.	To evaluate slope and deflection in determinate beams.

UNIT I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9

Rigid bodies and deformable solids - Tension, Compression and Shear Stresses - Deformation of simple and compound bars - Thermal stresses - Elastic constants - Volumetric strains - Thin shells - circumferential and longitudinal stresses in thin cylinders - deformation of thin cylinder - stresses in spherical shells - Deformation of spherical shells.

UNIT II	TRANSVERSE LOADING AND STRESSES IN BEAM	9

Beams - types transverse loading on beams - Shear force and bending moment in beams - Cantilevers - Simply supported beams and over-hanging beams. Theory of simple bending - bending stress distribution - Shear stress distribution - Flitched beams.

UNIT III	ANALYSIS OF PLANE TRUSSES	9

Determinate and indeterminate plane trusses - determination of member forces by method of joints, method of sections and method of tension coefficient.

UNIT IV	TORSION	9

Torsion formula - stresses and deformation in circular and hollows shafts - Stepped shafts - Deflection in shafts fixed at the both ends - Stresses in helical springs - Deflection of helical springs - carriage springs.

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UNIT V	DEFLECTION OF BEAMS	9
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay's method - Area moment method - Conjugate beam method.		
		Total Theory Hours: 45

1	**EXPERIMENT 1**
	Determination of Tensile strength and double shear strength on steel rod
2	**EXPERIMENT 2**
	Determination of Torsion test on mild steel rod
3	**EXPERIMENT 3**
	Determination of Compression strength on wood
4	**EXPERIMENT 4**
	Determination of Impact test on metal specimen (Izod and Charpy)
5	**EXPERIMENT 5**
	Determination of Hardness test on metals (Rockwell and Brinell Hardness Tests)
6	**EXPERIMENT 6**
	Estimation of deflection on carriage spring and compression test on helical spring.
7	**EXPERIMENT 7**
	Determination of deflection on metal beam.
8	**EXPERIMENT 8**
	Determination of soundness of cement by Le Chatelier's principle
9	**EXPERIMENT 9**
	Determination of setting time of cement.
	Total Practical Hours: 30

Total Instructional Hours: 45 + 30 = 75

BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Understand the various stresses, strain and deformation principles.
CO2	Solve the shear force and bending moment problems in different beams.
CO3	Practice the problems related to structural elements and develop the deformation behavior for different types of loads.
CO4	Calculate the torsion stresses in design of circular shafts and helical springs.
CO5	Design the beams and buckling load of columns under different boundary conditions

Text Books	
1.	Rajput R.K. “Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 7th edition, 2018.
2.	Rattan S.S., “Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.
3.	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
4.	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

References	
1.	Singh. D.K., “Strength of Materials”, Ane Books Pvt Ltd., New Delhi, 2021.
2.	Beer. F.P. & Johnston. E.R. “Mechanics of Materials”, Tata McGraw Hill, 8th Edition, New Delhi 2019.
3.	Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
4.	Subramanian R., “Strength of Materials”, Oxford University Press, Oxford Higher Education Series, 2007.
5.	Hibbeler, R.C., “Mechanics of Materials”, Pearson Education, Low Price Edition, 2007
6.	Ferdinand P. Been, Russell Johnson, J.R. and John J. Dewole “Mechanics of Materials”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2005.
7.	https://nptel.ac.in/courses/112/106/112106141/

List of Equipment’s Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine	1
3.	Izod impact testing machine	1
4.	Hardness testing machine (Rockwell, Vicker’s Brinnel) (any 2)	1 each

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5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	Le Chatelier’s apparatus	2
10.	Vicat’s apparatus	2
11.	Mortar cube moulds	10

BoS Chairman

B.Tech.	B23AGT401 – POST HARVEST TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the engineering properties of agricultural materials.
2.	To discuss the fundamentals of psychrometry and drying process.
3.	To explain the post harvest cleaning & grading methods of harvested crops.
4.	To compare the shelling & handling process and design of conveyors and elevators.
5.	To develop knowledge on processing techniques for different crops.

UNIT I	FUNDAMENTALS OF POST HARVESTING	9

Post harvest 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.

UNIT II	PSYCHROMETRY AND DRYING	9

Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – 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 – Solar Dryers – types and its uses.

UNIT III	CLEANING AND GRADING	9

Principles - air screen cleaners – adjustments - cylinder separator - spiral separator – magnetic separator - colour sorter - inclined belt separator – length separators - effectiveness of separation and performance index.

UNIT IV	SHELLING AND HANDLING	9

Principles and operation – maize sheller – groundnut decorticator – castor sheller – material handling – belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.

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UNIT V	CROP PROCESSING	9
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.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the importance of properties of various materials for processing.
CO2	Compare the dryers and drying process.
CO3	Differentiate suitable equipments for cleaning and grading of cereal grains, oilseeds, and pulses.
CO4	Analyse the operations of post harvest equipments like sheller and conveyors.
CO5	Evaluate processing methods for different crops (rice, wheat, millets, oil seeds and pulses).

Text Books	
1.	Chakraverty, A.Post harvest technology for Cereals, Pulses and oilseeds. Oxford & IBH publication Pvt Ltd, New Delhi, Third Edition, 2019.
2.	Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi,1994.

References	
1	Amalendu Chakraverty, Post harvest Technology and Food Process Engineering, 2019.
2.	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
3.	Henderson, S.M. and R.L. Perry, Agricultural Process Engineering. John Wiley and Sons, New York.1955.

BoS Chairman

B.Tech.	B23AGT402 – ENGINEERING MATERIALS, CONSTRUCTION, ESTIMATION AND COSTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the characteristics of stones and bricks.
2.	To discuss various types of cementing materials lime, cement and timber.
3.	To explain the concept and design of foundation, stone, and brick masonry.
4.	To apply the engineering properties of concrete, steel, and other building materials in construction.
5.	To calculate the material quantity and cost estimation for farm structures

UNIT I	STONES AND BRICKS	9

Classification of rocks – Characteristics of Stones – Testing of Stones – Manufacture of Bricks – Moulding – Drying and Burning of bricks – Properties of good Brick – Classification of Bricks – Clay Products – Ceramics – Tiles – Earthenware and Stoneware and uses.

UNIT II	LIME, CEMENT AND TIMBER	9

Lime – Natural Sources – Types of lime – Calcination – Cement – Raw Materials – Water Cement Ratio – Manufacture of Portland Cement Wet and Dry Process – Standard Specifications – Storage of Cement – Timber – Definition – Defects in timber – Qualities of good timber – Market forms – Industrial timber – Plywood – Veneer – Thermocol – Panels of laminates – Plastic pipes and materials.

UNIT III	BRICK AND STONE MASONRY	9

Concept of Foundation – Factors affecting Selection of Foundations – Types of soils – Subsurface investigations – Bearing Capacity of soil – Testing & Improving Bearing Capacity of soil – Types of Foundations – Piles – Foundation in Black Cotton soil – Site Selection - Design of Foundation – General Principles – precautions in brick masonry – Stone Masonry – Comparison between Brick and Stone Masonry – Classification – General Principles and Precautions in Stone Masonry – Specification.

UNIT IV	CONCRETE, STEEL AND PRINCIPLES OF CONSTRUCTION	9

Concrete – Ingredients – Manufacturing Process – Properties of fresh concrete – Slump – Flow and Compaction Factor – Properties of hardened concrete – Tests – Mix specification – Mix proportioning

– BIS Method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete – Steel – Aluminum and Other Metallic Materials – Composition – Aluminum composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – admixtures - Distempers – light weight concrete blocks – Interlocking blocks - Basic Principles of Construction of Stones, Bricks Masonry, Concrete and RCC Structures.

UNIT V	**ESTIMATION AND COSTING**	**9**
Introduction on preparation of estimates – Detail and Abstract estimates. Estimation and Costing – Bill of quantities - Preparation of detail and abstract estimates for farm steads – Bunding and Terracing – Farm roads – Check dams – Masonry weirs - Percolation ponds.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the properties of building stones, brick and concrete blocks.
CO2	Compare the types of cements and timber quality.
CO3	Explain the design of foundations and construct of stone and brick masonary.
CO4	Demonstrate the engineering behavioral pattern of concrete, steel and other building materials.
CO5	Apply the principles of construction and preparation of bill of cost for construction works.

Text Books	
1.	B.N Dutta ‘Estimating and Costing in Civil Engineering’, CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.
2.	Varghese .P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, Second Edition, 2015.

References	
1.	Gambhir M.L., &NehaJamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2017.
2.	Sharma S.C. “Construction Equipment and Management”, Khanna Publishers, New Delhi,1988.
3.	Jagadish K.S. "Alternative Building Materials Technology". New Age International, 2017
4.	IS383-1970. Indian Standard specification for coarse and fine aggregate from natural Sources for concrete
5.	https://nptel.ac.in/courses/105106206

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B.Tech.	B23AGT403 – UNIT OPERATIONS IN AGRICULTURAL PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand about the evaporation and concentration process
2.	To explain the process of mechanical separation
3.	To apply the techniques of size reduction and governing laws of crushing.
4.	To demonstrate about the process of contact equilibrium.
5.	To analyse crystallization and distillation principles and equipments

UNIT I	EVAPORATION AND CONCENTRATION	9

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.

UNIT II	MECHANICAL SEPARATION	9

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.

UNIT III	SIZE REDUCTION	9

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.

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UNIT IV	CONTACT EQUILIBRIUM SEPARATION	9
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 – equipments.		

UNIT V	CRYSTALLISATION AND DISTILLATION	9
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.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the process of evaporation and concentration
CO2	Classify the mechanical separation process and its types.
CO3	Employ the size reduction equipments for agricultural products.
CO4	Apply the principles and process of contact equilibrium for extraction and leaching of fine and coarse solids.
CO5	Develop and use the equipments for crystallization and distillation.

Text Books	
1.	Prabhat K. Nema. Unit operation in Food Processing. New India Publishing, 2023.
2.	Earle, R.L., “Unit operations in Food Processing”, Pergamon Press, Oxford, U.K, 1985.
3.	Sahay, K.M., and Singh, K.K. “Unit Operations of Agricultural Processing”, Vikas Publishing House, Pvt. Ltd., New Delhi, 1994.

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References	
1.	George Saravacos and Athanasios E. Kostaropoulos. Handbook of Food Processing Equipment . Springer International Publishing. 2018.
2.	Coulson, J.M and J.F. Richardson. Chemical Engineering. Volume I to V. The Pergamon Press. New York, 1999.
3.	Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press LLC, Florida, 2003.
4.	https://nptel.ac.in/courses/126/105/126105011/

BoS Chairman

B.Tech.	B23AGP401 – POST HARVEST ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To assess the engineering properties of grains.
2.	To evaluate thresher, winnower and shellers.
3.	To evaluate and test bucket elevator, screw conveyors and rubber roll shellers.
4.	To assess the oil content of oil seeds
5.	To plan for a field investigation in rice and pulse milling industries.

Exp. No.	List of Experiments
1	Determination of moisture content of grains by oven method and moisture meter.
2	Determination of porosity of grains.
3	Determination of coefficient of friction and angle of repose of grains.
4	Testing of paddy thresher & paddy winnower.
5	Testing of groundnut decorticator & maize sheller
6	Evaluation of thin layer dryer
7	Evaluation of Solar dryer
8	Determining the efficiency of bucket elevator and screw conveyor
9	Evaluation of shelling efficiency of rubber roll Sheller
10	Determining the oil content of oilseeds.
11	Visit to modern rice mill
12	Visit to pulse milling industry
	Total Instructional Hours: 30

COURSE OUTCOMES: Students will be able to	
CO1	Estimate the engineering properties of grains.
CO2	Assess the efficiency of grain handling equipments.
CO3	Estimate the efficiency and compute performance index of elevators and screw conveyors.
CO4	Test the oil content of oil seeds.
CO5	Develop the industrial experience in post harvest technology

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REFERENCES	
1.	Chakraverty, A. Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2019.
2.	Amalendu Chakraverty, Post harvest Technology and Food Process Engineering, 2019
3.	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
4.	Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955
5..	Mohsenin, N.N. Physical Properties of Plant and Animal Materials Gordon and Breach Publishers, Ludhiana, 1970.

List of Equipment's Required		
Sl.No	**Description of Equipment**	**Quantity**
1	Hot air oven, Grain moisture meter	1 No
2	Porosity apparatus	1 No
3	Coefficient of friction apparatus	1 No
4	Angle of repose – round type and L type	1 No
5	Paddy thresher	1 No
6	Groundnut decorticator and maize sheller	1 No
7	Thin layer dryer	1 No
8.	Solar Dryer	1 No
9	Bucket elevator and screw conveyor	1 No
10	Rubber roll sheller	1 No
11	Oil expeller	1 No

BoS Chairman

B.E / B.TECH	B23MAT404 – PROBABILITY AND STATISTICS (Common to AGRI, AI&DS & AI&ML)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To introduce the basic concepts of probability and random variables.
2.	To understand the basic concepts of two dimensional random variables.
3.	To acquaint the knowledge in testing of hypothesis for small and large samples with applications in real life problems.
4.	To provide the basic concepts for classifications of design of experiments.
5.	To expose to the basic concepts of classifications of design of experiments which apply in agriculture and statistical quality control.

UNIT I - ONE DIMENSIONAL RANDOM VARIABLES	12
Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.	

UNIT II - TWO DIMENSIONAL RANDOM VARIABLES	12
Definition - Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Central limit theorem (for independent and identically distributed random variables - without proof).	

UNIT III - TESTING OF HYPOTHESIS	12
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chisquare and F distributions for mean, variance - Contingency table (test for independent) - Goodness of fit.	

UNIT IV - DESIGN OF EXPERIMENTS	12
One way and Two way classifications - Completely randomized design - Randomized block design - Latin square design - 2^2 factorial design.	

Approved by BoS Chairman

UNIT V - STATISTICAL QUALITY CONTROL	12
Control charts for measurements ($\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits - Acceptance sampling.	
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Interpret the fundamental knowledge of the concepts of probability and standard distributions.
CO2	Develop the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3	Demonstrate a solid understanding of testing of hypothesis.
CO4	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO5	Develop the sampling distributions and statistical quality control techniques used in engineering and management problems.

Text Books	
1.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2020.
2.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2009.

Reference Books	
1.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 9th Edition, 2016.
2.	Papoulis. A. and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2017.
3.	Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.
4.	Iyengar. T. K. V, Krishna Gandhi. B, Ranganthan. S and Prasad. M.V.S.S.N "Probability and Statistics", S. Chand Publications, Edition, 2017.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2013.

Approved by BoS Chairman

Semester - V

B.Tech.	B23AGT501 – FARM TRACTOR AND ENGINES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To classify different types of tractors based on their design, functionality, and application in agricultural and industrial settings.
2.	To gain knowledge about the construction and function of key engine components.
3.	To evaluate various transmission systems, including clutches and gearboxes.
4.	To explore the principles of hydraulic systems in tractors.
5.	To understand testing and evaluation procedures of tractors and power tillers.

UNIT I	TRACTORS	
Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers.		

UNIT II	ENGINE SYSTEMS	9
Valves-inlet and outlet valves – valve timing diagram. Air cleaner- exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor- electrical system.		

UNIT III	TRANSMISSION SYSTEMS	9
Transmission - clutch - gear box - sliding mesh - constant mesh - synchro mesh. Differential, final drive and wheels. Steering geometry - steering systems - front axle and wheel alignment. Brake - types - system.		

UNIT IV	HYDRAULIC SYSTEMS	9
Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operators seat.		

UNIT V	POWER TILLER, BULLDOZER AND TRACTOR TESTING	9

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Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors, power tillers and bulldozers. Bulldozer- salient features – turning mechanism, track mechanism, components – operations performed by bulldozers. Types of tests- test procedure - need for testing & evaluation of farm tractor -Test code for performance testing of tractors and power tillers.

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Apply their understanding of tractor classifications for specific agricultural tasks.
CO2	Analyze and explain the functions of various engine components.
CO3	Evaluating different transmission systems and their configurations.
CO4	Explaining the working principles of hydraulic systems and their applications in tractors.
CO5	Design and conduct performance tests on tractors and power tillers.

Text Books	
1.	Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 2019.
2.	Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 2004.

References	
1.	Domkundwar A.V.A course in internal combustion engines. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi,2010.
2.	Black, P.O. Diesel engine manual. Taraporevala Sons & Co., Mumbai,2013.
3.	Grouse, W.H. and Anglin, D.L. Automative mechanics. Macmillan McGraw Hill, Singapore, Indian Standard Codes for Agricultural Implements Published by ISI, New Delhi, 2013.
4.	Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 2010.
5.	https://nptel.ac.in/courses/126/105/126105009/

Approved by BoS Chairman

B.Tech.	B23AGT502 – SOIL AND WATER CONSERVATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the various types of soil erosion and its processes.
2.	To evaluate and apply different soil conservation methods.
3.	To analyze various water conservation techniques.
4.	To develop skills to estimate soil erosion using established methods and their applications and limitations.
5.	To assess sedimentation processes in reservoirs.

UNIT I	SOIL EROSION PRINCIPLES	
Approaches to soil conservation – Soil conservation in India - Erosion – Agents - Causes - Mechanics of water erosion – Soil erosion problems - Types of water erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully –- Landslides – Shifting cultivation - Wind Erosion – Principles and Mechanics - Land use capability classification - Classification of eroded soils..		

UNIT II	ESTIMATION OF SOIL EROSION	9
Runoff computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation - Permissible erosion – Estimation of Wind Erosion.		

UNIT III	EROSION CONTROL MEASURES	9
Prerequisites - Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Bunding: Types and design specifications - Mechanical measures for hill slopes – Terracing: Classification and design specification of bench terrace – Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures - Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways – Wind Erosion control measures – Wind break and Shelter belts – Sand dunes Stabilization.		

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UNIT IV	WATER CONSERVATION MEASURES	9
In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis - Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.		

UNIT V	SEDIMENTATION	9
Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed and suspended load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks – Silt Conservation and its uses - Sediment and its control methods.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Apply their knowledge of soil erosion types and mechanisms to address erosion issues in various agricultural contexts.
CO2	Demonstrate the ability to evaluate the effectiveness of different soil conservation techniques.
CO3	Designing and implementing water conservation strategies, contributing to sustainable agricultural practices and resource management.
CO4	Estimating soil erosion rates using various methodologies, enabling them to make informed decisions regarding land management and conservation.
CO5	Analyze sedimentation processes and their impacts on reservoirs.

Text Books	
1.	Suresh, R., “Soil and Water Conservation Engineering”, Standard Publication, New Delhi, 2007.
2.	Ghanshyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
3.	“Sedimentation Engineering”, 2006, ASCE Manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.

Approved by BoS Chairman

References	
1.	Murthy, V.V.N., “Land and Water Management Engineering”, Kalyani Publishers, Ludhiana, 1998.
2.	Gurmail Singh, “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi, 1982.
3.	Mal, B.C., “Introduction to Soil and Water Conservation Engineering”, Kalyani Publishers, New Delhi, 2002.
4.	https://nptel.ac.in/courses/126/105/126105009/

Approved by BoS Chairman

B.Tech.	B23AGI501 – FOOD AND DAIRY PROCESSING	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To gain a comprehensive understanding of the dairy industry and the various types of milk and their compositions.
2.	To learn the essential techniques for processing milk.
3.	To explore the manufacturing processes of various dairy products.
4.	To analyze the properties of food and the kinetics of reactions during different processing.
5.	To learn to implement quality control measures in food processing and packaging.

UNIT I	PROPERTIES AND PROCESSING OF MILK	9

Dairy Industry – importance and status – Milk Types – Composition and properties of milk Production of high quality milk - Method of raw milk procurement and preservation – Processing - Staining - Filtering and Clarification - cream separation – Pasteurization – Homogenization sterilization, UHT processing and aseptic packaging – emulsification - Fortification.

UNIT II	DAIRY PRODUCTS AND ITS CLASSIFICATION	9

Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk - Butter milk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal.

UNIT III	FOOD AND ITS PROPERTIES, REACTION AND KINETICS	

Constituents of food - thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning - Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves - water activity, sorption behaviour of foods - isotherm models - monolayer value, BET isotherms, Raoult“ s law, Norrish, Ross, Salwin - Slawson equations.

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UNIT IV	PROCESSING AND PRESERVATION OF FOODS	
Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.		

UNIT V	PACKAGING AND QUALITY CONTROL	
Food packaging, importance, flexible pouches - retort pouches - aseptic packaging, granules, powder and liquid packaging machines - nanotechnology - principles - applications in food processing - food plant location - Quality control of processed food products - Factors affecting quality.		
		Total Theory Hours:

1	**EXPERIMENT 1**
	Determination of cooking properties of parboiled and raw rice.
2	**EXPERIMENT 2**
	Estimation of microbial load in food materials
3	**EXPERIMENT 3**
	Determination of rehydration ratio of dehydrated foods
4	**EXPERIMENT 4**
	Experiment on osmotic dehydration of foods
5	**EXPERIMENT 5**
	Experiment of food extruder
6	**EXPERIMENT 6**
	Experiment on properties of food through microwave oven heating
7	**EXPERIMENT 7**
	Determination of properties of milk
8	**EXPERIMENT 8**

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	Experiments on cream separator to determine the separation efficiency
9	**EXPERIMENT 9**
	Experiments on construction and operation of butter churn and butter working accessories
10	**EXPERIMENT 10**
	Experiments on detection of Food Adulteration
11	**EXPERIMENT 11**
	Determination of sugars
12	**EXPERIMENT 12**
	Experiment on expansion and Oil absorption characteristic of snacks on frying

Total Practical Hours: 30

Total Instructional Hours: 45 + 30 = 75

COURSE OUTCOMES: Students will be able to	
CO1	Apply their knowledge of dairy industry fundamentals to assess the quality and composition of different types of milk and dairy products
CO2	Demonstrate proficiency in various milk processing techniques to produce high quality dairy products.
CO3	Capable of manufacturing a range of dairy products for specific processes and standards required for each product type.
CO4	Analyze the effects of thermal processing on food properties and enhance product shelf life.
CO5	Evaluate quality control measures in food processing and packaging.

Text Books	
1.	Singh, R. Paul and Heldman, R. Dennis 2004, Introduction to Food Engineering, 3rd Edition, Academic Press, London.
2.	Kessler, H.G.1981 Food engineering and dairy technology, Verlag A. Kessler, Freising.

References	
1.	Walstra, P.T.J. Geurts, A. Nooman, A. Jellema and M.A. J.S Van Boekel, 2005, Dairy Technology, Marcel Dekker Inc. New york.

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2.	Clunie Harvey, W.M and Harry Hill. 2009 Milk Products. IV Edition Biotech Books, New Delhi.
3.	Robinson, R.K.1986. Modern dairy technology Vol.I Advances in Milk processing. Elsevier Applied Science Publishes, London.
	Charm, S.E.1971. The fundamentals of Food engineering, AVI pub.Co.,Inc,

List of Equipment's Required		
Sl.No	**Description of Equipment**	**Quantity**
1	Extruder	1
2	Pasteurizer	1
3	Hot air oven	1
4	Hand refractometer	1
5	Dessicator	1
6	Dean and Stark"s apparatus	1
7	Cabinet dryer	1
8	Soxhlet flask	1
9	Distillation column	1
10	Kjeldahl flask	1
11	Distillation apparatus	1
12	Microwave oven	1
13	Cream separator	1
14	Butter churner	1

Approved by BoS Chairman

B.Tech.	B23AGT503 – IoT IN AGRICULTURAL ENGINEERING AND ITS APPLICATIONS	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the foundation of Internet of Things (IoT).
2.	To learn about various types of sensors used in agriculture and integrate devices into IoT platforms for effective data acquisition.
3.	To explore data storage solutions and analytics techniques.
4.	To understand the various communication technologies and protocols relevant to IoT applications in agriculture.
5.	To develop practical skills in project planning and implementation by designing and executing an IoT project that addresses a specific agricultural problems.

UNIT I	INTRODUCTION TO IoT in AGRICULTURE ENGINEERING	9

Overview of IoT - Definition, components, and architecture of IoT systems - Importance of IoT in Agriculture - Benefits and challenges of implementing IoT in agricultural practices - Case Studies - Review of successful IoT applications in precision agriculture.

UNIT II	IoT DEVICES AND SENSORS	9

Types of Sensors - Soil moisture, temperature, humidity, and crop health sensors - Device Integration: How to connect sensors to IoT platforms - Data Acquisition - Techniques for collecting and transmitting data from agricultural fields.

UNIT III	DATA MANAGEMENT AND ANALYSIS	15

Data Storage Solutions - Cloud computing and edge computing for agricultural data - Data Analytics: Techniques for analyzing agricultural data to derive insights - Machine Learning Applications - Introduction to machine learning algorithms for predictive analytics in agriculture.

UNIT IV	IoT Communication Protocols	15

Communication Technologies - Overview of protocols such as MQTT, CoAP, and LoRaWAN - Network Design - Designing a robust IoT network for agricultural applications - Security Considerations: Addressing security and privacy issues in IoT systems.

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UNIT V	PROJECT DEVELOPMENT AND IMPLEMENTATION	12
Project Planning - Steps to design and implement an IoT project in agriculture – Hands on Project - Students will work on a project that involves creating an IoT solution for a specific agricultural problem - Presentation and Evaluation - Students will present their projects, demonstrating the application of IoT technologies in agriculture.		
		Total Hours:60

COURSE OUTCOMES: Students will be able to	
CO1	Identify the benefits and challenges associated with its implementation, supported by case studies of successful applications.
CO2	Select and integrate appropriate sensors and devices into IoT systems.
CO3	Analyze agricultural data using various data management techniques and machine learning algorithms.
CO4	Design a robust IoT network for agricultural applications, demonstrating knowledge of relevant communication protocols.
CO5	Develop, and present an IoT project that addresses a specific agricultural challenges and practical applications

References	
1.	Zoranovic T, Erceg V, Berkovic I. IoT project in agriculture. InProceedings/8 th International conference on applied internet and information technologies 2018 Oct 5 (Vol. 8, No. 1, pp. 17-21). “St Kliment Ohridski” University-Bitola, Faculty of Information and Communication Technologies-Bitola, Republic of Macedonia.
2.	Gondchawar N, Kawitkar RS. IoT based smart agriculture. International Journal of advanced research in Computer and Communication Engineering. 2016 Jun;5(6):838-42.

Approved by BoS Chairman

B.E / B.Tech	B23MCT505- Holistic Insight into UN SDGs (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand the origin, purpose, and significance of the UN Sustainable Development Goals (SDGs).
2.	To explore the 17 SDGs, their interconnections, and challenges in achieving them.
3.	To analyze global and local case studies of SDG implementation.
4.	To evaluate the role of governments, businesses, and individuals in sustainable development.
5.	To develop practical solutions and action plans for achieving SDGs at community and policy levels

SYLLABUS:

UNIT - I	INTRODUCTION TO SUSTAINABLE DEVELOPMENT & SDGS	6

Concept of **sustainability** and its evolution.

UN Millennium Development Goals (MDGs) vs. Sustainable Development Goals (SDGs). Overview of the **17 SDGs**, their targets, and indicators.

Importance of **global collaboration** for sustainable development.

UNIT - II	PEOPLE-CENTERED SDGS (SDG 1–6)	6

SDG 1: No Poverty – Causes, measures & policies.

SDG 2: Zero Hunger – Food security & sustainable agriculture.

SDG 3: Good Health & Well-being – Universal healthcare & disease prevention.

SDG 4: Quality Education – Inclusive and equitable education.

SDG 5: Gender Equality – Women's empowerment & equal opportunities.

SDG 6: Clean Water & Sanitation – Water conservation & access to sanitation.

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UNIT - III	ECONOMIC & INFRASTRUCTURE SDGS (SDG 7–12)	6

SDG 7: Affordable & Clean Energy – Renewable energy solutions.

SDG 8: Decent Work & Economic Growth – Inclusive economic policies.

SDG 9: Industry, Innovation & Infrastructure – Sustainable development & digital transformation.

SDG 10: Reduced Inequalities – Social inclusion & global justice.

SDG 11: Sustainable Cities & Communities – Smart urban planning & resilience.

SDG 12: Responsible Consumption & Production – Circular economy & waste management.

UNIT - IV	ENVIRONMENTAL SDGS (SDG 13–15)	6

SDG 13: Climate Action – Climate change impacts & mitigation strategies.

SDG 14: Life Below Water – Ocean conservation & marine biodiversity.

SDG 15: Life on Land – Forest preservation & biodiversity protection.

UNIT - V	Governance & Global Partnerships (SDG 16–17)	6

SDG 16: Peace, Justice & Strong Institutions – Human rights & good governance.

SDG 17: Partnerships for the Goals – Role of international cooperation, businesses & individuals.

Course Outcomes: Students will be able to	
CO1	Explain the origin, purpose, and significance of the UN Sustainable Development Goals.
CO2	Summarize the 17 SDGs, their interconnections, and challenges in achieving them.
CO3	Interpret global and local case studies of SDG implementation.
CO4	Describe the roles of governments, businesses, and individuals in sustainable development.
CO5	Illustrate practical solutions and action plans for achieving SDGs at community and policy levels.

Approved by BoS Chairman

Text Books	
1.	Sachs, J. D. (2015). The Age of Sustainable Development. Columbia University Press.
2.	United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development.
3.	Griggs, D., Stafford-Smith, M., Gaffney, O., & Rockström, J. (2017). Sustainable Development Goals: Harnessing Business to Achieve the SDGs Through Finance, Technology and Innovation. Routledge.
4.	Mebratu, D., & Swilling, M**. (2019).** Transformational Infrastructure for Development of a Wellbeing Economy. Springer.

Reference Books	
1.	Leal Filho, W. (Ed.). (2020). Encyclopedia of the UN Sustainable Development Goals. Springer.
2.	Sachs, J. D. (2021). The Decade of Action: Mobilizing the World to Achieve the SDGs. Columbia University Press.

Approved by BoS Chairman

B.Tech.	B23AGP501 – DESIGN AND DRAWING OF FARM STRUCTURES	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To understand planning of various farm buildings for residence, livestock, storage and roads.
2.	To learn the design aspects of cattle sheep and poultry houses, silos and machinery sheds.
3.	To acquire the drawing skills of various farm structures.
4.	To analyse the farm fencing methods and designs of sanitary structures.
5.	To learn the farm roads, culverts and drawing of such structures.

List of Experiments

Expt. No.	Description of the Experiments
1.	Planning and Layout of farmstead
2.	Design and Drawing of stall bam
3.	Design and Drawing of loose housing and milk parlors
4.	Design and Drawing of poultry house
5.	Design and Drawing of a sheep / goat house
6.	Design and Drawing of ventilation system for dairy and poultry house
7.	Design and Drawing of silos – over ground and underground and hay storages
8.	Design and Drawing of farm fencing system
9.	Design and Drawing of machinery and equipment shed and workshops
10.	Design and Drawing of anaerobic digestion and sanitary structures
11.	Design and Drawing of rural/farm roads and culverts.
12.	Design and Drawing of underground irrigation pipe systems.
	Total Instructional hours : 60

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Analyze and evaluate different farmstead layouts.
CO2	Create comprehensive design plans for various agricultural structures.
CO3	Assess the ventilation requirements for different agricultural buildings.
CO4	Design underground irrigation systems and sanitary structures.
CO5	Design their projects effectively, articulating their design choices and justifications, demonstrating communication and presentation skills.

Text Books	
1.	Barre, H.J. and Sammet, L.L. "Farm Structures". John Wiley and Sons Inc. 2010
2.	Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 2007.
3.	Khanna, S.K. and Justo, C.E.G. "Highway Engineering". Nemchand and Bros., Roorkee, India.,2002.
4.	Lennart P. Bengtsson, James H. Whataker “Farm structures in Tropical Climate”, FAO, United Nations, Rome, 2004.

Reference Books	
1.	Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 1961.
2.	Dutta, B.N. "Estimating and Costing in Civil Engineering Theory and Practice". S. Dutta and Co,2020.
3.	Bazirani, V.N. and Ratwani, M.M. "Steel Structures". Khanna Publishers, Delhi, 1981.
4.	Justo, C.E.G. and Khanna, S.K. "Highway Engineering". Nemchand and Bros., Roorkee, India (Revised).
5.	https://nptel.ac.in/courses/126/105/126105010/

List of Equipment’s Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	AUTOCAD	1

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B.Tech.	B23AGP502 – ICT LABORATORY FOR AGRICULTURAL ENGINEERS	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To apply the ICT tools in irrigation management
2.	To understand the use of agro meteorological sensors.
3.	To create knowledge on mobile applications in agriculture.
4.	To learn crop simulation models
5.	To apply cloud services and farm advisories for technology transfer

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Configuring timers for automatic switching “on and off” of irrigation systems
2.	Experience with solenoid valves for pressurized irrigation
3.	Using sensors for Agro meteorological measurements
4.	Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5.	Use of mobile apps for controlling or triggering an agricultural system
6.	Construction of crop growth function (best fit) for crop yields simulations
7.	Image Processing as tool for biotic and abiotic stress identification
8.	Experience with existing open source crop simulation models
9.	Exposing cloud resources for agricultural applications
10.	Developing automated agro advisory systems
Total Instructional hours : 60	

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Create automated irrigation systems, demonstrating their understanding of irrigation management.
CO2	Demonstrate proficiency in using sensors for agro-meteorological measurements, allowing for real-time data collection and analysis.
CO3	Design and implement control circuits using PCBs or breadboards, showcasing their ability to integrate hardware and software for agricultural automation..
CO4	Develop and utilize mobile applications to control agricultural systems,.
CO5	Analyze data to construct crop growth functions, enabling them to simulate and predict crop yields.

Reference Books	
1.	Aoki, E. ; Kudo, K. ; Fukuda, A. ; Nakanishi, T. ; Tagashira, S. ; Okayasu, T. ; Tsuruda, N. ; Yamasaki, S. ;Imura, Y., "Study on Knowledge Management Platform about the Field of Agricultural Infomatization" Complex, Intelligent and Software Intensive Systems (CISIS), 2012 Sixth International Conference on Digital Object Identifier: 10.1109/CISIS.2012.149, Pp 705-710, (2012), IEEE Conference Publications, Print ISBN: 978-1-4673-1233-2 INSPEC Accession Number:12882390
2.	Awuor, F. ; Kimeli, K. ; Rabah, K. ; Rambim, D., "ICT solution architecture for agriculture", IST-Africa Conference and Exhibition (IST-Africa), Pp 1-7 (2013), IEEE Conference Publications , ISBN: 978-1- 905824-38-0
3.	https://archive.nptel.ac.in/courses/126/104/126104006/

List of Equipment's Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	Timing devices and small pumps for simulations	1 set
2.	Solenoid valves and layout of drip or sprinkler system	1 set
3.	Time Domain Reflectometer (TDR)	1 No.
4.	Digital thermometer	1 No.
5.	Breadboards, relays etc.	4 sets
6.	MATLAB software	4 nos.
7.	Open source Crop simulation models - any one for demonstration	1
8.	Other facilities for cloud resources, agro advisory systems etc.	1 each

Approved by BoS Chairman

Semester - VI

B.Tech.	B23AGT601 – IRRIGATION AND DRAINAGE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To comprehend the various water resources available in India and Tamil Nadu.
2.	To understand different irrigation methods, including surface, subsurface, drip, and sprinkler systems
3.	To learn the principles of designing various types of diversion and impounding structures
4.	To explore the hydraulic systems involved in canal irrigation and command area development.
5.	To assess the principles of agricultural drainage, including surface and subsurface drainage systems.

UNIT I	WATER RESOURCES AND IRRIGATION REQUIREMENT	

Water Resources - River basins - Development and Utilization in India and Tamil Nadu - Irrigation – Duty and Delta - Rooting characteristics - Moisture use of crop, Evapotranspiration – PET & ET Crop - Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

UNIT II	METHODS OF IRRIGATION	9

Methods of Irrigation - Surface and Subsurface methods - Borders, Furrow, Check basins and Sub irrigation - Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible channels - Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system.

UNIT III	DIVERSION AND IMPOUNDING STRUCTURES	9

Head works - Weirs and Barrage - Types of impounding structures - Factors affecting, location of dams - Forces on a dam - Design of Gravity dams - Earth dams, Arch dams - Spillways - Energy dissipaters.

UNIT IV	CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT	9

Classification of canals, alignment of canals, Design of irrigation canals – Regime theories, Kennedy's and Lacey's theory, Canal head works and regulators, Canal drops, Cross drainage works, Lining and maintenance of canals, Tanks – system and non-system tanks, Command area – Concept, components of CADP – On farm development works; Farmers Committee – its role for water distribution and system operation, Warabandi and rotational irrigation system.

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UNIT V	AGRICULTURAL DRAINAGE	9
Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy“ s law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Apply knowledge of water resources and irrigation requirements
CO2	Evaluate different irrigation methods and select appropriate systems based on crop types
CO3	Design diversion and impounding structures, ensuring they meet safety and operational standards while considering environmental impacts.
CO4	Implement canal irrigation systems and understand the integration of agricultural machinery, enhancing operational efficiency in irrigation practices.
CO5	Analyze and design effective agricultural drainage systems, ensuring optimal water management and soil health for sustainable agricultural practices

Text Books	
1.	Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice - Hall of India, New Delhi
2.	Michael, A.M., “Irrigation Engineering”, Vikas Publishers, New Delhi, 2008.
3.	Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 2008.
4.	Ritzema, H.P., “Drainage Principles and Applications”, Publication No.16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

References	
1.	Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2.	Murthy, V.V.N. Land and water management, Kalyani Publishing, New Delhi, 1998.
3.	Bhattacharya, A.K., and Michael, A.M., “Land Drainage – Principles, Methods and Applications”, Konark Publishers Pvt. Ltd., New Delhi, 2003.
4.	Irrigation water Management, Training Manual No.6, Drainage of Irrigated Lands, Foods and Agriculture Organisation, Rome 1996
5.	Sharma R.K and Sharma T.K., "Irrigation Engineering", S.Chand, New Delhi, 2008.
6.	https://nptel.ac.in/courses/126/105/126105010/

Approved by BoS Chairman

B.Tech.	B23AGT602 – DESIGN OF FARM MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand fundamental principles of the design process in machines.
2.	To develop the skills to select and design various power transmission systems.
3.	To understand the design aspects of shafts and couplings.
4.	To design various energy-storing elements such as springs, considering both constant and varying loads.
5.	To understand the principles of gear and bearing design.

UNIT I	STRESSES IN MACHINE MEMBERS	
Introduction to design process - factor influencing the machine design, selection of material based on mechanical properties - Direct, bending and torsional stress equations - calculation of Principal stresses for combined loading. Design of curved beams - factor of safety - theories of failure-stress concentration - design of variable loading - Soderberg and Goodman relations.		

UNIT II	DESIGN OF POWER TRANSMISSION SYSTEMS	9
Selection of V-Belts and pulleys - selection of flat belts and pulleys - wire ropes and pulleys - selection of transmission chains and sprockets - Design of pulleys and sprockets – Hydraulic systems.		

UNIT III	DESIGN OF SHAFTS, COUPLINGS AND SPRINGS	9
Design of solid and hollow shafts based on strength and rigidity - Design of keys, keyways and splines - Design of rigid and flexible couplings. Design of bolts and nuts - knuckle and cotter joints – Design of Springs – Compression and Tension.		

UNIT IV	DESIGN OF ENERGY STORING ELEMENTS	9
Design of helical, leaf, disc and torsional springs under constant loads and varying loads - Concentric torsion springs.		

UNIT V	DESIGN OF GEARS AND BEARINGS	9
Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation -		

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Buckingham equation - Failure of gear teeth - Applications of different types of Gears – Crown and Pinion - Types of bearings - sliding contact and rolling contact types - Bearing selection based on application - Lubrication in journal bearings - calculation of bearing dimensions.
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Apply their knowledge of mechanical properties and stress analysis to design machine components.
CO2	Analyze the performance of different power transmission systems and select appropriate designs based on efficiency and application needs
CO3	Demonstrate proficiency in designing shafts, couplings, and springs, ensuring they meet strength and rigidity requirements for various mechanical applications.
CO4	Make use of energy storage in machine elements
CO5	Applying the design knowledge for gears and bearings.

Text Books	
1.	Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house, 2005.
2.	Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

References	
1.	Norton R.L, Machine Design - An Integrated Approach, Pearson Publications, 3rd Edition, 2006.
2.	Ashby M.F., Materials selection in Mechanical Design 2nd Edition, Butter worth 1999.
3.	Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000
4.	Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.
5.	Gary Krutz, Lester Thompson and Paul Clear., “Design of Agricultural Machinery”, John Wiley and Sons, New York, 1984.
6.	https://nptel.ac.in/courses/112/105/112105125/

Approved by BoS Chairman

B.Tech.	B23AGI601 – FARM MACHINERY AND EQUIPMENTS	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To learn the objectives and significance of farm mechanization.
2.	To explore various tillage methods and the design and functionality of primary and secondary tillage implements.
3.	To gain knowledge about different sowing and fertilizing equipment.
4.	To examine various weeding and plant protection equipment.
5.	To learn the principles of harvesting machinery, including the operation and adjustment of various types of harvesters.

UNIT I	FARM MECHANIZATION	9

Farm mechanization – objectives. Tillage - objectives - methods – primary tillage implements – secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted Field capacity - forces acting on tillage tool.

UNIT II	PRIMARY AND SECONDARY TILLAGE IMPLEMENTS	9

Mould board plough- attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough – Chisel plough - Cultivators - types - construction. Disc harrows - Bund former – Rotavator - ridger – leveller. Basin lister - Wetland preparation implements.

UNIT III	SOWING AND FERTILIZING EQUIPMENT	9

Crop planting - methods - row crop planting systems - Devices for metering seeds – furrow openers – furrow closers- types – Types of seed drills and planters – calibration-fertilizer metering devices - seed cum fertilizer drills – paddy transplanters – nursery tray machines.

UNIT IV	WEEDING AND PLANT PROTECTION EQUIPMENT	9

Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders.

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Sprayers – types - classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.

UNIT V	HARVESTING MACHINERY	9
Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses.		
	Total Theory Hours:45	

1	**EXPERIMENT 1**
	Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping thetractor
2	**EXPERIMENT 2**
	Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the powertiller.
3	**EXPERIMENT 3**
	Operation of tractor and hitching practice
4	**EXPERIMENT 4**
	Study and field operation and adjustments of ploughs
5	**EXPERIMENT 5**
	Study and field operation and adjustments of cultivators
6	**EXPERIMENT 6**
	Study and field operation of sowing and planting equipment and their adjustments
7	**EXPERIMENT 7**
	Study and field operation of plant protection equipment
8	**EXPERIMENT 7**
	Study and field operation of harvesting equipment

Total Practical Hours: 30

Total Instructional Hours: 45 + 30 = 75

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COURSE OUTCOMES: Students will be able to	
CO1	Apply the principles of farm mechanization to assess and improve agricultural practices.
CO2	Design and select appropriate tillage implements based on soil characteristics and crop requirements.
CO3	Demonstrate operational proficiency in using sowing and fertilizing equipment.
CO4	Evaluate and implement effective weeding and plant protection.
CO5	Analyze and execute the operation of harvesting machinery.

Text Books	
1.	Senthilkumar, T., B. Suthakar and G. Manikandan, 2023. Text Book of Farm Machinery and Equipment (As per 5th deans committee recommendation), Brillion Publishers, New Delhi.
2.	Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi.

References	
1.	Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi 99, 1997.
2.	Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.
3.	Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.
4.	https://onlinecourses.nptel.ac.in/noc19_ag01/preview

List of Equipment's Required		
Sl.No	**Description of Equipment**	**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

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B.Tech.	B23AGT603 – AGRICULTURAL BUSINESS MANAGEMENT	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand agri-business, its scope, characteristics, and types and importance of management in agricultural contexts.
2.	To identify and evaluate different forms of agri-business organizations.
3.	To gain knowledge of agricultural marketing, including production and operations management.
4.	To understand the financial aspects of agri-business, including capital acquisition, budget analysis
5.	To learn about marketing promotion activities, pricing methods, and human resource management

UNIT I	CONCEPTS OF AGRICULTURAL BUSINESS	9

Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.

UNIT II	AGRI BUSINESS ORGANIZATION	9

Principles, forms of agri-business organizations, staffing, directing, supervision and motivation. Controlling - types, performance evaluation and control techniques. Management approaches - Profit Centered Approach, Management by objectives and Quality Circles. Strength, Weakness, Opportunities and Threat (SWOT) Analysis.

UNIT III	AGRICULTURAL MARKETING	9

Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality. Agro-inputs and products inventory management - raw material procurement, inventory types, and costs. Marketing management- Marketing environment, marketing mix - Agricultural input marketing firms

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UNIT IV	AGRICULTURAL BUSINESS FINANCE	9
Forms of agri-business organizations - Role of lead bank in agribusiness finance - Financial management. Acquiring capital- Budget analysis. Concepts and determinants- Business project scheduling of raw material procurement - production management - launching products (branding, placement) - Input marketing promotion activities.		

UNIT V	MARKET PROMOTION AND HUMAN RESOURCES	9
Agricultural products - marketing promotion activities - product pricing methods. District Industries Centre - Consumer survey - Agricultural inputs retailing - Market potential assessment - types of distribution channels - Return on Investment - Personnel management. Recruitment, selection and training - Technology in Agri Business		
		Total Theory Hours:45

COURSE OUTCOMES: Students will be able to	
CO1	Articulate the key concepts of agri-business and management, demonstrating comprehension of their relevance in agricultural production
CO2	Analyze various agri-business organizations and their management strategies
CO3	Creating effective marketing strategies for agricultural products.
CO4	Perform financial analyses relevant to agri-business, including budgeting and project scheduling
CO5	Formulate human resource management plans that include recruitment, selection, and training strategies

Text Books	
1.	Himanshu, “Agri Business Management – Problems and prospects”, Ritu Publications, Jaipur, 2005.
2.	Smita Diwase, “Indian Agriculture and Agribusiness Management”, Krishi resource Management Network, Pune 2004.

References	
1.	Chandra Prasanna, “Projects: Preparation, Appraisal, Budgeting and Implementation”, Tata McGraw Hill Publications, New Delhi, 2001.
2.	Kotler, P., “Marketing Management. Analysis, Planning and Control”, Prentice Hall Inc., New York, 2001
3.	Rao, V.S.P., and Narayana, P.S., “Principles and Practices of Management”, Konark Publishing Private Limited, New Delhi, 2001.
4.	Tripathy, P.C., and Reddy, P.N., “Principles of Management”, Tata McGraw Hill Publications, New Delhi, 2000.

Approved by BoS Chairman

B.Tech CSBS	B23MCT605 CYBER SAFETY CONCEPTS	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand various types of cyber-attacks and cyber-crimes
2.	To learn threats and risks within context of the cyber security
3.	To have an overview of the cyber laws & concepts of cyber forensics
4.	To study the defensive techniques against these attacks
5.	To understand various cyber security privacy issues

UNIT- I	Introduction to Cyber Security	9

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT- II	Cyberspace and the Law & Cyber Forensics	9

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

UNIT- III	Cybercrime: Mobile and Wireless Devices	9

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in
Mobile Computing Era, Laptops.

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UNIT- IV	Cyber Security	9
Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations		

UNIT- V	Privacy Issues	9
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains medical, financial, etc.		
		Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Analyze and evaluate the cyber security needs of an organization.
CO2	Understand Cyber Security Regulations and Roles of International Law.
CO3	Design and develop a security architecture for an organization.
CO4	Understand fundamental concepts of data privacy attacks.
CO5	Explain fundamental concepts of data privacy and analyze the role of privacy policies and privacy- preserving techniques.

Text Books	
1.	Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2.	B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.
Reference Books	
1.	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2.	Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Approved by BoS Chairman

B.Tech.	B23AGP601 – IRRIGATION SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To gain knowledge about various instruments used in meteorological laboratories and their applications in agricultural practices.
2.	To determine the infiltration rate of soil using double ring and digital infiltrometers, enabling them to assess soil water dynamics.
3.	To study the wetting patterns of soil moisture for effective irrigation scheduling.
4.	To acquire skills in designing drip and sprinkler irrigation systems, focusing on efficiency and water conservation techniques.
5.	To evaluate the uniformity coefficient for both drip and sprinkler irrigation systems, using methods such as the catch can method, to ensure optimal water distribution.

List of Experiments

Expt. No.	Description of the Experiments
1.	To study various instruments in the Meteorological Laboratory
2.	Determination of infiltration rate using double ring and digital infiltrometer
3.	Determination of soil moisture wetting pattern for irrigation scheduling
4.	Design of Drip irrigation system
5.	Design of sprinkler irrigation system
6.	Measurement of flow properties in open irrigated channels (flumes, notches)
7.	Evaluation of surface irrigation
8.	Determination of uniformity coefficient for drip irrigation system
9.	Determination of uniformity coefficient for sprinkler system (catch can method)
10.	To conduct experiment on disc filter for micro irrigation systems
11.	Visit to Automatic Weather Station
	Total Instructional hours : 60

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Apply theoretical knowledge of meteorological instruments to practical scenarios in agricultural settings
CO2	Determine soil infiltration rates, interpreting the results to inform irrigation practices and soil management strategies.
CO3	Analyze soil moisture wetting patterns, allowing them to create precise irrigation schedules that optimize water use and crop yield.
CO4	Demonstrate the ability to design efficient drip and sprinkler irrigation systems
CO5	Evaluating the uniformity coefficient of irrigation systems

References	
1.	Michael, A.M., “Irrigation Theory and Practice“, Vikas Publishing House, New Delhi, 1999.
2.	Asawa, G.L., “Irrigation Engineering", New Age International Private Limited, New Delhi, 1996.
3.	Laboratory Manual, Centre for Water Resources, Anna University, Chennai.

List of Equipment’s Required		
Sl.No	**Description of Equipment**	**Quantity**
1.	Meteorological lab with Cup counter anemometer, Sunshine recorder, Open pan vaporimeter, Stevenson’s screen - Dry bulb, wet bulb thermometers, recording and nonrecording type rain gauge etc	1 (Each)
2.	Double ring infiltrometer	1
3.	Digital infiltrometer	1
4.	Parshall flume, cut throat flume	1
5.	V notch, Rectangular notch and trapezoidal notch	1
6.	Drip irrigation system with all accessories	-
7.	Sprinkler irrigation system with all accessories	-
8.	Required number of stop watches	-
9.	Weighing balance	1
10.	Catch cans, measuring jars	Required Numbers

Approved by BoS Chairman

VERTICALS

B.Tech.	B23AG901- ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To gain a comprehensive understanding of the principles of ergonomics and its significance in agricultural practices
2.	To explore human metabolism, including energy liberation and the types of metabolism
3.	To examine the human skeletal system, muscle structure, and physiological stresses.
4.	To learn to apply anthropometric principles to the design of tools and equipment.
5.	To investigate the human-machine interface in tractor design.

UNIT I	ERGONOMICS	9

Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metaboism- energy requirements at work – acceptable work load

UNIT II	PHYSIOLOGICAL FUNCTIONS	9

Human Skeletal system – muscle, structure and function - Physiological stress - Efficiency of work - Physical functions - Age and individual differences in physical functions- Physiological and operational criteria of physical activity

UNIT III	ENERGY EXPENDITURE	9

Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of Spraying-Weeding operations - Movements of body members- Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time

UNIT IV	ANTHROPOMETRY	9

Anthropometry – introduction- Types of data- Principles of applied anthrophometry - concept of percentile – Normal distribution – Estimating the range – Minimum and Maximum dimensions- Cost benefit analysis - applications of anthropometric data. Anthropometric consideration in tool / equipment design.

Approved by BoS Chairman

UNIT V	HUMAN ENGINEERING IN TRACTOR DESIGN	9
The operator – Machine Interface – Operator exposure to environmental factors – Thermal comport for tractor operator – Spatial, Visual and Control requirement of the operator – Occupational health hazards- Noise – Dust- Vibration in Tractor.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts of ergonomics and its role in agriculture.
CO2	Demonstrate an understanding of human metabolism and energy requirements.
CO3	Apply knowledge of physiological functions to assess work efficiency.
CO4	Analyze anthropometric data to evaluate the design of agricultural tools and equipment.
CO5	Evaluate the human-machine interface in tractor design.

Text Books	
1.	Mehta, C.R., Kumar, Adarsh, Gite, L.P., Agrawal, K.N. Textbook of Ergonomics and Safety in Agriculture, DKMA, ICAR, New Delhi. 2022.
2.	Sharma, D.N and Mukesh, S. Design of Agricultural Tractor- Principles and Problems, Jain Brothers, New Delhi. 2012.
3.	Hand Book of Agricultural Engineering, Indian Council of Agricultural Research, New Delhi. 2013. (ISBN : 978-81-7164-134-5)

References	
1.	Sanders, M. S. and McCormick, E. J., Human Factors in Engineering and Design, McGraw-Hill, Sixth Edition
2.	Bridger, R. S., Introduction to Ergonomics, Taylor and Francis Group, Third Edition
3.	Halander M, A Guide to Human factors and Ergonomics, Taylor and Francis Group, Second Edition
4.	https://onlinecourses.nptel.ac.in/noc24_mg108/preview

Approved by BoS Chairman

B.Tech.	B23AGE902- TILLAGE MECHANICS AND TRACTION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand of the mechanics involved in tillage tools.
2.	To analyze the dynamics of tillage, focusing on the design principles of tillage tools
3.	To explore the concepts of traction and mobility in agricultural machinery
4.	To evaluate the impact of tyre size and geometry on performance
5.	To apply concepts of soil compaction, variability, and geostatistics, utilizing GIS technology to analyze and improve soil dynamics

UNIT I	MECHANICS OF TILLAGE	9
Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts,stress strain relationship		

UNIT II	DYNAMICS OF TILLAGE	9
Design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics performance of tillage tools.		

UNIT III	TRACTION	9
Introduction to traction and mechanics, off road traction and mobility, traction model, tractionimprovement, traction prediction,		

UNIT IV	TYRES	9
Tyre size, tyre lug geometry and their effects, tyre testing		

UNIT V	APPLICATIONS	9
Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics.		
	Total Instructional Hours: 45	

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COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts and terminology related to the mechanics of tillage.
CO2	Demonstrate the principles of soil cutting and the design equations used in the analysis of tillage tools.
CO3	Apply their knowledge of traction mechanics to predict traction performance and suggest improvements for agricultural machinery
CO4	Analyze the effects of tyre geometry on performance
CO5	Evaluate the applications of soil dynamics and GIS in agriculture.

Text Books	
1.	Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub.Co. NewYork
2.	J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki , 1996. Tractors and their power units. Fourth ed. American Society of Agricultural Engineers, ASAE
3.	Hand Book of Agricultural Engineering, Indian Council of Agricultural Research,New Delhi. 2013. (ISBN : 978-81-7164-134-5)

References	
1.	Ralph Alcock.1986. Tractor Implements System. AVI Publ.
2.	S. C. Jain, Farm Machinery- An Approach
3.	https://onlinecourses.nptel.ac.in/noc24_ag04/preview

Approved by BoS Chairman

B.Tech.	B23AGE903- FARM POWER AND MACHINERY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To analyze the impact of farm mechanization on productivity, employment, and social and technological changes in agriculture.
2.	To evaluate the fixed and variable costs associated with farm machinery, including the effects of inflation and the economic viability of different machinery types.
3.	To develop skills to select and match tractors and farm machinery based on horsepower requirements and operational needs.
4.	To gain practical knowledge in the operation and adjustment of various farm machinery for land preparation, planting, and harvesting.
5.	To formulate and assess custom hiring projects, comparing ownership versus custom hiring services for economic viability in farm machinery use.

UNIT I	FARM MECHANIZATION	9
The role of farm mechanization and its relationship to productivity, employment, social and Technological change.- Farm Power availability- Mechanization status in India–performance index of power source and farm machinery -Scheduling of farm operations		

UNIT II	COST ANALYSIS	9
Farm records and inventory control - cost analysis of machinery: fixed cost and variable costs, effect of inflation on cost;Cost economics of tractor and farm machinery – land preparation, planting , intercultural, plant protection and harvesting machinery cost calculation		

UNIT III	MACHINERY SELECTION	9
Selection of tractor and farm machinery – Matching implements for different hp- computation of hp requirement -optimum machinery and Replacement criteria; Break-even analysis, reliability and cash flow problems		

UNIT IV	FARM MACHINERY OPERATION AND MANAGEMENT	9
Operations and adjustments of Land preparation , planting, intercultural, plant protection and harvesting machinery – management of machinery .		

UNIT V	CUSTOM HIRING MODELS	9

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Custom hiring project formulation – ownership vs custom hiring services- Economic viability of custom hiring service units – Replacement of farm machinery
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Identify key components of farm mechanization and its relationship to agricultural productivity and employment.
CO2	Explain the cost structures of farm machinery, including fixed and variable costs, and the impact of inflation on these costs.
CO3	Apply principles of machinery selection to determine the appropriate equipment for specific agricultural tasks based on horsepower and operational requirements.
CO4	Analyze the operational efficiency of various farm machinery and make adjustments to optimize performance during different farming operations.
CO5	Evaluate the economic viability of custom hiring services versus ownership of farm machinery, using break-even analysis and cash flow assessments to inform decision-making.

Text Books	
1.	Donnell Hunt , 2013, Farm Power and Machinery Management, Medtech; 10th edition (12 November 2013); scientific international
2.	Johl S S and Kapur T R 1989. Fundamentals of Farm Business Management, Kalyani Publishers , Ludhiana

References	
1.	Sharma D N and S.Mukesh, 2013. Farm Power and Machinery Management, Jain Brothers, New Delhi.
2.	Mahajan M 2001. Industrial Engineering and Production Management Dhanpet Rai and Co (P) Ltd. New Delhi

Approved by BoS Chairman

B.Tech.	B23AGE904- TESTING AND EVALUATION OF FARM MACHINERY AND EQUIPMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand testing and evaluation systems for agricultural tractors and machinery in India
2.	To perform various tests on agricultural machinery, including PTO performance tests, engine tests, and drawbar performance tests.
3.	To assess the performance of tillage and sowing equipment through laboratory and field tests
4.	To understand methodologies for testing intercultural equipment, including weeders and pesticide application devices, to ensure efficiency and safety.
5.	To acquire knowledge about safety testing methods for agricultural machinery.

UNIT I	TESTING OF AGRICULTURAL TRACTORS	9

Testing and evaluation system in India - Agricultural machinery situation -Mechanization policy – future prospects - standardization efforts - type of testing systems – General regulations - terminology- basic measurements, speed, fuel consumption, smoke density and power measurement - test items, specifications checking - PTO performance test- engine test, drawbar performance test - field test procedures -interpretation of results

UNIT II	TESTING OF TILLAGE AND SOWING EQUIPMENT	9

Testing of tillage machinery - laboratory test (hardness testing, chemical analysis) - field test (rate of work, quality of work, draft measurement, fuel consumption) - seed drill - laboratory test (seed drill calibration) - field checking and field tests

UNIT III	TESTING OF INTERCULTURAL EQUIPMENT	9

Testing and evaluation of weeders - types of tests for weeder - types of pesticide application equipment - terminology - types of tests for sprayers - testing methods - types of test for duster - testing methods

UNIT IV	TESTING OF COMBINE HARVESTER	9

Types of grain combines - combine systems - test items - procedure for laboratory testing - materials for field test - observations during field tests - sample analysis- data analysis - summary of performance parameters - analysis of field test data.

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UNIT V	SAFETY TESTING OF AGRICULTURAL MACHINERY	9
Types of agricultural machinery accidents - causes of agricultural machinery accidents - technical measurements for ensuring safety - methods of safety testing- ROPS and FOPS -safety precautions		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Identify the key components and terminology related to the testing and evaluation of agricultural tractors and machinery.
CO2	Explain the various testing methods and performance evaluation criteria for different types of agricultural equipment, including tillage and sowing machinery.
CO3	Apply testing procedures to conduct field tests on agricultural machinery, measuring parameters such as fuel consumption and work quality.
CO4	Analyze test results from laboratory and field evaluations to determine the performance and efficiency of agricultural equipment.
CO5	Evaluate safety measures and testing protocols for agricultural machinery, assessing the effectiveness of safety features

Text Books	
1.	Metha M.L., SR.Verma, K Mishra and VK Sharma. 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana
2.	Indian Standards Test Codes related to tractors, power tillers and agricultural implements

References	
1.	Anonymous. 1983. RNAM Test Codes & Procedures for Farm Machinery. Technical Series 12.
2.	Nebraska Tractor Test Codes for Testing Tractors, Nebraska, USA.

Approved by BoS Chairman

B.Tech.	B23AGE905 - FARM MACHINERY DESIGN AND PRODUCTION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand fundamental design parameters of agricultural machines and the overall design procedure.
2.	To explore the knowledge about the design and application of standard power transmission components in agricultural machinery
3.	To analyze the advancements in the production of agricultural machinery
4.	To implement heat treatment processes for steels, including pack carburizing and shot peening
5.	To understand the principles of quality management in agricultural machinery production

UNIT I	INTRODUCTION TO DESIGN PARAMETERS	9
Introduction to design parameters of agricultural machines & design procedure. Characteristics of farm machinery design. Research and development aspects of farm machinery.		

UNIT II	POWER TRANSMISSION COMPONENTS	9
Design of standard power transmission components used in agricultural machines: mechanical & hydraulic units. Introduction to safety in power transmission. Application of design principles to the systems of selected farm machines.		

UNIT III	PRODUCTION AND MATERIAL ADVANCES	9
Critical appraisal in production of Agricultural Machinery; Advances in material used for agricultural machinery. Cutting tools including CNC tools and finishing tools. Advanced manufacturing techniques including powder metallurgy, EDM (Electro-Discharge Machining).		

UNIT IV	HEAT TREATMENT AND QUALITY MANAGEMENT	9
Heat Treatment of steels including pack carburizing, shot pining process, etc. Limits, Fits & Tolerances, Jigs & Fixtures. Industrial lay-out planning.		

UNIT V	QUALITY MANAGEMENT	9
Quality production management. Reliability. Economics of process selection. Familiarization with Project Report.		

Approved by BoS Chairman

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Identify key design parameters and procedures relevant to agricultural machinery design.
CO2	Explain the functions and importance of power transmission components in agricultural machines, including safety considerations.
CO3	Apply advanced manufacturing techniques and material advancements in the production of agricultural machinery.
CO4	Analyze the effects of heat treatment processes on the properties of agricultural machinery components and assess their impact on performance.
CO5	Evaluate quality management practices in agricultural machinery production, assessing reliability and economic factors in process selection.

Text Books	
1.	Khurmi, R. S. and Gupta, J. K. 2012.Text Book of Machine Design.S Chand Publications
2.	Sharma, D. N. and Mukesh, 2010.S., Farm Machinery Design.2ndedition. LP, New Delhi.

References	
1.	Sharma, D. N. and Mukesh, S. 2012.Design of Agricultural Tractor.2nd edition. LP, New Delhi.

Approved by BoS Chairman

B.Tech.	B23AGE906 - PRECISION FARMING EQUIPMENTS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the role of Electronics
2.	To explore sensors and microcontrollers
3.	To implement precision farming concepts
4.	To develop site-specific management systems:
5.	To utilize unmanned vehicles and IoT

UNIT I	ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING	9

Role of electronics in agricultural engineering for precision agriculture. Basics of precision agriculture, tools for implementation of precision agriculture. Introduction of GIS/GPS positioning system for precision farming. Use of GIS and GPS in farm machinery and equipment.

UNIT II	SENSORS, MICROCONTROLLER AND ACTUATOR FOR PRECISION AGRICULTURE	9

Types of sensor- principle and concept of different sensor like ultrasonic, proximity, PIR, IR, radar, pressure, gas, temperature, moisture, strain /weight, colour sensor etc. used in agriculture. Microcontroller: Arduino, Raspberry Pi and PLC Actuator : DC Motor, Pump, linear Actuator etc. - Basic input circuits and signal conditioning systems – amplifiers and filters.

UNIT III	PRECISION FARMING CONCEPTS AND PRECISION FARMING MACHINERY	9

Precision farming concepts- Map based system- Real time system – Combination Map and real time system -components of PF – Site specific management- Constraints of PF- Precision tillage, planting, intercultural, plant protection and harvesting equipment, laser guided leveller, power sprayer, straw chopper cum spreader, straw bailer, combine harvester etc.

UNIT IV	SITE-SPECIFIC MANAGEMENT SYSTEM	9

Site-specific nutrient management- weeds management- Agro-chemicals and fertilizer management, data sources and decision making for site-specific management. Grain quality and yield. Yield monitoring and mapping, soil sampling and analysis.

Approved by BoS Chairman

UNIT V	UNMANNED VEHICLES AND IOT IN AGRICULTURE	9
UAV -Drones- Types - applications – rules and regulations – Autonomous ground vehicles – Robotics-platforms and unmanned agricultural vehicles- IoT - crop yield estimates- threat identification- crop insurance-pesticides spraying, environmental monitoring- protected cultivation- food quality monitoring etc,		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Identify the key components and technologies involved in precision agriculture, including GIS and GPS systems.
CO2	Explain the principles and functions of various sensors and microcontrollers used in agricultural Applications.
CO3	Apply precision farming concepts to real-world scenarios, utilizing appropriate machinery for site-specific agricultural practices.
CO4	Analyze data from site-specific management systems to make informed decisions regarding nutrient and weed management.
CO5	Evaluate the effectiveness of unmanned vehicles and IoT applications in agriculture, assessing their impact on crop yield and environmental sustainability.

Text Books	
1.	Hermann, J.H. 2013. Precision in Crop Farming, Site Specific Concepts and Sensing Methods: Applications and Results. Springer, Netherlands.
2.	Krishna, K. R. 2016. Push Button Agriculture Robotics, Drones, Satellite-Guided Soil and Crop Management. Apple Academic Press

References	
1.	Srivastava,A K., Carroll E.G., Roger P. R. and Dennis R.B.2006. Engineering Principles of Agricultural Machines. American Society of Agricultural and Biological Engineers, USA.
2.	Kepner, R.A., Bainer, R. and Berger, E.L. 1978. Principles of Farm Machinery.AVI Publ..

Approved by BoS Chairman

B.Tech.	B23AGE907 - SPECIAL FARM EQUIPMENTS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the importance of farm mechanization in modern agriculture.
2.	To study the construction, working, and applications of special farm equipment.
3.	To learn the principles and selection of implements for efficient field operations.
4.	To evaluate performance, cost-effectiveness, and energy efficiency of specialized machines.
5.	To gain knowledge of recent advances in precision and protected agriculture equipment.

UNIT I	EQUIPMENTS FOR SOIL WORKING	9

Implements for deep tillage – Subsoilers, Chisel ploughs, Rotary tillers – construction, working, performance evaluation. Equipment for minimum and conservation tillage. Special harrows and clod crushers.

UNIT II	SEEDING, PLANTING AND FERTILIZER APPLICATION	9

Specialized seed drills – Inclined plate, pneumatic planters, precision planters – metering mechanisms. Nursery raising machines, vegetable transplanters. Fertilizer applicators – band placement, fertigation units, and aerial application techniques.

UNIT III	PLANT PROTECTION EQUIPMENTS	9

Sprayers – power-operated, tractor-mounted, air-assisted, electrostatic sprayers. Dusters – knapsack, rotary, ultra-low volume sprayers. Drone-based spraying systems – advantages and limitations. Safety in pesticide application.

UNIT IV	EQUIPMENTS FOR INTERCULTURAL AND HARVESTING OPERATIONS	9

Weeders – cono weeder, power weeders, rotary weeders. Sugarcane cutter planters and ratoon management devices. Harvesting machines – self-propelled reapers, combine harvesters, root crop harvesters, forage harvesters. Performance evaluation and economics.

Approved by BoS Chairman

UNIT V	MODERN AND PROTECTED FARM EQUIPMENTS	9
Greenhouse and protected cultivation equipment – soil sterilizers, potting machines, shade-net irrigation stems. Precision farming tools – GPS/GIS-based equipment, drone applications, sensor-based nutrient plicators. Solar-powered farm equipment and recent trends in mechanization.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Identify and classify different special farm equipments and their functional requirements.
CO2	Apply principles of design and operation of specialized sowing, planting, and protection machinery.
CO3	Evaluate intercultural and harvesting equipment for performance and efficiency.
CO4	Analyze modern mechanization technologies for protected cultivation and precision farming.
CO5	Recommend suitable special equipment based on crop, soil, and farm conditions for sustainable agriculture.

Text Books	
1.	Jagadeeshwar, K. (2016). Elements of Agricultural Engineering. Kalyani Publishers.
2.	Michael, A.M. and Ojha, T.P. (2015). Principles of Agricultural Engineering Vol. I & II. Jain Brothers.
3.	Srivastava, A.K. et al. (2006). Engineering Principles of Agricultural Machines. ASABE.

References	
1.	Kepner, R.A., Bainer, R., and Barger, E.L. (2017). Principles of Farm Machinery. CBS Publishers.
2.	Singh, G. (2013). Farm Machinery – Principles and Applications. ICAR Publications.
3.	Hunt, D. (2012). Farm Power and Machinery Management. Waveland Press.
4.	Recent NPTEL Courses on Farm Machinery and Power Engineering.

Approved by BoS Chairman

B.Tech.	B23AGE908 – HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the hydrological cycle, including the processes of precipitation, evaporation, and infiltration.
2.	To explore the characteristics of watersheds and catchments.
3.	To examine the concepts of floods and droughts.
4.	To learn the principles of reservoir design, including site selection, storage estimation, and sedimentation management.
5.	To investigate the origin, classification, and properties of aquifers, focusing on groundwater flow equations.

UNIT I	PRECIPITATION AND ABSTRACTIONS	9

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods – Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration - Horton's equation - double ring infiltrometer, infiltration indices.

UNIT II	RUN OFF	9

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships - flow measurements - Hydrograph – Unit Hydrograph – IUH.

UNIT III	FLOOD, DROUGHT AND RESERVOIRS	9

Natural Disasters - Flood Estimation - Frequency analysis - Flood control - Definitions of droughts - Meteorological, hydrological and agricultural droughts - IMD method - NDVI analysis - Drought Prone Area Programme (DPAP), Classification of reservoirs, General principles of design, site selection, spillways, elevation – area, capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

UNIT IV	FLOOD ROUTING	9

Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing

Approved by BoS Chairman

UNIT V	GROUND WATER AND MANAGEMENT	9
Origin - Classification and types - properties of aquifers - governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Classify the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
CO2	Apply the knowledge of hydrological processes to address watershed characteristics, runoff and hydrograph
CO3	Organize the concept of hydrological extremes and its management strategies.
CO4	Classify different types of reservoirs and its storage methods.
CO5	Apply the concepts of steady and unsteady flow equation for groundwater modelling

Text Books	
1.	Subramanya .K. (2010), "Engineering Hydrology"- Tata McGraw Hill.
2.	Jayarami Reddy .P. (2008)"Hydrology", Tata McGraw Hill.
3.	Linsley, R.K. and Franzini, J.B. (1995) "Water Resources Engineering", McGraw Hill International Book Company.

References	
1.	David Keith Todd. (2007)"Groundwater Hydrology", John Wiley & Sons, Inc.
2.	VenTe Chow, Maidment, D.R. and Mays, L.W. (1998)"Applied Hydrology", McGraw Hill International Book Company.
3.	Raghunath .H.M., (1998)"Hydrology", Wiley Eastern Ltd.
4.	Iyer R. Ramaswamy, (2007) “Towards Water Wisdom: Limits, Justice, Harmony”, Sage Publications, New Delhi,
5.	https://nptel.ac.in/courses/105/105/105105110

Approved by BoS Chairman

B.Tech.	B23AGE909 - GROUNDWATER AND WELL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the groundwater occurrence and its temporal and spatial variability.
2.	To learn about the design, construction and maintenance of various types of water wells.
3.	To analyze the sources and causes of groundwater pollution.
4.	To explore strategies for managing groundwater resources.
5.	To evaluate the major issues related to groundwater development and management in India

UNIT I	GROUNDWATER OCCURRENCE	9

Occurrence of groundwater, temporal and spatial variability of groundwater, methods for groundwater exploration, determination of aquifer parameters, pumping tests, assessment of groundwater potential

UNIT II	WELL CONSTRUCTION	9

Groundwater structures, groundwater development and utilization, types of water wells, design and construction of water wells, drilling methods, well development, well maintenance and rehabilitation, groundwater monitoring, monitoring wells, design and construction of monitoring wells

UNIT III	GROUNDWATER POLLUTION	9

Groundwater development and quality considerations, groundwater contamination, sources and causes of groundwater pollution, contaminated systems and their rehabilitation, groundwater bioremediation, management of salt water ingress in inland and coastal aquifers.

UNIT IV	GROUNDWATER MANAGEMENT	9

Management of declining and rising water table, Natural and artificial groundwater recharge, Groundwater recharge basins and injection wells. Groundwater management in irrigation command, conjunctive water use, water lifting, different types of pumps, selection of pumps, pump characteristics curve, cost of groundwater pumping, comparative economics of surface and groundwater use for irrigation

UNIT V	GROUNDWATER DEVELOPMENT POLICIES	9

Major issues related to groundwater development and management in India, Legal aspects of groundwater exploitation, Diagnostic survey of sick wells/tube wells and their rehabilitation.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Classify the different aspects of groundwater and its parameters
CO2	Apply the concepts of Well hydraulics and different flow equations
CO3	Utilize the concepts of well designs for agriculture applications
CO4	Apply the theory behind well construction and management of wells.
CO5	Analyze the aspects of groundwater, its availability, assessment and utilization

Text Books	
1.	Walton, W.C. 1976. Groundwater Resource Evaluation. Mc Graw Hill. New York.
2.	Karanth, K.R. 1987. Groundwater Assessment, Development and Management. Tata-mcgraw Hill. New Delhi.
3.	Michael, A.M. and Khepar, S.D. 1989. Water Well and Pump Engineering. Tata-mcgraw Hill Publ. Co. New Delhi.

References	
1.	Giordano, M. and Villholth, K.G. 2007. The Agricultural Groundwater Revolution Volume 3.
2.	CABI Head Office, Nosworthy Way, Wallingford, Oxfordshire, OX10 8DE, UK Ghosh, N.C. and Sharma, K.D. 2006. Groundwater Modelling and Management.
3.	Madan Kumar Jha and Stefan Peiffer Applications of Remote Sensing and GIS Technologies in Groundwater Hydrology: Past, Present and Future.
4.	Todd, D.K., “Groundwater Hydrology”, John Wiley and Sons, New York, 1994
5.	https://onlinecourses.nptel.ac.in/noc24_ce83/preview

Approved by BoS Chairman

B.Tech.	B23AGE910 - WATERSHED PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental concepts of watersheds.
2.	To apply hydrologic data in the watershed planning process
3.	To evaluate participatory watershed management strategies and runoff management techniques.
4.	To create a detailed design for water harvesting structures, incorporating principles of in-situ and ex-situ moisture conservation
5.	To synthesize knowledge of various watershed development programs in India.

UNIT I	INTRODUCTION	9

Watershed – Definition - concept - Objectives – Land capability classification - Watershed Based Land Use Planning-Watershed Characteristics: Classification and Measurement- priority watersheds - land resource regions in India- Importance of Watershed Properties for Watershed Management.

UNIT II	WATERSHED PLANNING	9

Importance of Watershed Planning - Utility of Hydrologic Data in Watershed Planning -Watershed Delineation - Planning principles – collection of data – present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system

UNIT III	WATERSHED MANAGEMENT	9

Participatory watershed Management - run off management - Factors affecting runoff - Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands

UNIT IV	WATER CONSERVATION PRACTICES	9

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro catchment water harvesting - Ground water recharge – percolation ponds -Water harvesting Design of Water Harvesting Structures - Farm pond - Supplemental irrigation - Evaporation suppression - Seepage reduction

Approved by BoS Chairman

UNIT V	WATERSHED DEVELOPMENT PROGRAMME	9
River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rainfed Agriculture (NWDPRA) - Other similar projects operated in India – Govt. of India guidelines on watershed development programme - Watershed based rural development – infrastructure development - Use of Aerial photography and Remote sensing in watershed management - Role of NGOs in watershed development.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Explain the principles and concepts of watershed management.
CO2	Illustrate the principles of watershed planning
CO3	Demonstrate the skills on participatory watershed management and various control measures
CO4	Develop the water conservation practices for irrigated and dry tracts.
CO5	Build the goals and activities under various Watershed Development Programmes.

Text Books	
1.	Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
2.	Ghanshyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.

References	
1.	Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi..
2.	Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi
3.	Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi
4.	Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi
5.	Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.

Approved by BoS Chairman

B.Tech.	B23AGE911 - ON-FARM WATER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles of irrigation channel design
2.	To apply the concepts of command area management
3.	To analyze the conjunctive use of surface and groundwater resources
4.	To evaluate groundwater balance models and performance indicators
5.	To create comprehensive designs for farm drainage systems

UNIT I	DESIGN OF IRRIGATION CHANNELS	9

Design of Erodible (earthen), Non-Erodible (lined) & Alluvial channels (pre-fabricated) - Kennedy's and Lacey's Theories; Materials for Lining watercourses and field channel; Water control and Diversion structure - Design - Land grading - Land Levelling methods.

UNIT II	COMMAND AREA	9

Command area - Concept - CADA Programmes in Tamil Nadu; Duty of water expression - relationship between duty and delta; Warabandhi - water distribution and Rotational Irrigation System - Participatory irrigation management.

UNIT III	CONJUNCTIVE USE OF SURFACE AND GROUNDWATER	9

Availability of water - rainfall, canal supply and groundwater - conjunctive use - crop calendar Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water - Dependable rainfall - Rainfall analysis by Markov chain method - Probability matrix.

UNIT IV	WATER BALANCE	9

Groundwater balance model - Weekly water balance - Performance indicators Appropriateness, Adequacy, Dependability, Equity, Reliability, Timeliness and efficiency - conjunctive use plan by optimization; Agricultural productivity indicators - Water use efficiency.

UNIT V	DESIGN OF FARM DRAINAGE SYSTEM	9

Agricultural drainage – types and Concept - Issues; Principles of flow through soils - Darcy's law - drainage coefficient -Infiltration theory; Surface drainage - methods - design - Random drainage - Herringbone - Grid iron types -Design of Open Drains. Steady State flow - Dupit's Forchimer assumptions -Hooghoudt's equation; Methods & Design - Mole drains - Drainage wells - Pipe materials -Problem soils - Leaching Requirements; Land reclamation - methods of Reclamation.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Explain the design criteria for various types of irrigation channels
CO2	Demonstrate the ability to implement effective command area management strategies
CO3	Analyze water availability and irrigation demands, utilizing statistical methods to predict over and under-utilization of water resources
CO4	Evaluate groundwater balance models and performance indicators.
CO5	Design effective farm drainage systems, employing principles of soil flow and drainage methods

Text Books	
1.	Michael, A.M. 2006. “Irrigation Theory and practice”, Vikas publishing house, New Delhi
2.	Michael, A.M. and Ojha, T.P. “Principles of Agricultural Engineering -Vol II “,Jain Brothers, New Delhi,2002.

References	
1.	Israelson,“Irrigation principles and practices”, John Wiley & sons, New York, 2002..
2.	Modi, P.N., “Irrigation and water resources and water power engineering”, Standard Book House, New Delhi,2002.
3.	Suresh, R., “Land and water management principles”, Standard Publishers & Distributors,New Delhi,2008

Approved by BoS Chairman

B.Tech.	B23AGE912 - INTEGRATED FARMING SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental concepts of farming systems
2.	To analyze the components and characteristics of Integrated Farming Systems (IFS)
3.	To apply livestock production techniques within IFS
4.	To evaluate the benefits and types of agroforestry, aquaculture, and other IFS components
5.	To create resource recycling strategies within IFS

UNIT I	INTRODUCTION TO FARMING SYSTEM	9

Farming system – introduction – scope of farming system – importance – concept – principles of farming system - Types of farming systems – Advantages and limitations - suitability – factors affecting the farming system

UNIT II	INTEGRATED FARMING SYSTEM	9

Integrated farming system-historical background - objectives and characteristics advantages of IFS – Components of IFS - Integrated Farming System in Wetland – IFS in garden land –- IFS in dryland and fallow land

UNIT III	LIVESTOCK PRODUCTION IN IFS	9

IFS With Goats and Sheep – housing and feeding management – deworming – Young stock management - Dairy Farming in IFS - Fodder production in IFS - IFS With poultry rearing - Duck farming – Rabbit farming – Piggery

UNIT IV	IFS COMPONENTS	9

Agroforestry – definition – types of agroforestry system – benefits of agroforestry system– Aquaculture – Fish cum agriculture and horticulture – Beekeeping – types and cast of bees – care and management in beekeeping – Sericulture - Mulberry cultivation – Silkworm rearing – Organic farming – Azolla – Small scale nursery

UNIT V	RESOURCE RECYCLING IN IFS	9

Resource recycling in wetland IFS - Resource flow in crop + dairy + biogas + spawn + silviculture In

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IFS - Biogas production through IFS – Resource recycling in crop + goat IFS - Uses and features of biogas - Structure and function of Dheenabandhu Gas plant - Vermicompost - Preparation of vermicompost from farm residue – Mushroom production in IFS.
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Explain the various types of farming systems and their significance in sustainable agriculture,.
CO2	Analyze the components of Integrated Farming Systems
CO3	Apply effective livestock management practices within IFS.
CO4	Evaluate the integration of agroforestry, aquaculture, and other components in IFS
CO5	Design and implement resource recycling systems within IFS

Text Books	
1.	Nanda, Sankarsana. Integrated farming system practices: challenges and opportunities. New India Publishing Agency, 2016.
2.	Ravikiran Vasant Mane, Integrated Farming System: A Strategy for Sustainable Farm Production & Livelihood Security, Scitus Academics, 2016

References	
1.	Zaman, Integrated Farming System and Agricultural, New India Publishing Agency, 2019
2.	Nanwal R. K. Farming System and Sustainable Agriculture, Kalyani Publishers, 2017

Approved by BoS Chairman

B.Tech.	B23AGE913 - CLIMATE CHANGE AND ADAPTATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the earth's climate system.
2.	To understand the atmosphere and its compounds.
3.	To learn about the impacts of climate change on Agriculture, Forestry, Water Resources and other Ecosystems.
4.	To analyse the observed changes and their causes.
5.	To create knowledge on clean development mechanism and mitigation measures.

UNIT I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment - Ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.

UNIT II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere – Physical, Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Lapse rates - Temperature inversion - effects of inversion on pollution dispersion.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole - sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits - CDM - Initiatives in India - Kyoto Protocol Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – Global Scale and in India.

Approved by BoS Chairman

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel–Natural Compost – Eco friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy - Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) – Waste - MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the Greenhouse effect and Global warming concepts.
CO2	Classify the components of atmosphere.
CO3	Apply skills on impact studies on climate change.
CO4	Organize the observed changes, IPCC and UNFCC.
CO5	Choose mitigation measures and adaptation to climate change.

Text Books	
1.	Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007.

References	
1.	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
2.	Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3.	Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003.
4.	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.

Approved by BoS Chairman

B.Tech.	B23AGE914 - Rural Water Supply and Sanitation Engineering	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand sources of water and their quality standards for rural areas.
2.	To learn methods of water treatment, distribution, and storage.
3.	To study rural sanitation practices and waste disposal systems.
4.	To analyze appropriate low-cost and sustainable technologies.
5.	To evaluate rural water supply and sanitation programs.

UNIT I	INTRODUCTION TO WATER SUPPLY	9

Sources of water – surface and groundwater. Rural vs. urban water supply. Water demand – domestic, livestock, irrigation. Quality standards (IS/WHO).

UNIT II	WATER TREATMENT AND DISTRIBUTION	9

Sources of water – surface and groundwater. Rural vs. urban water supply. Water demand – domestic, livestock, irrigation. Quality standards (IS/WHO).

UNIT III	SANITATION SYSTEMS	9

Sanitation requirements in rural areas. On-site sanitation – septic tanks, pit latrines, twin pit toilets, biogas-linked toilets. Wastewater disposal methods.

UNIT IV	SOLID WASTE MANAGEMENT	9

Rural solid waste characteristics.
Composting, biogas production, recycling.
Faecal sludge management. Low-cost rural technologies.

UNIT V	**COMMUNITY PARTICIPATION AND PROGRAMS**	9

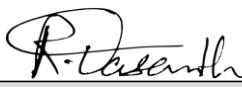
National Rural Drinking Water Program (NRDWP), Swachh Bharat Mission (SBM).
Water user associations, participatory irrigation management.
Operation, maintenance and sustainability issues.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Classify water sources and quality parameters for rural water supply.
CO2	Apply treatment methods for safe water distribution in rural areas.
CO3	Design low-cost sanitation systems for villages.
CO4	Evaluate solid and liquid waste management techniques.
CO5	Analyze rural water and sanitation programs for sustainability.

Text Books	
1.	Garg, S.K. (2010). Water Supply Engineering. Khanna Publishers.



Approved by BoS Chairman

B.Tech.	B23AGE915 - REFRIGERATION AND COLD STORAGE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To gain a foundational understanding of refrigeration principles.
2.	To explore the mechanics of vapor compression and vapor absorption cycles.
3.	To learn to apply psychrometric principles to analyze air properties and processes.
4.	To evaluate different types of air conditioning systems.
5.	To investigate the applications of refrigeration in food processing and preservation.

UNIT I	REFRIGERATION PRINCIPLES AND COMPONENTS	9

Refrigeration principles - refrigeration effect coefficient of performance -units of refrigeration - Refrigeration components – compressor – classification - principle and working – condensers - types construction, principle and working. Evaporators - types-principle and working. Expansion device types construction, principle and working. Refrigerants properties classification comparison and advantages chloroflouro carbon (CFC) refrigerants - effect on environmental pollution – alternate refrigerants

UNIT II	VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE	9

Simple vapour compression cycle - T-S diagram - p-h chart- vapour compression system-different types-vapour absorption cycle simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator Lithium bromide refrigeration-construction and principles.

UNIT III	APPLIED PSYCHROMETRY	9

Principle and properties of psychrometry, Representation of various psychometric processes on psychometric chart and their analysis, by-pass factor, sensible heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, apparatus dew point, ventilation and infiltration, energy efficiency ratio. Use of psychometric charts. Cooling and heating load calculations

UNIT IV	AIR CONDITIONING SYSTEM	9

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-application of refrigeration and air conditioning-domestic refrigerator and freezer- ice manufacture.

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UNIT V	APPLICATIONS OF REFRIGERATION IN FOOD PROCESSING AND PRESERVATION	9
Cooling and heating load estimation, cold storage design, types of cooling plants for cold storage. Insulation properties and types of insulation material. Cold storage for milk, meat, fruits, vegetables, poultry and marine products. Refrigerated Transport, Handling and Distribution, Cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display. Sensors for cold storage management.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Select appropriate components of the refrigeration unit and analyze the effect of different refrigerants on environment
CO2	Differentiate various refrigeration cycles and its applicability
CO3	Apply knowledge of psychrometry for air conditioning & various food processing operations
CO4	Apply the knowledge of refrigeration and air conditioning in persevering foods using domestic and industrial refrigeration systems
CO5	Choose and design appropriate cold storage system for ensuring the product quality

Text Books	
1.	C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2008
2.	Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009
3.	Roy J. Dossat, Principles of Refrigeration, Pearson Education, New Delhi, 2007

References	
1.	N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 2008
2.	Manohar Prasad, Refrigeration and Air Conditioning, Wiley Eastern Ltd., 2007
3.	J. B Hains, Automatic Control of Heating & Air conditioning, Tata McGraw Hill Publishing Company Private Limited, 2005
4.	https://onlinecourses.nptel.ac.in/noc19_me58/preview

Approved by BoS Chairman

B.Tech.	B23AGE916 - PRINCIPLES OF AGRICULTURAL ECONOMICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the agricultural economics, including its definitions, characteristics, and the role of agriculture
2.	To analyze the laws of demand and production.
3.	To evaluate cost concepts and market structures
4.	To explore the concepts of distribution theory, factor markets, and national income accounting
5.	To examine the importance of population theories, taxation systems, and the characteristics of different economic systems.

UNIT I	AGRICULTURAL ECONOMICS	9

Meaning, definition, characteristics of agriculture& horticulture,importance and its role in economic development. Planning and development of agriculture and allied sectors in the country

UNIT II	DEMAND AND LAWS OF RETURNS	9

Meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creationof utility, factors of production, input output relationship - Law of variable proportions and law of returns to scale.

UNIT III	COST AND MARKET STRUCTURE	9

Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply - meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

UNIT IV	DISTRIBUTION THEORY AND NATIONAL INCOME	9

Meaning, factor market and pricing of factors of production - Concepts of rent, wage, interest and profit - Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.Concept of money and inflation.

Approved by BoS Chairman

UNIT V	POPULATION, TAX AND ECONOMIC SYSTEMS	9
Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control - public revenue and public expenditure meaning, direct and indirect taxes, agricultural taxation, VAT - Concepts of economy and its functions, important features of capitalistic,socialistic and mixed economies, elements of economic planning.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts and terminology related to agricultural economics
CO2	Demonstrate the demand concepts by explaining the law of demand
CO3	Apply their knowledge of cost structures to analyze short-run and long-run cost curves
CO4	Analyze the factors affecting national income and distribution theory,
CO5	Evaluate the impact of population policies and taxation systems on economic growth.

Text Books	
1.	Barkley, A., & Barkley, P. W. (2016). Principles of agricultural economics. Routledge.

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B.Tech.	B23AGE917 - PROCESS ENGINEERING OF FRUITS AND VEGETABLES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand about internal composition of horticultural crops and different ripening methods.
2.	To learn the cleaning and grading of fruits and vegetables.
3.	To understand the preservation of fruits and vegetables related technologies.
4.	To know different dryers with working principles and their construction.
5.	To apply different storage conditions for fruits and vegetables.

UNIT I	STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE	9

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 – maturity indices - mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage.

UNIT II	CLEANING, GRADING AND ON-FARM PROCESSING	9

Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables – peeling - equipments – construction and working – pre-cooling – importance, methods, pretreatments and advantages.

UNIT III	PRESERVATION OF FRUITS AND VEGETABLES	9

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 IV	DRYING AND DEHYDRATION	9

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

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UNIT V	STORAGE	9
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.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand composition and ripening parameters of fruits.
CO2	Infer the grading and post harvest of fruits and vegetables.
CO3	Classify the preservation techniques for different fruits and vegetables.
CO4	Outline the working and construction of different dryers with its applications.
CO5	Apply skills about different storage and waxing of fruits.

Text Books	
1.	Fellows. P. 2000. Food Processing Technology – Principles and Practice, second edition, CRC Press, Woodland Publishing Limited, Cambridge, England.
2.	Sudheer K. P. and V. Indra.2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi.
3.	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.

References	
1.	Heid,J.L. and M.A.Joslyn. 1983. Food processing operations. Vol. II. AVI Publishing Co. Inc. Westport, Connecticut.
2.	Potter, N.N.1976. Food science. AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition.
3.	Norman W. Desrosier, and James N. Desrosier. The Technology of Food Preservation 4th Edition, CBS Publisher & Distributions, New Delhi, 2004.

Approved by BoS Chairman

B.Tech.	B23AGE918 - STORAGE AND PACKAGING TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand environment and storage relate structures.
2.	To know various kinds of packaging methods.
3.	To apply the storage techniques using different equipments.
4.	To learn the basics of canning operations.
5.	To create knowledge on special packaging techniques.

UNIT I	STORAGE ENVIRONMENT AND STORAGE STRUCTURES	9

Storage losses in agricultural commodities. Physical properties of grain affecting storability- Factors of spoilage- fungi and mycotoxins- Treatments for enhancing shelf life- Fumigation Processes for bag storage piles. Rural storage structures- Bag Storage and its Design - Parameters and types of storage structure. Bulk Storage in silos and large Bins Construction of Silos, Problems of Silo storage, relative Costs of Silo and Bag Storage. Quality Changes and remedial measures of Grains during storages. Design considerations and heat load calculation of cold storage

UNIT II	INTRODUCTION TO PACKAGING	9

Introduction Protection of Food products major role and functions of food packaging Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life. Estimating the shelf life requirement accelerated storage studies. Tests on packaging materials Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates.

UNIT III	CONTROLLED ATMOSPHERE STORAGE AND MODIFIED ATMOSPHERE PACKAGING	9

Introduction and concept of CA Storage Equipment for creating, maintaining and measuring controlled atmosphere - Biochemical aspects of CA storage - Static & Dynamic CA, Fruit Ripening, Hypobaric and Hyperbaric Storage. Effects of concentrations of compositional gases on Fruits and vegetables. MAP-Film & Coating types, Permeability, Gas Flushing, Perforation, Absorbents, Humidity, Temperature, Chilling Injury, Shrink wrapping, Vacuum Packing, Modified Interactive Packaging, Minimal Processing, Equilibrium Modified Atmosphere Packaging, Effect of scavengers.

UNIT IV	CANNING	9

Metal Cans and Glass Bottles as Packaging. Types of Metallic cans. Basics of Canning operations, Can closures. Glass jars and Bottles in food packaging, Design features and applications, Sterilization

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of bottles, advantages and problems, Bottle and jar closures, different types of caps and liners used. Plastics used and their Specific applications - Polyethylene (LDPE and HDPE),Cellulose, Polypropylene (PP), Polyesters, Polyvinylidene Chloride (PVDC Diofan, Ixan andSaran),Polyvinyl chloride, Copolymers their applications. Closing and sealing of Rigid plasticcontainers Seal types.

UNIT V	FLEXIBLE FILMS PACKAGING	9

Formation of Films and pouches, Co-extruded films and Laminates applications. Filling and Sealing of pouches and flexible plastic containers, Pouch form fill seal machines: Rigid and Semi rigid plastic packaging. Fabrication methods Thermo forming, Blow moulding, Injection moulding, Extrusion Blow moulding applications. Laminated Paper board Cartons, Fibre Board and Corrugated Card Board packaging - applications. Nano packaging and smart packaging. Printing on packages, Bar codes, Nutrition labeling and legislative requirements. Sensors and IoT in Food packaging

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand storage environment and storage losses.
CO2	Explain the various packaging techniques
CO3	Apply different storage techniques
CO4	Construct the different canning operations
CO5	Make use of special packaging techniques like nano packaging and print on packaging etc.

Text Books	
1.	Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.
2.	Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3.	Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.

References	
1.	Samuel Matz, The Chemistry and Technology of Cereals as Food and Feed, Chapman & Hall, 1992.
2.	N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman), Oxford, UK,1994.
3.	Ruth H. Matthews: Pulses Ã¢?? Chemistry, Technology and Nutrition Mercel Dekker Inc., USA,1989.
4.	Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993
5.	Donald Downing, Complete Course in Canning (3 Volumes) CTI Publications Inc, USA, 1996

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B.Tech.	B23AGE919 - FOOD PROCESS EQUIPMENT AND DESIGN	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental principles and concepts of process equipment design
2.	To apply the general design procedures and parameters for process equipment
3.	To analyze the design and operational principles of different types of heat exchangers
4.	To evaluate the design of conveying systems, including belt conveyors
5.	To create optimized designs using Computer-Aided Design (CAD) tools

UNIT I	PROCESS EQUIPMENT DESIGN	9
Introduction on process equipment design, principles and selection of food processing equipment Application of design engineering for processing equipment.		

UNIT II	DESIGN PROCEDURE	9
Design parameters and general design procedure, Material specification, Types of material for process equipment, Design codes, Pressure vessel design, Design of cleaners		

UNIT III	HEAT EXCHANGER	9
Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger Problems on tubular heat exchanger, shell and tube type heat exchanger and plate heat exchanger		

UNIT IV	CONVEYING SYSTEM	9
Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers. Design of milling equipment.		

UNIT V	CAD	9
Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design		
		Total Instructional Hours: 45

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COURSE OUTCOMES: Students will be able to	
CO1	Analyse the various process equipment design.
CO2	Understand the design procedure the development of vessels and cleaners.
CO3	Analyse the different types heat exchanger methods
CO4	Apply the different methods of conveying system
CO5	Optimize the variables using CAD for the process equipment design.

Text Books	
1.	Rajput R K, 2008 Heat and Mass Transfer. S Chand Publishers
2.	Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
3.	Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
4.	Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi

References	
1.	Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2.	Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
3.	McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.

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B.Tech.	B23AGE920 - EMERGING TECHNOLOGIES IN FOOD PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand and apply the different emerging technologies in processing of foods
2.	To analyze mechanism of electric field processing
3.	To understand the fundamentals food irradiation
4.	To evaluate various alternative non thermal processing techniques
5.	To analyze the thermal processing techniques

UNIT I	HIGH PRESSURE PROCESSING	9

Principles - Mechanism and applications of high pressure processing to food systems - High pressure processing of salads, meats and sea foods, fruits and fruit products -Effect of high pressure on microorganisms, enzymes, textural and nutritional quality of foods - Other applications of high pressure processing - High Pressure Freezing: principles and equipment, types of high pressure freezing process, microbiological and enzymatic inactivation after high pressure freezing.

UNIT II	PULSED ELECTRIC FIELDS PROCESSING	9

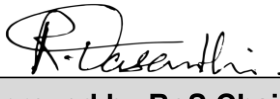
Principles - Mechanism - PEF treatment systems - Main processing parameters PEF technology Equipment - Applications - Mechanisms of microbial and enzyme inactivation. PEF processing of solid foods, liquid foods and beverages. Food safety aspects of pulsed electric fields.

UNIT III	FOOD IRRADIATION	9

Introduction - Fundamentals of food Irradiation - Type and sources of radiation, dosimetry, mode of action of ionizing radiation - Direct and indirect effect, radiation effect on food constituents, Dose requirement for different products and regulations

UNIT IV	ALTERNATIVE NON THERMAL PROCESSING TECHNIQUES	9

High intensity pulsed light technology:- principles of PLT technology - Technological aspects of PLT - Effects of PLT technology on microorganisms and food quality. Ultrasound Processing:Principle of ultrasound - Fundamentals - Ultrasound as a processing and food preservation tool - Effect of ultra sound on properties of foods - Applications of ultrasound in microbial inactivation, assisted drying, extraction, osmotic dehydration, detection of foreign bodies, filtration and freezing - challenges in ultrasound processing. Radio frequency electric fields: equipment, applications for heating and drying,



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effect of radio frequency electrical field on inactivation of microorganisms.

UNIT V	ALTERNATIVE THERMAL PROCESSING TECHNIQUES	9
Hurtle technology- Microwave heating and microwave drying: Microwaves - dielectric heating, dielectric properties of foods - thermal properties of foods - Recent developments in microwave heating - combined microwave-vacuum drying, microwave freeze-drying - applications. Case Study – development of a nonthermal processing technique for food and beverages.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the effect of high pressure processing on microbial inactivation of foods
CO2	Apply the principle of pulsed electric field and analyse the impact of pulsed electric field processing for both solid and liquid foods
CO3	Apply and assess the irradiation dosage requirement for foods
CO4	Apply non thermal technologies for inactivation of microorganisms and improve the food quality
CO5	Apply advanced thermal treatments for food processing and preservation

Text Books	
1.	Emerging Technologies for Food Processing. Da-Wen Sun (Ed), Academic Press, 2 Edition, 2014.
2.	Novel Food Processing Technologies. M. P. Cano, M. S. Tapia, and G. V. BarbosaCanovas, CRC Press, 1st Edition, 2004.

References	
1.	Maria Laura Passos, Claudio P. Ribeiro, Innovation in Food Engineering: New Techniques and Products, CRC press, 2010.
2.	Howard Q. Zhang, Gustavo V. Barbosa-Canovas, V. M. Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan, Nonthermal Processing Technologies for Food,2000
3.	Amit K. Jaiswal, Food Processing Technologies: Impact on Product Attributes. CRC Press, 2017

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B.Tech.	B23AGE921 - Sustainable Agriculture and Food Security	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand concepts of sustainability in agriculture.
2.	To study soil, water, and biodiversity conservation for food security.
3.	To learn integrated approaches to crop production and protection.
4.	To examine policies and programs for food security.
5.	To analyze climate change impacts and adaptation strategies.

UNIT I	INTRODUCTION TO SUSTAINABLE AGRICULTURE	9
Concept, principles and dimensions of sustainability. Green revolution vs. evergreen revolution. Agro-ecology and circular economy.		

UNIT II	NATURAL RESOURCE CONSERVATION	9
Soil health management, organic matter recycling, water use efficiency, watershed management. Biodiversity in farming systems.		

UNIT III	CROP MANAGEMENT STRATEGIES	9
Integrated nutrient management (INM), integrated pest management (IPM), integrated farming systems. Climate-smart agriculture.		

UNIT IV	FOOD SECURITY	9
Definition, pillars of food security. National Food Security Act. Public distribution system (PDS). Role of technology in achieving food security.		

UNIT V	EMERGING TRENDS	9
Precision farming, conservation agriculture, agroforestry, carbon farming. Climate adaptation and mitigation in agriculture.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Define sustainability concepts and their application in agriculture.

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CO2	Apply resource conservation methods for sustainable farming.
CO3	Integrate crop production and protection technologies.
CO4	Evaluate food security challenges and policy measures.
CO5	Recommend innovative strategies for climate-smart agriculture.

Text Books	
1.	Uphoff, N. (2002). Agroecological Innovations. Earthscan. Pretty, J. (2008). Sustainable Agriculture. Earthscan. FAO Reports on Climate-Smart Agriculture and Food Security.

References	
1.	Uphoff, N. (2002). Agroecological Innovations. Earthscan.
2.	Pretty, J. (2008). Sustainable Agriculture. Earthscan.
3.	FAO Reports on Climate-Smart Agriculture and Food Security.

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B.Tech.	B23AGE922 - MACHINE LEARNING FOR SOIL AND CROP MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the machine learning and deep learning concepts and their applications in agricultural practices.
2.	To analyze multivariate data using statistical techniques, enabling them to interpret complex agricultural datasets effectively.
3.	To apply principal component analysis (PCA) and regression methods.
4.	To evaluate various classification and clustering algorithms
5.	To implement advanced machine learning techniques, including diffuse reflectance spectroscopy and UAV applications.

UNIT I	INTRODUCTION TO MACHINE LEARNING AND DEEP LEARNING IN AGRICULTURE	9

Overview of ML and DL Applications - Understanding the role of machine learning (ML) and deep learning (DL) in enhancing agricultural practices. Key Concepts - Definitions, differences between ML and DL, and their relevance to agriculture - Case Studies - Examples of successful ML and DL applications in crop management, soil analysis, and yield prediction.

UNIT II	FUNDAMENTALS OF MULTIVARIATE DATA ANALYTICS	9

Introduction to Multivariate Data - Understanding the nature of multivariate data and its significance in agricultural research - Data Collection and Preparation - Techniques for collecting and preparing multivariate datasets for analysis - Statistical Techniques - Overview of statistical methods used in multivariate analysis, including correlation and covariance.

UNIT III	PRINCIPAL COMPONENT ANALYSIS AND REGRESSION IN AGRICULTURE	9

Principal Component Analysis (PCA): Understanding PCA, its purpose in dimensionality reduction, and its application in agricultural data - Regression Analysis: Exploring various regression techniques and their applications in predicting agricultural outcomes - Case Studies: Practical applications of PCA and regression in analyzing crop yield and soil health.

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UNIT IV	CLASSIFICATION AND CLUSTERING METHODS IN AGRICULTURE	9
Classification Techniques - Overview of classification algorithms - decision trees, support vector machines and their applications in crop classification and disease detection - Understanding clustering techniques - k-means, hierarchical clustering and their use in identifying patterns in agricultural data. Practical Applications - Case studies demonstrating the use of classification and clustering in precision agriculture.		

UNIT V	ADVANCED APPLICATIONS OF ML IN SOIL AND CROP MANAGEMENT	9
Diffuse Reflectance Spectroscopy - Basics and applications for analyzing crop and soil properties - UAV and Hyperspectral Remote Sensing - Exploring the use of drones and hyperspectral imaging in agricultural monitoring and analysis - Digital Soil Mapping - Techniques for digital soil mapping using continuous and categorical variables, including practical applications in soil management and conservation.		
	Total Instructional Hours: 45	

COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts and terminology related to machine learning and deep learning applications in agriculture.
CO2	Demonstrate an understanding of multivariate data analytics by explaining its significance and methods used in agricultural research.
CO3	Apply PCA and regression techniques to real-world agricultural datasets, producing meaningful analyses and predictions.
CO4	Analyze the effectiveness of different classification and clustering methods in agricultural contexts.
CO5	Evaluate the implementation of advanced ML techniques in soil and crop management

Text Books	
1.	Introduction to Multivariate Statistical Analysis in Chemometrics by Kurt Varmuza and Peter Filzmoser
2.	Using R for Digital Soil Mapping by Malone, Minasny, and McBratney

References	
1.	Attri, Ishana, Lalit Kumar Awasthi, and Teek Parval Sharma. "Machine learning in agriculture: a review of crop management applications." Multimedia Tools and Applications 83, no. 5 (2024): 12875-12915.
2.	Padarian J, Minasny B, McBratney AB. Machine learning and soil sciences: A review aided by machine learning tools. Soil. 2020 Feb 6;6(1):35-52.
3.	https://onlinecourses.nptel.ac.in/noc22_ag05/preview

Approved by BoS Chairman

B.Tech.	B23AGE923 - PROTECTED CULTIVATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know about various types of protected cultivation.
2.	To understand the protected cultivation technology of vegetable crops.
3.	To create knowledge on hi-tech protected cultivation of flower crops.
4.	To understand the precision farming techniques and tools used.
5.	To acquire skill on the precision farming of horticultural crops.

UNIT I	PROTECTED CULTIVATION AND ITS TYPES	9

Importance and methods of protected culture in horticultural crops - Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, 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.

UNIT II	PROTECTED CULTIVATION OF VEGETABLE CROPS	9

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.

UNIT III	PROTECTED CULTIVATION OF FLOWER CROPS	9

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.

UNIT IV	PRECISION FARMING TECHNIQUES	9

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

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management (PPM) – Remote sensing.

UNIT V	PRECISION FARMING OF HORTICULTURAL CROPS	9
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.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand knowledge on Protected cultivation.
CO2	Apply protected cultivation techniques for vegetable crops.
CO3	Select Hi-tech protected cultivation methods for flower crops.
CO4	Make use of the various precision tools for farming.
CO5	Categorize the precision farming techniques of Horticultural crops.

Text Books	
1.	Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
2.	Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.

References	
1.	Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
2.	David Reed. 1996. Water, Media and nutrition for green house crops. Ball publishing USA.
3.	Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors, Darya ganj, New Delhi.
4.	https://nptel.ac.in/courses/126/105/126105014/

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B.Tech.	B23AGE924 - IT IN AGRICULTURAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand about precision farming methods
2.	To learn the artificial environment control and expert systems in agriculture.
3.	To understand the agriculture systems and its resources.
4.	To know different weather prediction models.
5.	To apply different decision support systems in agriculture systems.

UNIT I	PRECISION FARMING	9

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II	ENVIRONMENT CONTROL SYSTEMS	9

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..

UNIT III	AGRICULTURAL SYSTEMS MANAGEMENT	9

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.

UNIT IV	WEATHER PREDICTION MODELS	9

Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

UNIT V	E-GOVERNANCE IN AGRICULTURAL SYSTEMS	9

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.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Understand the applications of IT in remote sensing applications such as Drones etc..
CO2	Explain how a greenhouse can be automated and its advantages.
CO3	Apply IT principles and concepts for management of field operations.
CO4	Understand the about weather models, their inputs and applications.
CO5	Apply IT can be used for e-governance in agriculture.

Text Books	
1.	National Research Council, “Precision Agriculture in the 21st Century”, National Academies Press, Canada, 1997.
2.	H. Krug, Liebig, H.P. “International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation”, 1989.

References	
1.	Peart, R.M., and Shoup, W. D., “Agricultural Systems Management”, Marcel Dekker, New York, 2004.
2.	Potter, N.N.1976. Food science. AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition.
3.	Hammer, G.L., Nicholls, N., and Mitchell, C., “Applications of Seasonal Climate”, Springer, Germany, 2000.

Approved by BoS Chairman

B.Tech.	B23AGE925 - UAV APPLICATIONS IN AGRICULTURE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand of various types of UAV systems and their applications in agriculture.
2.	To apply remote sensing techniques for effective crop monitoring and health assessment.
3.	To explore the principles of precision agriculture and how UAV technology can be integrated with smart sensors and IoT applications.
4.	To develop skills in UAV-based soil assessment techniques
5.	To apply UAV technology in pest detection and integrated pest management (IPM) strategies

UNIT I	INTRODUCTION TO UAV TECHNOLOGY IN AGRICULTURE	9

Fundamentals of UAV types and systems - Regulatory framework and safety protocols for agricultural UAV operations - Basic principles of remote sensing - UAV mission planning and execution - Data collection methodologies

UNIT II	CROP MONITORING AND HEALTH ASSESSMENT	9

Remote sensing techniques for crop monitoring - Vegetation indices and their interpretation - Phenological observations using UAVs - Crop health status assessment - Early disease detection and monitoring

UNIT III	PRECISION AGRICULTURE AND UAV INTEGRATION	9

Principles of precision agriculture - Integration of UAV technology in precision farming - Smart sensors and IoT applications - Data analytics and artificial intelligence in agriculture - Variable-rate application technologies - Resource optimization strategies

UNIT IV	SOIL ANALYSIS AND MAPPING	9

UAV-based soil assessment techniques - Soil electrical conductivity mapping - Moisture content monitoring - Nutrient level assessment - Terrain mapping and analysis - Integration with ground-based sensors

UNIT V	PEST MANAGEMENT AND CROP PROTECTION	9

UAV applications in pest detection - Integrated Pest Management (IPM) strategies - Precision spraying techniques - Crop damage assessment - Disease identification and monitoring - Data-driven decision making for pest control

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Identify different types of UAV systems and their specific applications in agricultural settings.
CO2	Explain the basic principles of remote sensing and how they apply to crop monitoring and health assessment.
CO3	Demonstrate the use of UAV technology in precision agriculture by integrating smart sensors and IoT applications to optimize resource use.
CO4	Analyze soil data collected via UAVs to assess soil health and make informed decisions regarding nutrient management.
CO5	Evaluate the effectiveness of UAV applications in pest management and crop protection

Text Books	
1.	Mgendi, G., 2024. Unlocking the potential of precision agriculture for sustainable farming. Discover Agriculture, 2(1), p.87.
2.	Halliday, B., 2017. Drones: The Complete Collection Three books in one. Drones The Professional Drone Pilot's Manual, Drones Mastering Flight Techniques, Drones Fly Your Drone Anywhere Without Getting Busted. CreateSpace Independent Publishing Platform.

References	
1.	Guebsi, R., Mami, S. and Chokmani, K., 2024. Drones in precision agriculture: A comprehensive review of applications, technologies, and challenges. Drones, 8(11), p.686.
2.	Lamine, S., Srivastava, P.K., Kayad, A., Arriola, F.M. and Pandey, P.C. eds., 2023. Remote Sensing in Precision Agriculture: Transforming Scientific Advancement into Innovation. Elsevier.

Approved by BoS Chairman

B.Tech.	B23AGE926 - IoT CONCEPTS AND APPLICATIONS IN AGRICULTURE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To explain the fundamental concepts of IoT and its historical context in agriculture.
2.	To identify and describe various sensor technologies and communication protocols used in agricultural IoT applications.
3.	To analyze and evaluate the applications of IoT in precision agriculture, automated irrigation, and crop monitoring.
4.	To assess the benefits and challenges associated with the implementation of IoT in agriculture, including data security and technology adoption barriers.
5.	To explore and discuss emerging technologies and innovations in agricultural IoT, including their implications for sustainability and food security.

UNIT I	INTRODUCTION TO IOT IN AGRICULTURE	9

Overview of IoT - Definition and fundamental concepts of IoT - Historical Context: Evolution of agriculture and technology integration - Importance of IoT in Agriculture - Discuss the role of IoT in enhancing productivity and sustainability in farming practices.

UNIT II	IOT TECHNOLOGIES AND INFRASTRUCTURE	9

Sensor Technologies - Types of sensors used in agriculture (e.g., soil moisture, temperature, humidity) - Communication Protocols: Overview of protocols used in agricultural IoT (e.g., MQTT, CoAP) - Data Management: Techniques for data collection, storage, and analysis in agricultural settings.

UNIT III	APPLICATIONS OF IOT IN SMART FARMING	9

Precision Agriculture - Techniques for optimizing field-level management regarding crop farming - Automated Irrigation Systems - How IoT enables efficient water management through automation - Crop Monitoring and Management: Use of IoT for real-time monitoring of crop health and growth conditions.

UNIT IV	BENEFITS AND CHALLENGES OF IOT IN AGRICULTURE	9

Advantages - Increased efficiency, reduced waste, and enhanced decision-making capabilities – Challenges - Addressing issues such as data security, technology adoption barriers, and infrastructure limitations - Case Studies - Examination of successful IoT implementations in agriculture.

UNIT V	FUTURE TRENDS AND INNOVATIONS IN AGRICULTURAL IOT	9

Emerging Technologies - Exploration of AI, machine learning, and big data analytics in agriculture -

Approved by BoS Chairman

Sustainability and Food Security - How IoT can contribute to sustainable agricultural practices and food security - Policy and Ethical Considerations: Discussion on regulations and ethical implications of IoT in agriculture.
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand of IoT concepts and their relevance to modern agricultural practices
CO2	Apply knowledge of sensor technologies and communication protocols to design basic IoT solutions
CO3	Analyze case studies of IoT applications in agriculture, identifying strengths and weaknesses in their implementation.
CO4	Evaluate the impact of IoT on agricultural productivity and sustainability
CO5	Synthesize information from various sources to propose innovative IoT solutions.

Text Books	
1.	Peart, R.M., and Shoup, W. D., “Agricultural Systems Management”, Marcel Dekker, New York, 2004.
2.	Sadiku, M.N., Ashaolu, T.J., Ajayi-Majebi, A. and Musa, S.M., 2021. Internet of things in agriculture: a primer. Int J Sci Adv, 22, pp.215-220.

References	
1.	Farooq, M.S., Riaz, S., Abid, A., Umer, T. and Zikria, Y.B., 2020. Role of IoT technology in agriculture: A systematic literature review. Electronics, 9(2), p.319.

Approved by BoS Chairman

B.Tech.	B23AGE927 - SYSTEMS ANALYSIS IN AGRICULTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the students to the application of systems concept to agricultural engineering problems, planning and management.
2.	To understand the linear &Dynamic programming applied in agriculture.
3.	To acquire the knowledge on different simulation methods for agriculture engineering.
4.	To learn the neural networks application in agriculture engineering.
5.	To understand the basics of fuzzy logic and genetic algorithm applications.

UNIT I	SYSTEM CONCEPTS	9
Definition, classification and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation		

UNIT II	LINEAR PROGRAMMING	9
Introduction to operations research – Linear programming, problem formulation, graphical solution by simplex method – Sensitivity analysis.		

UNIT III	DYNAMIC PROGRAMMING	9
Dynamic Programming – Concepts – Problem formulation – Optimal solution – Applications in Agriculture Engineering problems.		

UNIT IV	SIMULATION	9
Basic principles and concepts – Random variate and random process – Monte Carlo techniques – Model development – Inputs and outputs – Deterministic and stochastic simulation – Irrigation Scheduling - application.		

UNIT V	NEURAL NETWORKS & FUZZY LOGIC	9
Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques - Basic concepts of fuzzy logic, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic and applications.		
		Total Instructional Hours: 45

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COURSE OUTCOMES: Students will be able to	
CO1	Explain system concepts and will be able to apply the optimization techniques like LP, DP.
CO2	Apply simulation modelling in agricultural engineering.
CO3	Apply ANN in agricultural applications.
CO4	Understand fuzzy logic concepts in agriculture and irrigation.
CO5	Demonstrate the Genetic Algorithm and it's working principles.

Text Books	
1.	Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2.	Robert M Peart and W David Shoup, Agricultural Systems Management – Optimizing efficiency and performance, CRC Press, 2013.
3.	Gupta, P.K., and Man Mohan, “Problems in Operations Research”, (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.

References	
1.	Chaturvedidi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi, 1997.
2.	Taha, H.A., “Operations Research”, McMillan Publication Co., New York, 1995.
3.	Hiller, F.S., and Liebermann, G.J., “Operations Research”, CBS Publications and Distributions, New Delhi, 1992.

Approved by BoS Chairman

B.Tech.	B23AGE928 - Mulching Technology for Crop Production	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study principles and types of mulching in agriculture.
2.	To learn materials used for mulching and their properties.
3.	To evaluate effects of mulching on soil, water, and crops.
4.	To design and operate mulch-laying equipment.
5.	To analyze economics and environmental impact of mulching.

UNIT I	INTRODUCTION TO MULCHING	9
Definition, objectives, principles. Historical development. Types – organic, inorganic, living mulches. Sources of water – surface and groundwater. Rural vs. urban water supply. Water demand – domestic, livestock, irrigation. Quality standards (IS/WHO).		

UNIT II	MATERIALS AND PROPERTIES	9
Straw, leaves, compost, plastics, biodegradable films, synthetic mulches. Reflective and colored mulches. Thermal and physical properties.\		

UNIT III	EFFECTS OF MULCHING	9
Soil temperature, soil moisture, weed control, nutrient conservation. Effects on crop growth, yield, and quality.		

UNIT IV	EQUIPMENT FOR MULCHING	9
Mulch laying machines – manual and tractor-operated. Plastic mulch removal machines. Fertigation with mulching.		

UNIT V	ECONOMICS AND ENVIRONMENTAL IMPACT	9
Cost–benefit of mulching. Residue management. Biodegradable mulches and sustainability issues. Case studies.		
	Total Instructional Hours: 45	

COURSE OUTCOMES: Students will be able to	
CO1	Classify water sources and quality parameters for rural water supply.
CO2	Apply treatment methods for safe water distribution in rural areas.
CO3	Design low-cost sanitation systems for villages.

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CO4	Evaluate solid and liquid waste management techniques.
CO5	Analyze rural water and sanitation programs for sustainability.

References	
1.	Garg, S.K. (2010). Water Supply Engineering. Khanna Publishers.
2.	Punmia, B.C. (2016). Water Supply Engineering. Laxmi Publications.
3.	Eawag (2015). Compendium of Sanitation Systems and Technologies.

Approved by BoS Chairman

B.Tech.	B23AGE929 - BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the types of biomass, the fuels derived from it, and the methods used for biomass fuel characterization.
2.	To learn about the biochemical degradation of biomass.
3.	To analyze thermochemical conversion methods.
4	To evaluate different cogeneration technologies and waste heat recovery systems
5.	To apply their knowledge of biomass energy systems to real-world scenarios

UNIT I	BIOMASS CHARACTERIZATION	9

Biomass – types – fuels from biomass. Terms and units used in biomass production. Biomass fuel characterization – physical, chemical and thermal – energy release. Supply chain – harvesting / collection – transportation and processing. Briquetting – types – pelletizing.

UNIT II	BIOCHEMICAL CONVERSION	9

Biochemical degradation – factors affecting biogas production - types of biogas plants – construction details – operation and maintenance – utilization of biogas - slurry handling, utilization and enrichment – high rate biomethanation process – landfills – bioethanol – feedstock – process – utilization - composting - methods – machinery.

UNIT III	THERMO CHEMICAL CONVERSION BY COMBUSTION	9

Thermochemical degradation. stoichiometric air requirement - Combustion process – chemistry of combustion - combustion zones - emissions. Cofiring of biomass. Incinerators - layout. Combustion of wastes and MSW. Wood burning stoves - types- operation

UNIT IV	THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS	9

Biomass gasification – chemistry of gasification – types of gasifier – Gas cleaning & conditioning - utilization of producer gas - emissions – commercial gasifies plants. Pyrolysis – product recovery – types - biochar – bio oil – operation – recovery.

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UNIT V	COGENERATION AND WASTE HEAT RECOVERY	9
Cogeneration technologies – cycles – topping – bottoming – problems – applications – selection. Waste heat recovery - plate heat exchangers - waste heat boilers - heat pumps - thermic fluid heaters - selection of waste heat recovery.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Recall the key concepts of biomass identification and classes
CO2	Demonstrate biomass characters and biochemical conversion.
CO3	Apply their thermo chemical conversion techniques and cogeneration from waste
CO4	Analyze cogeneration technologies and waste heat recovery systems
CO5	Evaluate the effectiveness of different biomass conversion technologies

Text Books	
1.	Chawla, O.P.1986. “Advances in Biogas Technology”. ICAR Publication, New Delhi.
2.	Rao. S and B.B. Parulekar. 2000. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi.
3.	Horlock JH, 1987. Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford Press.

References	
1.	Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi
2.	Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.
3.	Mathur,A.N. and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi
4.	https://archive.nptel.ac.in/courses/103/103/103103207/

Approved by BoS Chairman

B.Tech.	B23AGE930 - WASTE AND BY PRODUCT UTILIZATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the wastewater treatment, including the types of waste generated in food processing industries.
2.	To learn to analyze the chemical properties of wastewater
3.	To explore methods for utilizing by-products from wastewater
4.	To evaluate various wastewater processing techniques, including pre-treatment, secondary, and tertiary treatment methods
5.	To examine advanced wastewater treatment processes, focusing on the removal of specific contaminants and the assessment

UNIT I	INTRODUCTION TO WASTE WATER TREATMENT	9

Types and formation of by-products and waste; magnitude of Waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment.

UNIT II	CHEMICAL PROPERTIES	9

Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbigy of waste, other ingredients like insecticide, pesticides and fungicides residues.

UNIT III	BY-PRODUCT UTILIZATION	9

Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting.

UNIT IV	PROCESSING TECHNIQUES	9

Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary• treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.

UNIT V	ADVANCED WASTE WATER TREATMENT PROCESSES	9

Approved by BoS Chairman

Sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation.
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts and terminology related to wastewater treatment
CO2	Demonstrate an understanding of the chemical properties of wastewater
CO3	Apply their knowledge of by-product utilization to propose practical solutions
CO4	Analyze different wastewater processing techniques.
CO5	Evaluate advanced wastewater treatment processes

Text Books	
1.	Huang, R.T. 1982. Compost Engineering: Principles and Practices.John Willey & Sons, NewYork.
2.	Joseph C A., (2019)"Anaerobic Waste-Wastewater Treatment and Biogas Plants-A Practical Handbook", CRC Press,
3.	Antoine P. T., (2017) "Biofuels from Food Waste Applications of Saccharification Using Fungal Solid State Fermentation", CRC press

References	
1.	Standards, ASAE: Manure Production and Characteristics. ASAE, NewYork.
2.	USDA: Agricultural Waste Management Field Hand Book, New York, USA..
3.	Palmiro P. and Oscar F.D'Urso, (2016) 'Biotransformation of Agricultural Waste and By Products',The Food, Feed, Fibre, Fuel (4F) Economy, Elsevier
4.	Kaur Brar S., Gurpreet Singh D. and Carlos R.S., (Eds), (2014)'Biotransformation of Waste Biomass into High Value Biochemicals', Springer.
5.	https://archive.nptel.ac.in/courses/105/103/105103205/

Approved by BoS Chairman

B.Tech.	B23AGE931 - Energy Requirement in Agricultural crops and Farms	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand Energy Concepts in agriculture crop production
2.	To analyze energy inputs and outputs
3.	To explore renewable energy options.
4.	To implement energy management strategies.
5.	To evaluate future trends and emerging technologies in agriculture.

UNIT I	INTRODUCTION TO ENERGY IN AGRICULTURE	9

Overview of energy concepts in agriculture - Types of energy used in agricultural practices (direct and indirect) - The role of energy in crop production and farm operations - Energy consumption trends in the agri-food chain

UNIT II	ENERGY INPUTS AND OUTPUTS IN CROP PRODUCTION	9

Analysis of energy inputs for various agricultural operations (e.g., planting, irrigation, harvesting) - Understanding energy outputs in terms of crop yield and quality - The relationship between energy use and agricultural productivity - Case studies on energy efficiency in crop production

UNIT III	RENEWABLE ENERGY SOURCES IN AGRICULTURE	9

Exploration of renewable energy options (solar, wind, biomass) for agricultural applications - Benefits and challenges of integrating renewable energy into farming practices - Practical applications of bioenergy in crop production and farm management - Policy and regulatory frameworks supporting renewable energy in agriculture

UNIT IV	ENERGY MANAGEMENT AND OPTIMIZATION STRATEGIES	9

Techniques for assessing energy consumption on farms - Strategies for optimizing energy use in agricultural operations - The role of technology and innovation in energy management - Economic implications of energy efficiency measures in farming

UNIT V	FUTURE TRENDS IN AGRICULTURAL ENERGY USE	9

Emerging technologies and their impact on energy requirements in agriculture - The role of precision agriculture in energy optimization - Sustainability considerations and the future of energy in agriculture - Research and development trends in agricultural energy management.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Identify different types of energy used in agricultural practices and their respective roles in crop production.
CO2	Explain the relationship between energy inputs and outputs in crop production, including how energy efficiency impacts agricultural productivity..
CO3	Demonstrate the use of renewable energy sources in agricultural applications and assess their feasibility for specific farming practices.
CO4	Analyze energy consumption data on farms to identify areas for improvement and develop strategies for energy optimization..
CO5	Evaluate the implications of emerging technologies on energy requirements in agriculture

Text Books	
1.	Solanki, C.S. “Renewable Energy Technologies: A Practical guide for beginners”, PHI learning Pvt. Ltd, New Delhi. 2008.
2.	Bouley James .E & David Follis - Biochemical Engineering Fundamentals McGraw-Hill publishing company, Tokyo.1986

References	
1.	Rao. S and B.B. Parulekar. “Energy Technology – Non conventional, Renewable and Conventional”, Khanna Publishers, Delhi, 2000.
2.	Rajput. R.K. “Non- Conventional Energy Sources and Utilization”, S. Chand & Company Pvt. Ltd, New Delhi, 2013..

Approved by BoS Chairman

B.Tech.	B23AGE932 - ENERGY CONSERVATION IN AGRO INDUSTRIAL UTILITIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To explain the fundamental concepts of energy, power, and their consumption patterns at global and national levels.
2.	To analyze energy consumption patterns in electrical systems including transformers, motors, and illumination systems.
3.	To evaluate the thermal system and computation process.
4.	To evaluate the effectiveness of different energy conservation measures in agro-industrial settings
5.	To develop comprehensive energy management plans for agro-industrial facilities

UNIT I	INTRODUCTION	9

Energy - Power – Past & Present scenario of World; National Energy consumption Data - Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, - Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II	ELECTRICAL SYSTEMS	9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III	THERMAL SYSTEMS	9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV	ENERGY CONSERVATION IN MAJOR UTILITIES	9

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems Cooling Towers – D.G. sets

UNIT V	ENERGY CONSERVATION AND AUDIT IN AGRO-INDUSTRIES	9

Overview of energy consumption in agro-industrial utilities - Importance of energy conservation for sustainability and cost reduction - Key concepts and principles of energy management - Definition and objectives of energy audits - Types of energy audits: pre-audit, audit, and post-audit - Methodologies for conducting energy audits in nonindustrial utilities - Tools and instruments used in energy auditing

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Explain the principles of energy conservation and management in the context of agro-industrial applications
CO2	Apply different electrical components and systems
CO3	Apply computation process of thermal systems
CO4	Construct the different conservation techniques and utilities
CO5	Describe the methodology of energy auditing and the role of energy managers in implementing conservation strategies

Text Books	
1.	Rao. S and B.B. Parulekar. 2000. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi.
2.	Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India, 2011

References	
1.	Eastop T. D. and D. R. Croft, Energy Efficiency for Engineers & Technologists, Longman, 1990
2.	Doty S. and W. C. Turner, Energy Management Hand book, 7/e, Fairmont Press, 2009.

Approved by BoS Chairman

B.Tech.	B23AGE933 - FARM LEVEL ENERGY AUDITING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the Fundamentals of Energy Auditing
2.	To analyze Energy Consumption Patterns:
3.	To identify and Evaluate Energy Efficiency Measures
4.	To integrate Renewable Energy Solutions
5.	To develop Reporting and Continuous Improvement Strategies

UNIT I	INTRODUCTION TO ENERGY AUDITING	9

Overview of Energy Auditing - Definition, importance, and objectives of energy audits in agricultural settings - Types of Energy Audits: Walkthrough of different audit types (preliminary, detailed, investment-grade) - Regulatory Framework: Understanding local and national regulations affecting energy use in agriculture.

UNIT II	ENERGY CONSUMPTION ANALYSIS	9

Data Collection Techniques - Methods for gathering energy consumption data on farms (meter readings, utility bills) - Energy Use Pattern - Analyzing energy consumption patterns in various farm operations (irrigation, heating, cooling) – Benchmarking - Establishing benchmarks for energy use based on similar agricultural operations.

UNIT III	ENERGY EFFICIENCY MEASURES	9

Identifying Opportunities - Techniques for identifying energy-saving opportunities in farm operations - Technologies and Practices - Overview of energy-efficient technologies (solar panels, energy-efficient motors) and best practices (crop rotation, soil management) - Cost-Benefit Analysis - Evaluating the financial implications of implementing energy efficiency measures.

UNIT IV	RENEWABLE ENERGY INTEGRATION	9

Renewable Energy Sources - Introduction to solar, wind, and biomass energy options for farms - Feasibility Studies - Conducting feasibility studies for renewable energy projects on farms - Incentives and Funding - Exploring available grants, subsidies, and incentives for renewable energy adoption in agriculture.

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UNIT V	REPORTING AND CONTINUOUS IMPROVEMENT	9
Audit Reporting - Best practices for documenting audit findings and recommendations - Implementation Strategies - Developing action plans for implementing energy efficiency measures - Monitoring and Evaluation - Establishing metrics for ongoing evaluation of energy use and efficiency improvements.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Define key terms and concepts related to energy auditing and its significance in agriculture.
CO2	Explain the different types of energy audits and the regulatory frameworks that govern energy use in agricultural practices.
CO3	Demonstrate data collection techniques and apply analytical methods to assess energy consumption patterns on farms.
CO4	Analyze energy efficiency measures and conduct cost-benefit analyses to determine the viability of various energy-saving technologies.
CO5	Develop comprehensive audit reports and action plans that outline strategies for implementing energy efficiency measures

Text Books	
1.	Murphy, W. R. (2007), Energy Management (1st edition), Elsevier India Private Limited
2.	De, B. K., (2010), Energy Management audit & Conservation, (2nd Edition), VrindaPublication.

References	
1.	Turner, W. C., Doty, S. and Truner, W. C., (2009), Energy Management Handbook, (7thedition), Fairmont Press
2.	L.C. Witte, P.S. Schmidt, D.R. Brown, (1988) Industrial Energy Management and Utilisation, (1stedition) Hemisphere Publication, Washington

Approved by BoS Chairman

B.Tech.	B23AGE934 - ENERGY MANAGEMENT AND ENVIRONMENT UTILITIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the awareness on the energy scenario of India with respect to world
2.	To learn the methodology adopted for an energy audit
3.	To apply the concepts adopted in project management
4.	To study the different techniques adopted for financial appraisal of a project
5.	To comprehend the impact of energy on environment

UNIT I	ENERGY SCENARIO	9

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing –energy security-energy conservation and its importance -EnergyConservationAct2001

UNIT II	ENERGY MANAGEMENT	9

Energy audit - need – types – methodology – barriers - analysis on energy costing and sharing - bench marking - fuel and energy substitution – billing parameters in TANGEDCO – demand side management - instruments for energy audit – energy monitoring and targeting – CUSUM – energy labeling

UNIT III	PROJECT MANAGEMENT	9

Four Basic Elements of Project Management - Project Management Life Cycle - Steps in Project Management Project Definition and Scope, Technical Design, Financing, Contracting, Implementation Techniques (Gantt Chart, CPM and PERT) and PerformanceMonitoringEnMS5001

UNIT IV	FINANCIAL MANAGEMENT	9

Investment appraisal for energy conservation projects - Financial analysis techniques –Simple payback period, Return on investment, Net present value, Internal rate of return - Cash flows – Risk and sensitivity analysis: micro and macro factors- Financing options- energy performance contracts- ESCOs.

Approved by BoS Chairman

UNIT V	ENERGY AND ENVIRONMENT	9
Greenhouse effect and the carbon cycle - current evidence and future effects of climate change Global Environmental Concerns-United Nations Frame work Convention on Climate Change(UNFCC), Kyoto Protocol, Conference of Parties(COP), Emissions trading(ET), Joint implementation(JI), Clean Development Mechanism (CDM), Proto type Carbon Fund(PCF), Sustainable Development		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Understand the importance of energy conservation and suggest measures for improving per capita energy consumption
CO2	Analyse the energy sharing and cost sharing pattern of fuels used in industries
CO3	Apply Gantt Chart, CPM and PERT in energy conservation projects
CO4	Evaluate the techno-economics of a project adopting discounting and non-discounting Cash flow techniques
CO5	Assess the sources of additional revenue generation for energy conservation projects Adopting UNFCC

Text Books	
1.	L.C. Witte, P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ,Washington,1988
2.	W.C.turner, “Energy Management Hand book”Wiley,NewYork,1982

References	
1.	W.R.Murphy and G.McKay “Energy Management” Butter worths, London 1987.
2.	Eastop.T.D & Croft D.R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.

Approved by BoS Chairman

B.Tech.	B23AGE935 - Waste Conservation into Energy	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study types and sources of agricultural, industrial, and municipal wastes.
2.	To learn technologies for waste-to-energy conversion.
3.	To evaluate biogas, biomass, and biofuel technologies.
4.	To analyze environmental and economic benefits of energy recovery.
5.	To understand policies, programs, and case studies.

UNIT I	SOURCES AND CHARACTERISTICS OF WASTES	9

Classification of wastes: agricultural residues, livestock manure, crop by-products, municipal solid waste, industrial wastes. Physical, chemical, and biological characteristics relevant to energy conversion.Energy potential assessment methods and waste quantification techniques. Challenges in waste collection, segregation, and transportation. Case studies of waste generation and availability in India.

UNIT II	BIOLOGICAL CONVERSION TECHNOLOGIES	9

Principles of anaerobic digestion and factors affecting biogas yield. Design, construction, and operation of fixed dome and floating drum biogas plants. Biogas purification, enrichment, and utilization for cooking, electricity, and transport. Composting for energy recovery and nutrient recycling. Algal biofuel production – systems, limitations, and prospects.

UNIT III	THERMOCHEMICAL CONVERSION TECHNOLOGIES	9

Principles of combustion, pyrolysis, gasification, and torrefaction. Design and operation of incinerators for energy recovery. Gasifiers – updraft, downdraft, and fluidized bed systems. Production of biochar – applications in soil improvement and carbon sequestration. Briquetting and pelletization – machinery, densification, and storage.

UNIT IV	LIQUID AND GASEOUS FUELS	9

Bioethanol production from sugarcane, maize, and lignocellulosic wastes. Biodiesel production from oilseed crops, non-edible oils, waste cooking oils, and microalgae. Synthesis gas and producer gas – applications in power and thermal energy. Hydrogen production from biomass and microbial processes. Fuel upgrading and blending for industrial and transport uses.

UNIT V	POLICIES, ECONOMICS AND CASE STUDIES	9

National and international waste-to-energy policies and programs. Waste-to-energy policies in India – National Bio-Energy Mission, Swachh Bharat initiatives. Economic feasibility, cost–benefit analysis, and life cycle assessment. Environmental and social impacts of waste-to-energy plants. Case studies of successful waste-to-energy projects in India and abroad.

Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Classify wastes with energy potential.
CO2	Apply bioconversion methods for energy recovery.
CO3	Analyze thermochemical waste-to-energy technologies.
CO4	Evaluate production of biofuels and gaseous fuels.
CO5	Assess policies, economics, and case studies in waste-to-energy sector.

Text Books	
1.	Mittal, K.M. (1997). Biogas Systems: Principles and Applications. New Age International. S. & Parulekar, B.B. (2010). Energy Technology. Khanna Publishers. Demirbas, A. (2016). Waste-to-Energy: Energy Conversion. Springer.

Approved by BoS Chairman

B.Tech.	B23AGE936 - DESIGN OF MICRO IRRIGATION SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts, tools, and skills used to deliver water efficiently and effectively on both a field and garden scale efficiency
2.	To learn about the role of irrigation water in agriculture, and the environmental factors that influence the type, frequency, and duration of irrigation
3.	To learn about the resources and essential skills needed to determine the proper timing and volume of irrigation, using both qualitative and quantitative methods
4.	To understand the economic aspects of micro irrigation systems, including cost analysis
5.	To learn about the need for automation in irrigation systems, including the components, types of controls.

UNIT I	MICRO IRRIGATION CONCEPT AND APPLICATIONS	9

Micro irrigation -Merits, demerits, types and components of micro irrigation system- Present status, Scope and potential problem of micro irrigation - Micro-irrigation applications: Hills, arid lands, coastal and wastelands, Financial Assistance for Promotion of Micro Irrigation in India.

UNIT II	DRIP IRRIGATION DESIGN	9

Drip irrigation - Components- Dripper- types and equations governing flow through drippers- Wetting pattern- Chemigation application- Pump capacity -Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation.

UNIT III	SPRINKLER IRRIGATION DESIGN	9

Sprinkler irrigation- Components and accessories - Hydraulic design - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Sprinkler discharge- Water distribution pattern- Droplet size, filtering unit, fertigation - System maintenance

UNIT IV	ECONOMIC ANALYSIS	9

Standardization and Quality Assurance of Micro Irrigation System Components. Terminologies in Economic Analysis, Optimal Flow Criterion for Economic Drip Irrigation Pipes Selection, Economic Viability of Micro Irrigation in Different Crops.

Approved by BoS Chairman

UNIT V	AUTOMATION IN MICRO IRRIGATION	9
Automation, Need for Automation of Irrigation, Merits and Demerits of Automation, Semiautomatic and Fully Automatic Systems of Automation, Components of Automation System, Types of Controls and Automation in Micro Irrigation		
	Total Instructional Hours: 45	

COURSE OUTCOMES: Students will be able to	
CO1	Categorize the different types of pumps and water lifting devices based on the principle, components, and working efficiency
CO2	Explain the working principle of centrifugal pump as well as its characteristics with efficiencies and design the centrifugal pump including impeller design, casing and other parts of pumps .
CO3	Estimate water budgets and hydraulics used to develop irrigation schedules through micro irrigation based on crop geometry
CO4	Design drip and sprinkler irrigation system including, main line, sub main and laterals designs by consider pump capacity
CO5	Design green house irrigation system and advanced types of irrigation including lift irrigation and automation

Text Books	
1.	Suresh, R., “Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors,New Delhi, 2010
2.	Michael, A.M., “Irrigation Theory and Practice”, Vikas Publishers, New Delhi, 2002.

References	
1.	Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 1991.
2.	Jack Keller and Rond Belisher., “Sprinkler and Trickle Irrigation”, Vannistrand Reinhold, New York, 1990.
3.	Sivanappan R.K., “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi, 1987.
4.	Keller.J and D. Karmeli, “Trickle Irrigation Design”, Rainbird sprinkler Irrigation anufacturing Corporation, Glendora, California, USA.
5.	https://onlinecourses.nptel.ac.in/noc21_ag08/preview

Approved by BoS Chairman

B.Tech.	B23AGE937 - IRRIGATION WATER QUALITY AND WASTE WATER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know the basics concepts of irrigation water quality
2.	To impart knowledge on water quality for irrigation purposes, besides relevant environmental problems and recycle and reuse concepts.
3.	To understand the importance of water quality for irrigation and major uses of water and the role environmental issues.
4.	To explore methods for recycling and reusing water
5.	To learn to implement water quality management strategies.

UNIT I	WATER QUALITY	9

Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers – Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages

UNIT II	IRRIGATION WATER QUALITY	9

Water quality for irrigation – Salinity and permeability problem – Root zone salinity – Irrigation practices for poor quality water – Saline water irrigation – Future strategies.

UNIT III	WATER POLLUTION	9

Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.

UNIT IV	RECYCLING AND REUSE OF WATER	9

Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation

Approved by BoS Chairman

UNIT V	WATER QUALITY MANAGEMENT	9
Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Recall key concepts and terminology related to water quality.
CO2	Demonstrate irrigation water quality by explaining the implications of salinity and permeability issues on agricultural practices.
CO3	Apply their knowledge of water pollution to identify sources of contamination and propose appropriate treatment technologies
CO4	Analyze the effectiveness of various water recycling and reuse methods, assessing their feasibility and impact on sustainable water management.
CO5	Evaluate water quality management strategies, discussing the importance of water quality

Text Books	
1.	George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, "Waste water Engineering: Treatment and Reuse", McGraw-Hill, 2002
2.	Vladimir Novonty, "Water Quality: Diffuse pollution and watershed Management", 2nd edition,John Wiley & Sons, 2003
3.	Mackenzie L Davis, David A Cornwell, "Introduction to Environmental Engineering", McGraw Hill 2006.

References	
1.	Stum, M and Morgan, A., "Aquatic Chemistry", Plenum Publishing company, USA, 1985
2.	Lloyd, J.W. and Heathcote, J.A., "Natural inorganic chemistry" in relation to groundwater resources, Oxford University Press, Oxford, 1988
3.	https://archive.nptel.ac.in/courses/105/106/105106119/

Approved by BoS Chairman

B.Tech.	B23AGE938 - COMMAND AREA DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the Fundamentals of Command Area Development
2.	To analyze Water Resource Management Techniques.
3.	To implement Sustainable Agricultural Practices.
4.	To examine Socio-Economic Impacts.
5.	To conduct Monitoring and Evaluation of CAD Programs.

UNIT I	INTRODUCTION TO COMMAND AREA DEVELOPMENT	9

Definition and Importance - Understanding what command area development (CAD) is and its significance in agricultural productivity - Historical Context - Overview of the evolution of CAD programs and their objectives in irrigation management - Key Concepts - Introduction to essential concepts such as irrigation potential, water management, and agricultural sustainability.

UNIT II	WATER RESOURCE MANAGEMENT	9

Irrigation Systems - Types of irrigation systems used in command areas (canal, drip, sprinkler) - Water Use Efficiency: Techniques for improving water use efficiency in agriculture - Challenges in Water Management - Identifying and addressing challenges such as water scarcity, salinity, and distribution inequities.

UNIT III	AGRICULTURAL PRACTICES IN COMMAND AREAS	9

Crop Selection and Rotation - Best practices for selecting crops suitable for command areas and implementing crop rotation strategies - Soil Management - Techniques for soil conservation and fertility management to enhance productivity - Integrated Pest Management: Approaches to managing pests and diseases in a sustainable manner.

UNIT IV	SOCIO-ECONOMIC ASPECTS OF COMMAND AREA DEVELOPMENT	9

Community Participation - The role of local communities in the planning and implementation of CAD programs - Economic Impact - Assessing the economic benefits of CAD on local farmers and the agricultural sector - Policy Framework - Understanding government policies and programs that support command area development.

UNIT V	MONITORING AND EVALUATION OF CAD PROGRAMS	9

Approved by BoS Chairman

Performance Indicators - Establishing indicators to measure the success of CAD initiatives - Data Collection and Analysis - Methods for collecting and analyzing data related to irrigation and agricultural productivity - Case Studies: Review of successful CAD programs and lessons learned from various regions.
Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Define key concepts related to command area development and its significance in agriculture.
CO2	Explain the historical evolution of CAD programs and their objectives in irrigation management.
CO3	Demonstrate the use of various irrigation systems and techniques to improve water use efficiency in agricultural practices.
CO4	Analyze the socio-economic impacts of CAD programs, including community involvement and economic benefits for local farmers.
CO5	Develop comprehensive monitoring and evaluation frameworks that include performance indicators and data analysis methods.

Text Books	
1.	Evaluation Study on Command Area Development & Water Management (CADWM) NITI Aayog/ Planning Commission, Government of India

References	
1.	Michel, A.M(1995). Irrigation theory and practice. Vikash publishing house Pvt. Ltd., 576, Masjid Road, Jangpura, New Delhi-110014.

Approved by BoS Chairman

B.Tech.	B23AGE939 - DESIGN OF AGRICULTURAL DRAINAGE SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the Fundamentals of Agricultural Drainage.
2.	To apply Planning and Design Principles.
3.	To design Surface and Subsurface Drainage Systems.
4.	To evaluate Water Quality and Environmental Impacts
5.	To implement Monitoring and Maintenance Strategies

UNIT I	INTRODUCTION TO AGRICULTURAL DRAINAGE	9

Overview of Agricultural Drainage - Definition, importance, and objectives of drainage systems in agriculture - Types of Drainage Systems: Introduction to surface drainage, subsurface drainage, and their applications - Regulatory Framework - Understanding environmental regulations and compliance related to agricultural drainage.

UNIT II	PLANNING AND DESIGN PRINCIPLES	9

Site Assessment - Techniques for evaluating land characteristics, soil types, and hydrology for effective drainage design - Drainage Coefficient - Understanding the concept of drainage coefficient and its significance in system design - Design Parameters - Key parameters influencing the design of drainage systems, including depth, spacing, and layout of drains.

UNIT III	SURFACE AND SUBSURFACE DRAINAGE SYSTEMS	9

Surface Drainage Design - Principles of designing surface drainage systems, including field channels and ditches - Subsurface Drainage Design - Techniques for designing subsurface drainage systems, including lateral drains and main drains - Installation Practices - Best practices for the installation of drainage systems to ensure efficiency and longevity.

UNIT IV	WATER QUALITY AND ENVIRONMENTAL CONSIDERATIONS	9

Water Quality Management - Assessing the quality of drainage water and its impact on agricultural practices - Environmental Impacts: Understanding the environmental implications of drainage systems, including effects on wetlands and groundwater - Mitigation Strategies - Strategies for minimizing negative environmental impacts associated with drainage discharge.

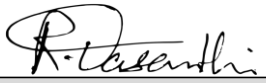
Approved by BoS Chairman

UNIT V	MONITORING, MAINTENANCE, AND CASE STUDIES	9
Monitoring Techniques - Methods for monitoring the performance of drainage systems and assessing their effectiveness - Maintenance Practices - Best practices for maintaining drainage systems to ensure optimal performance over time - Case Studies - Review of successful agricultural drainage projects and lessons learned from various regions.		
Total Instructional Hours: 45		

COURSE OUTCOMES: Students will be able to	
CO1	Define key terms and concepts related to agricultural drainage and its significance in enhancing agricultural productivity..
CO2	Explain the different types of drainage systems and their applications in agricultural settings.
CO3	Demonstrate techniques for site assessment and apply design parameters to create effective drainage plans.
CO4	Analyze the environmental impacts of drainage systems and evaluate strategies for mitigating negative effects on water quality.
CO5	Develop comprehensive monitoring and maintenance plans for drainage systems, incorporating performance indicators and best practices.

Text Books	
1.	Suresh, R., “Soil and Water Conservation Engineering”, Standard Publication, New Delhi, 2007.
2.	Ghanshyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.

References	
1.	Murthy, V.V.N., “Land and Water Management Engineering”, Kalyani Publishers, Ludhiana, 1998.
2.	Gurmail Singh, “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi, 1982.



Approved by BoS Chairman

B.Tech.	B23AGE940 - HYDRODYNAMICS OF PRESSURIZED IRRIGATION SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the Fundamentals of Hydrodynamics
2.	To analyze Flow Dynamics
3.	To design Pressurized Irrigation Systems
4.	To evaluate Water Distribution and Management
5.	To implement Monitoring and Optimization Techniques

UNIT I	FUNDAMENTALS OF HYDRODYNAMICS	9

Introduction to Fluid Mechanics - Basic principles of fluid mechanics relevant to irrigation systems, including properties of fluids and fluid statics - Hydrostatics vs. Hydrodynamics: Understanding the differences between hydrostatic and hydrodynamic principles and their applications in irrigation. Pressure Measurement - Techniques for measuring pressure in irrigation systems, including manometers and pressure gauges.

UNIT II	FLOW DYNAMICS IN IRRIGATION SYSTEMS	9

Types of Flow - Exploration of laminar and turbulent flow, and their implications for irrigation system design. Continuity Equation - Application of the continuity equation in analyzing flow rates and velocities in pressurized systems - Bernoulli's Equation - Understanding Bernoulli's principle and its application in calculating pressure changes in irrigation systems.

UNIT III	DESIGN OF PRESSURIZED IRRIGATION SYSTEMS	9

System Components - Overview of key components in pressurized irrigation systems, including pumps, pipes, valves, and emitters. Hydraulic Design Principles - Design considerations for ensuring efficient water delivery, including pipe sizing, layout, and pressure requirements. Energy Losses- Identifying and calculating energy losses due to friction, fittings, and other factors in pressurized systems.

UNIT IV	WATER DISTRIBUTION AND MANAGEMENT	9

Uniformity of Water Distribution - Techniques for assessing and improving the uniformity of water distribution in pressurized irrigation systems - Irrigation Scheduling- Principles of scheduling irrigation based on hydrodynamic analysis and crop water requirements - Water Quality Considerations - Understanding the impact of water quality on system performance and plant health.

Approved by BoS Chairman

UNIT V	Monitoring and Optimization of Irrigation Systems	9
Performance Evaluation - Methods for monitoring the performance of pressurized irrigation systems, including flow rate and pressure assessments - System Optimization - Strategies for optimizing system performance through adjustments in design and operation. Case Studies - Review of real-world applications and case studies demonstrating successful implementation and management of pressurized irrigation systems.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Define key terms and concepts related to hydrodynamics and pressurized irrigation systems.
CO2	Explain the principles of fluid mechanics, including the differences between hydrostatics and hydrodynamics, and their applications in irrigation.
CO3	Apply the continuity equation and Bernoulli's equation to analyze flow rates and pressure changes in pressurized irrigation systems.
CO4	Analyze the design parameters of pressurized irrigation systems, including energy losses and the impact of system components on overall performance.
CO5	Develop comprehensive monitoring and optimization plans for irrigation systems.

Text Books	
1.	Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
2.	Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.

References	
1.	Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2.	Murthy, V.V.N. Land and water management, Kalyani Publishing, New Delhi, 1998.

Approved by BoS Chairman

B.Tech.	B23AGE941 - IRRIGATION AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the Fundamentals of Irrigation Automation.
2.	To explore Sensor Technologies.
3.	To implement Control Systems.
4.	To design Automated Irrigation Systems.
5.	To evaluate System Performance and Future Trends.

UNIT I	INTRODUCTION TO IRRIGATION AUTOMATION	9

Overview of Irrigation Automation - Definition, significance, and objectives of automated irrigation systems in agriculture - Historical Development - Evolution of irrigation practices leading to automation technologies - Key Components - Introduction to essential components such as sensors, controllers, actuators, and communication systems.

UNIT II	SENSOR TECHNOLOGIES AND DATA ACQUISITION	9

Soil Moisture Sensors - Types, working principles, and applications in irrigation management - Weather Sensors - Role of environmental sensors (temperature, humidity, rainfall) in optimizing irrigation schedules - Data Acquisition Systems - Techniques for collecting and transmitting data from sensors to control systems.

UNIT III	CONTROL SYSTEMS AND AUTOMATION TECHNIQUES	9

Microcontrollers and IoT - Overview of microcontrollers (e.g., Arduino, Raspberry Pi) used in irrigation automation - Control Algorithms - Introduction to algorithms for decision-making based on sensor data - Wireless Communication -Techniques for remote monitoring and control of irrigation systems using IoT technologies.

UNIT IV	DESIGN AND IMPLEMENTATION OF AUTOMATED IRRIGATION SYSTEMS	9

System Design Principles - Key considerations for designing efficient automated irrigation systems, including layout and component selection - Installation Practices - Best practices for installing automated irrigation systems to ensure optimal performance - Integration with Existing Systems: Strategies for integrating automation into traditional irrigation systems.

Approved by BoS Chairman

UNIT V	MONITORING, MAINTENANCE, AND FUTURE TRENDS	9
Performance Monitoring - Methods for assessing the performance of automated irrigation systems, including data analysis and feedback loops - Maintenance Strategies: Best practices for maintaining automated systems to ensure longevity and reliability - Emerging Technologies: Exploration of future trends in irrigation automation, including advancements in AI, machine learning, and smart agriculture.		
		Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to	
CO1	Define key concepts and terminology related to irrigation automation and its components.
CO2	Explain the significance of sensor technologies and their applications in optimizing irrigation practices.
CO3	Apply knowledge of microcontrollers and control algorithms to develop basic irrigation automation systems..
CO4	Analyze the design principles of automated irrigation systems, including layout, component selection, and integration strategies..
CO5	Develop comprehensive monitoring and maintenance plans for automated irrigation systems

Text Books	
1.	Zhang Q, Pierce FJ, editors. Agricultural automation: Fundamentals and practices. crc Press; 2013 Mar 22.
2.	Mahmud MS, Abidin MS, Emmanuel AA, Hasan HS. Robotics and automation in agriculture: present and future applications. Applications of Modelling and Simulation. 2020 Apr 3;4:130-40.

References	
1.	Edan Y, Han S, Kondo N. Automation in agriculture. Springer handbook of automation. 2009:1095-128.
2.	Mahmud MS, Abidin MS, Emmanuel AA, Hasan HS. Robotics and automation in agriculture: present and future applications. Applications of Modelling and Simulation. 2020 Apr 3;4:130-40.

Approved by BoS Chairman

B.Tech.	B23AGE942 - Hydraulic Structures	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand fundamentals of hydraulic structures for irrigation and flood control.
2.	To study design principles of weirs, barrages, and dams.
3.	To analyze canal head regulators and cross-drainage works.
4.	To evaluate energy dissipation and sediment control methods.
5.	To apply hydraulic structures in water resources projects.

UNIT I	INTRODUCTION	9
Classification of hydraulic structures. Forces acting on hydraulic structures. Criteria for stability and safety.		

UNIT II	WEIRS AND BARRAGES	9
Types of weirs, design of vertical drop and sloping glacis weirs. Barrages – layout, design considerations.		

UNIT III	DAMS AND RESERVOIRS	9
Types – gravity, earthen, rock-fill dams. Spillways – types and energy dissipation devices. Reservoir panning and design.		

UNIT IV	CANAL HEAD WORKS AND CROSS DRAINAGE	9
Canal head regulators, sediment control devices. Cross drainage works – aqueducts, siphons, superpassages, level crossings.		

UNIT V	MODERN APPROACHES	9
Hydraulic modeling, numerical modeling in hydraulic structures. Environmental and social impacts of hydraulic structures. Case studies.		
		Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	CO1 Define types and stability requirements of hydraulic structures.
CO2	CO2 Apply design principles for weirs and barrages.
CO3	CO3 Evaluate dams, reservoirs, and spillways.
CO4	CO4 Analyze canal head regulators and cross-drainage works.
CO5	CO5 Apply modern approaches and impact assessment for hydraulic structures.

References	
1.	Modi, P.N. (2017). Irrigation and Water Resources Engineering. Standard Book House.
2.	Garg, S.K. (2010). Irrigation Engineering and Hydraulic Structures. Khanna Publishers.
3.	Punmia, B.C. & Lal, P.B.B. (2012). Irrigation and Water Power Engineering. Laxmi Publications.
4.	Modi, P.N. (2017). Irrigation and Water Resources Engineering. Standard Book House.

Approved by BoS Chairman

OPEN ELECTIVE

Open Elective - I

B.E.	B23AEO501- PRINCIPLES OF FLIGHT (Common to all Except AERO)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study the different component systems and functions.
2.	To understand the basic properties and principles behind the flight.
3.	To study the basic concepts of Aerodynamics.
4.	To study the different structures & construction.
5.	To study the various types of power plants used in aircrafts.

UNIT - I	AIRCRAFT CONFIGURATIONS	9

Brief History-Components of an airplane and their functions. Different types of flight vehicles, classifications. Basic instruments for flying.

UNIT - II	INTRODUCTION TO PRINCIPLES OF FLIGHT	9

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Different types of drag.

UNIT - III	INTRODUCTION TO AERODYNAMICS	9

Aerodynamic forces on aircraft – classification of NACA aerofoils, aspect ratio, wing loading, Mach number, centre of pressure and aerodynamic centre-aerofoil characteristics lift, drag curves.

UNIT - IV	INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS	9

General types of construction, Monocoque, semi-monocoque. Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

Programme Coordinator

BoS Chairman

UNIT - V	POWER PLANTS USED IN AIRPLANES	9
Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production., Principles of operation of rocket, types of rockets		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the types and classification of components and control system.
CO2	Identify the properties and principles to analyze lift, drag (including types), moment, and their variation with altitude.
CO3	Identify the aerodynamics forces and NACA Airfoils.
CO4	Identify different type of fuselage and constructions.
CO5	Categorize the different types of engines and principles of rocket.

Text Books	
1.	Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2.	E Rathakrishnan, “Introduction to Aerospace Engineering: Basic Principles of Flight”, John Wiley, NJ, 2021

Reference Books	
1.	Kermode, A.C., “Flight without Formulae”, McGraw-Hill, 1997.
2.	Sadhu Singh, “Internal Combustion Engines and Gas Turbine”, SS Kataraia & Sons, 2015.
3.	Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

Programme Coordinator

BoS Chairman

B.Tech.	B23AGO501 - Farm Automation	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals and scope of farm automation systems.
2.	To study various types of sensors and their role in smart farming.
3.	To analyze the working of automation systems in field operations.
4.	To explore greenhouse automation and resource management.
5.	To examine the role of advanced technologies like AI, drones, and robotics in agriculture.

UNIT I	INTRODUCTION TO FARM AUTOMATION	9
Definition and scope – Historical development – Classification of automation systems: manual, semi-automated and fully automated – Benefits of automation – Limitations and challenges – Status of automation in Indian agriculture – Automation in small and large farms – Farm automation value chain – Socio-economic implications.		

UNIT II	SENSORS AND SMART FARMING COMPONENTS	9
Types of sensors: soil moisture, pH, temperature, humidity, light, nutrient sensors – Actuators – Microcontrollers and microprocessors (Arduino, Raspberry Pi) – IoT architecture for agriculture – Wireless sensor networks – Communication protocols – Data acquisition and cloud connectivity – Mobile apps and remote monitoring systems.		

UNIT III	AUTOMATION IN FIELD OPERATIONS	9
Automatic steering and GPS-guided tractors – Variable Rate Technology (VRT) – Autonomous planters and seeders – Spraying automation – Robotic weeders – Harvesting automation – Drones for crop health monitoring – Field mapping – Automation kits – Safety aspects in field automation.		

UNIT IV	GREENHOUSE AND RESOURCE MANAGEMENT AUTOMATION	9
Greenhouse control systems: Temperature, humidity, light, CO_2 , irrigation and nutrient management – Automation of fertigation and irrigation (drip, sprinkler) – Scheduling using weather data – Software tools and apps for DSS – Renewable energy-based automation – Case studies of protected cultivation systems.		

UNIT V	ADVANCED TECHNOLOGIES IN AUTOMATION	9
Artificial Intelligence (AI) and Machine Learning (ML) in farming decisions – Robotics in seeding, pruning, sorting and packaging – Machine vision systems – Drones and UAVs in agriculture – Automation for post-harvest management – Success stories from India and abroad – Future prospects and trends.		
		Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Explain the concept and scope of farm automation.
CO2	Identify and interpret various sensors and smart devices in agriculture.
CO3	Apply automation techniques in field operations.
CO4	Demonstrate the application of automation in greenhouse and resource management.
CO5	Evaluate advanced automation technologies and their integration into smart farming systems.

Text Books	
1.	Nageshwar Rao, *Precision Farming and Agricultural Automation*, Kalyani Publishers, 2020.
2.	Manjunatha K.S., *Farm Machinery and Automation*, Jain Brothers, New Delhi, 2018.
3.	Rajvir Yadav, *Agricultural Automation*, Biotech Books, New Delhi, 2021.

References	
1.	CIGR Handbook of Agricultural Engineering Volume VI – Information Technology, ASABE, USA.
2.	Mehta M.L., Verma S.R., and Sharma V.K., *Farm Machinery and Power Engineering*, Jain Brothers.
3.	Internet of Things: https://nptel.ac.in/courses/106105166
4.	Articles and Case Studies from ICAR, IARI, and SmartFarm India

Approved by BoS Chairman

B.E/ B.TECH	B23ADO501– GEN AI WITH OPEN SOURCE FRAMEWORK	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the Core Concepts of Artificial Intelligence
2.	To explain the Fundamentals of Generative AI and Its Architectures
3.	To Outline Open-Source GenAI Tools and Frameworks
4.	To identify the Prompt Engineering Techniques and Build Chatbots
5.	To study the Real-World Applications of Generative AI in Open-Source Domains

UNIT-I	BASICS OF AI	9

Introduction to AI - Future of AI – Applications of AI – History of AI- Types of AI- Intelligent Agent: Types of Agents- Characteristics of Intelligent Agents - Structure of Agents – Agents and Environments- Examples of AI.

UNIT-II	GEN AI MODELS	9

Introduction of Gen Ai- Sub Sets of Gen Ai- Model Creation - Types of Generative Ai transformer Based Architecture -LLM- GAN architecture - Training GANs and challenges) - Variants of GANs- VAE : Encoder, Decoder, and Latent space- Applications of VAEs

UNIT-III	OPEN SOURCE GEN AI	9

Gen AI in open source - Benefits of Open source AI -Open source tools for generative AI - Deep learning frameworks for generative AI- Advantages and Disadvantages of these frameworks

UNIT-IV	PROMPT ENGINEERING & CHATBOT DEVELOPMENT	9

Basics of Prompt Engineering- Few-shot - Zero-shot prompting - Prompt tuning vs Fine-tuning - Building a chatbot using: Lang Chain -RAG (Retrieval-Augmented Generation)

UNIT-V	USE CASES OF GEN AI IN OPEN SOURCE	9

Open-Source Generative AI Models-generative ai use cases in open source- visual content- audio generation- Text generation- Manufacturing- Supply chain and logistics- Retail & e-commerce- Automotive.

Approved By BoS Chairman

	Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain Intelligent agents, and their interaction with environments.
CO2	Identify the structure and working principles of various Generative AI models
CO3	Apply open-source tools, frameworks, and platforms
CO4	Discover prompt engineering techniques
CO5	Examine use cases of Generative AI across various domains
TextBooks	
1.	Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 2021.
2.	Goodfellow I, Bengio Y and Courville, "A Deep Learning", MIT Press. Foster, D, 2022
Reference Books	
1.	Chollet, F. "Deep Learning with Python", Manning Publications, 2018
2.	Martin Musiol, "Generative Ai: Navigating the Course to the Artificial General Intelligence Future", John Wiley Sons, 2024

Approved By BoS Chairman

B.E / B.Tech	B23AMO501 – PRINCIPLES OF MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of Machine Learning.
2.	To study the Supervised Learning with Classifications.
3.	To analyse Random Forest methods and Backpropagation.
4.	To identify the Clustering Techniques for Data Analysis.
5.	To infer the applications of Machine Learning and Dimensionality Analysis.

UNIT - I	INTRODUCTION	9

Introduction to Machine Learning – Need of Machine Learning – Machine Learning Applications – Types of Machine Learning Systems – Challenges – Machine Learning Process – Data Collection – Exploration – Preparation – Training – Optimization – Performance Measures.

UNIT - II	SUPERVISED LEARNING	9

Classification and Regression Technique – Linear Regression – Polynomial Regression – Logistic Regression – Generalization – Overfitting – Underfitting – Support Vector Machine – Kernels – KNN – Naïve Bayes Classifiers – Decision Tree.

UNIT - III	ENSEMBLE LEARNING TECHNIQUES	9

Random Forest – Ensemble Learning – Bagging – Boosting – Ada Boost – Gradient Boosting – Neural Networks – ANN Perceptron – MLP's and Backpropagation – Hyperparameter Optimization – Dimensionality Reduction.

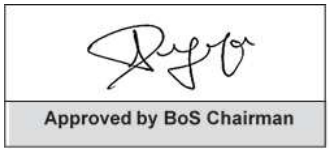
UNIT - IV	UNSUPERVISED LEARNING	9

Clustering – Techniques – K-Means Clustering – AGNES – DIANA – Density Based Clustering (DBSCAN) – Grid Based Clustering – Gaussian Mixtures – Clustering High Dimensionality Data – Outlier Analysis.

UNIT - V	APPLICATIONS OF ENSEMBLE LEARNING	9

Dimensionality Reduction Applications – Factor Analysis – Model Selection & Evaluation – Visualization of Results – Applications of ML : Medical Science, Fraud Detection, Traffic Prediction, Personal Assist, Stock Prediction.

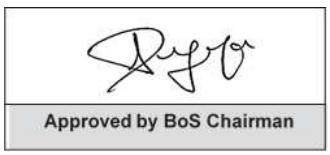
Total Instructional hours: 45



Text Books	
1.	Muller, Andreas C., and Sarah Guido. "Introduction to Machine Learning with Python : A Guide for Data Scientists." 3rd Edition, "O'Reilly Media, Inc.", 2016.
2.	Geron, Aurelien. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow : Concepts, Tools, and Techniques to build intelligent systems. 1st Edition, "O'Reilly Media, Inc.",

Reference Books	
1.	Himanshu Singh, Yunis Ahmed Lone, Deep Neuro-Fuzzy Systems with Python : With Case Studies and Applications from the Industry, 3rd Edition, 2019.
2	Leonardo De Marchi, Hands-On Neural Networks : Learn how to Build and Train Your First Neural Network Model using Python Book, 1st Edition, 2019.
3	James Loy, Neural Network Projects with Python : The Ultimate Guide to using Python to explore the true power of neural networks through six projects. 1st Edition, Kindle Edition,

Course Outcomes : Students will be able to	
CO1	Recall the basics of Machine Learning
CO2	Illustrate the Classification and Regressions
CO3	Identify the Concepts of Neural Networks and Ensemble Learning
CO4	Analyze the features of unsupervised Learning
CO5	Explain the applications of Machine Learning



B.E / B.Tech	BM23BMO501- PRINCIPLES OF BIOSENSORS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study the basic structural ,functional elements, the gaseous exchange and fluid maintenance of the human body.
2.	To learn the organs and structures involved in system formation and functions.
3.	To understand the functions of physiological system
4.	To Know the activity of sensory and motor nerves
5.	To analyse Different Physiological Conditions in the Human Body.

UNIT - I	INTRODUCTION TO BIOSENSOR	9
Biosensors- Advantages and limitations, various components of biosensors, Classification of Biosensors Based on Type of Transduction - Electrochemical, Optical, Acoustic, Calorimetric. Classification of Biosensors Based on Biological Element - Enzyme Sensor, Immunosensors, Cell-based Sensors		

UNIT - II	DESIGN OF BIOSENSOR	9
Introduction, Assay format, Immobilisation-Ligand Activity, Regeneration, Analysis of regeneration data, Signal correction, Buffer scouting, Extracting kinetic affinity constant, Extracting kinetic rate constant, Sensor Surfaces and Receptor Depth, Molecular Interaction.		

UNIT - III	OPTICAL AND BIOCHEMICAL BIOSENSORS	9
Principles of Optical biosensing, Immobilization of bio-recognition elements, Types of optical biosensor: Fiber optic, planar waveguide, Evanescent, Interferometric, and Surface plasmon resonance-biosensor-Applications. Chemical and other sensors - Biocatalysis based biosensors, Bio affinity based biosensors & Microorganisms based biosensors, Biologically active material and analyte. Types of membranes used		

Program Coordinator

Approved by BOS Chairman

in biosensor constructions.

UNIT - IV	IMMUNOSENSOR	9
introduction to Immuno biosensor- Enzyme Biosensor, Bio Affinity Biosensor, Labelled Immuno sensors, Non-Labelled Immuno sensors. Transducer Aspects of Immuno sensor Optical Immunosensor, Piezoelectric Crystal Immunosensors, Electrochemical Immunosensors. Biological Aspects of biosensor- Antibody Development, Immunosensor based Assay Development.		
UNIT - V	**DIAGNOSTIC APPLICATION OF BIOSENSOR**	**9**
Preparation of Doped Sol-Gel Glasses, Application of Sol-Gel Glasses in Biosensors- Glucose Biosensor, Urea Biosensor, Cholesterol Biosensor, Lactate Biosensor. Application of enzymes in analysis; design of enzyme electrodes and their application as biosensors in healthcare.		
Total Instructional hours : 45		

Course Outcomes: Students will be able to	
CO1	Apply principles and concepts of biology and engineering to design biosensors.
CO2	Apply principles and concepts of electronics and electrochemistry to design electrochemical biosensors.
CO3	Recognize different types of transducers, and their application in biosensor design.
CO4	Apply principles and concepts of sensing and engineering to design biosensors for detection of markers in biofluids.
CO5	Apply engineering tools to evaluate parameters needed for point-of-care devices.

Program Coordinator

Approved by BOS Chairman

Text book	
1.	Bansi D Malhotra, Anthony, Advances in Biosensors, Volume 5, 2003, Elsevier, Oxford.
2.	Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers, 1996
3.	Loic J Blum, Pierre R Coulet - Biosensors Principles and Applications, First edition, Marcel Dekker,Inc, 1991.
4.	Donald G. Buerk - Biosensors Theory and Applications, First Edition Technomic Publishing. Co, Inc, 1993.

Reference Books	
1.	Elizabeth A Hall - Biosensors, First Edition, Open University, Milton Keynes, 1990.
2.	Graham Ramsay - Commercial Biosensors, First edition, John Wiley & Sons, Inc. 1998.
3.	Tran Minh Canh - Sensor Physics & Technology – Biosensors, First Edition, Champan & Hall, 1993.
4.	Mathew A.Cooper, Label free Biosensors Techniques and Applications, Cambridge, 2009.

Program Coordinator

Approved by BOS Chairman

B. TECH.	B23BTO501 – BIOFERTILIZER PRODUCTION AND MUSHROOM CULTIVATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide a comprehensive understanding of the principles and practices of biofertilizer production and mushroom cultivation.
2.	To equip students with knowledge of microbial inoculants and their applications in sustainable agriculture.
3.	To explore the cultivation techniques and nutritional aspects of various edible mushrooms.
4.	To enable students to understand industrial mushroom processing, value addition, and quality control, including nutraceuticals and waste management.
5.	To familiarize students with the quality control and commercial aspects of biofertilizers and mushroom production.

UNIT - I	INTRODUCTION TO BIOFERTILIZERS AND MICROBIAL INOCULANTS	9

Introduction to biofertilizers: Significance and scope. Types of biofertilizers: Nitrogen-fixing, phosphate-solubilizing, potassium-mobilizing, and mycorrhizal biofertilizers. Microbial inoculants: *Rhizobium, Azotobacter, Azospirillum, Pseudomonas, Bacillus, Trichoderma*, and mycorrhizal fungi. Mechanisms of action of biofertilizers: Nitrogen fixation, phosphate solubilization, plant growth promotion. Carrier materials and their properties. Quality control of biofertilizers: Viability, purity, and efficacy testing.

UNIT - II	PRODUCTION TECHNOLOGY OF BIOFERTILIZERS	9

Isolation and characterization of effective microbial strains. Fermentation technology for biofertilizer production: Batch, fed-batch, and continuous fermentation. Scale-up and optimization of biofertilizer production. Formulation and packaging of biofertilizers. Storage and shelf-life of biofertilizers. Quality standards and FCO.

UNIT - III	MUSHROOM CULTIVATION: PRINCIPLES AND PRACTICES	9

Introduction to edible mushrooms: Nutritional and medicinal value. Cultivation techniques for various mushrooms: Oyster, button, shiitake, and milky mushrooms. Substrate preparation and sterilization. Spawn production and inoculation. Environmental control in mushroom cultivation: Temperature, humidity, and ventilation. Pest and disease management in mushroom cultivation.

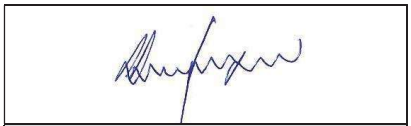
UNIT - IV	MUSHROOM PROCESSING AND VALUE ADDITION	9

Post-harvest handling and preservation of mushrooms. Processing of mushrooms: Drying, canning, and pickling. Value-added products from mushrooms: Mushroom powder, extracts, and nutraceuticals. Mushroom waste utilization. Quality assessment of mushrooms: Sensory, chemical, and microbiological analysis.

UNIT - V	COMMERCIAL ASPECTS AND ENTREPRENEURSHIP	9

Market potential and demand for biofertilizers and mushrooms. Economic analysis of biofertilizer and mushroom production. Entrepreneurial opportunities in biofertilizer and mushroom industries. Marketing and distribution strategies. Intellectual property rights (IPR) and patenting. Government schemes and subsidies.

Total Instructional hours : 45



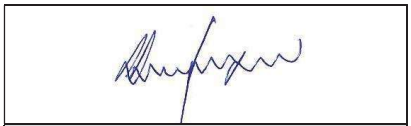
Approved by BoS Chairman

Course Outcomes After the successful completion of the course, the students will be able to,		Knowledge Level
CO1	Illustrate the principles of microbial inoculant production and application.	K2
CO2	Classify the different types of biofertilizers and their impact on soil fertility.	K2
CO3	Explain the cultivation techniques and nutritional value of various edible mushrooms.	K2
CO4	Demonstrate the quality and safety parameters of biofertilizers and mushroom products.	K2
CO5	Identify the commercial aspects and entrepreneurial opportunities in biofertilizer and mushroom industries.	K3

Text Books	
1.	Subba Rao N.S., "Soil Microbiology", Oxford & IBH Publishing Company, New Delhi, 2002.
2.	Himadri Panda H., "Manufacture of Biofertilizer and Organic Farming", Asia Pacific Business Press Inc., 2024.
3.	Tewari R.P., "Mushrooms: Cultivation, Marketing and Consumption", Daya Publishing House, Delhi, 2005.
4.	Chang S.T., Miles P.G., "Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact", CRC Press, Boca Raton, 2004.

References Books	
1.	Alexander M., "Introduction to Soil Microbiology", John Wiley & Sons, New York, 1977.
2.	Stamets P., "Mycelium Running: How Mushrooms Can Help Save the World", Ten Speed Press, Berkeley, 2005.

CO-PO-PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	-	2	3	3
CO2	2	1	-	-	-	-	-	2	2	-	-	2	3	3
CO3	2	2	-	-	-	-	-	2	2	-	-	2	3	3
CO4	2	2	-	-	-	-	-	2	2	-	-	2	3	3
CO5	2	2	-	-	-	-	-	2	2	-	-	2	3	3
Wt. Avg.	2	2	-	-	-	-	-	2	2	-	-	2	3	3



Approved by BoS Chairman

B.E.	B23CSO501- FOUNDATIONS OF DBMS (Except CSE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn the fundamentals of data models, relational algebra and SQL.
2.	To represent a database system using ER diagrams and to learn normalization techniques.
3.	To understand the concepts of transaction, concurrency and recovery processing.
4.	To understand the internal storage structures using different file and indexing techniques
5.	To have basic knowledge about the Distributed databases, NOSQL and DB security

UNIT - I	RELATIONAL DATABASES	9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT - II	DATABASE DESIGN	9

Entity-Relationship model – ER Diagrams – Enhanced-ER Model – ER to Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT - III	TRANSACTIONS	9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.

UNIT - IV	IMPLEMENTATION TECHNIQUES	9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

Approved by BoS Chairman

UNIT - V	ADVANCED TOPICS	9
Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Construct basic SQL Queries using relational algebra
CO2	Build database using ER model and normalize the database
CO3	Organize transaction-related queries while ensuring consistency and concurrency control
CO4	Evaluate various indexing and file organization strategies to optimize query performance
CO5	Analyze relational DB and NoSQL DB

Text Books	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2.	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

Reference Books	
1.	C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Approved by BoS Chairman

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3														
CO2	K3														
CO3	K3														
CO4	K5														
CO5	K4														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E / B. TECH	B23ECO501 COMMUNICATION ENGINEERING (Common to All Except ECE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of modulation techniques in generation of amplitude modulation and angle modulation.
2.	To impart knowledge in random process
3.	To familiarize students' optimum receivers for binary digital modulation schemes
4.	To examine digital modulation formats and their power spectral
5.	To understand the properties of spread spectrum techniques to design robust and efficient communication systems

UNIT – I FUNDAMENTALS OF ANALOG COMMUNICATION	9
Basics of communication systems; Fundamentals of Principles of amplitude modulation; AM envelope; frequency spectrum and bandwidth; modulation index and percent modulation; AM Voltage distribution; AM power distribution; Angle modulation; FM and PM waveforms; phase deviation and modulation index; frequency deviation and percent modulation; Frequency analysis of angle modulated waves; Bandwidth requirements for Angle modulated wave.	

UNIT–II RANDOM PROCESS AND SAMPLING	9
Review of probability and random process; Gaussian and white noise characteristics; Noise in amplitude modulation systems; Noise in Frequency modulation systems; Pre-emphasis and Deemphasis; Threshold effect in angle modulation; Low pass sampling; Aliasing; Signal Reconstruction; Quantization; Uniform & non-uniform quantization; quantization noise; Nyquist criterion; Logarithmic Companding; PAM; PPM; PWM; PCM; TDM; FDM.	

UNIT – III DIGITAL TRANSMISSION	9
Optimum Receiver for Binary Digital Modulation Schemes; Description of Binary ASK; PSK; and FSK Schemes; Binary PSK Signaling Schemes; M-ary Signaling Schemes; Synchronization Methods.	

UNIT – IV DIGITAL MODULATION TECHNIQUES	9
Digital modulation formats; Coherent Binary Modulation Techniques: BFSK and BPSK; QPSK; MSK; M-ary QAM; Power spectra of BFSK; BPSK; QPSK and MSK.	
UNIT – V SPREAD SPECTRUM AND MULTIPLE ACCESS	**9**

Approved by BOS Chairman

PN sequences: properties; m-sequence; DSSS; Processing gain; Jamming; FHSS; Synchronization and tracking; Multiple Access: FDMA; TDMA; CDMA.
Total Instructional hours:45

Course Outcomes: Students will be able to	
CO1	Apply principles of basic communication systems to design basic modulation schemes for efficient signal transmission.
CO2	Apply probability and random process principles to analyze noise in communication systems
CO3	Apply knowledge to design and assess optimum receivers for binary digital modulation schemes like ASK, PSK, FSK, and M-ary systems.
CO4	Analyze and differentiate between digital modulation formats and their power spectral.
CO5	Apply and evaluate concepts of PN sequences, DSSS, FHSS, and multiple access techniques

Text Books	
1.	K Sam Shanmugam, Digital and Analog Communication Systems, Wiley, 2019.
2.	Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2018.
3.	Simon Haykin, "Communication Systems", Wiley India, 4th edition, 2014.

Reference Books	
1.	H.Taub, D L Schilling and G Saha, "Principles of Communication", 4th Edition, Pearson Education, 2017.
2.	B.P.Lathi, Zhi Ding, Hari Mohan Gupta "Modern Analog and Digital Communication Systems", 4th Edition, Oxford University Press, 2017.
3.	Sanjay Sharma, "Communication Systems (Analog and Digital)", S.K. Kataria & Sons; Reprint 2013.
4.	B.Sklar, "Digital communications: Fundamentals and Applications", 2nd Edition, Pearson Education, 2012.

Evaluation Pattern:				
Continuous Internal Assessment				**End Semester Examinations**
CIA I (Theory) (100 Marks)		CIA II (Theory) (100 Marks)		
* Alternate Assessment Tool (AAT)	Written Test	* Alternate Assessment Tool (AAT)	Written Test	Theory End Semester Examinations (Examinations will be conducted for 100 Marks)
40 Marks	60 Marks	40 Marks	60 Marks	
40 Marks				60 Marks
Total: 100 Marks				

* AAT - Individual Assignment/ Case Study/ Seminar/ Mini project/ MCQ/ Role Play/ Group Discussion/ Debates/ Oral Presentations/ Poster Presentations/ Technical Presentations can also be provided course coordinator can choose any one/two components based on the nature of the course.

Approved by BOS Chairman

B.E	B23EEO501- ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of electric vehicle history and components.
2.	To understand properties of batteries.
3.	To understand the electrical machine properties and classifications.
4.	To understand the properties of electric vehicle drive systems.
5.	To understand the concepts of hybrid electric vehicles.

UNIT-I	INTRODUCTION TO ELECTRIC VEHICLES	9

Present scenario of electric vehicles, Need of electric vehicles, economics, environmental impacts of using electric vehicles, challenges faced by electric vehicles in replacing ICE, major requirements of electric vehicles.

UNIT-II	TYPES OF ELECTRIC VEHICLES AND THE CHALLENGES	9

Types of electric vehicles: Plug-in Electric Vehicle (PEV), Battery Electric vehicle (BEV), Fuel Cell electric vehicle (FCEV), Hybrid electric vehicle (HEV), Challenges of battery electric vehicle, hybrid electric vehicle and fuel cell electric vehicle.

UNIT-III	BATTERY ELECTRIC VEHICLE	9

Components of BEV drive train: electric propulsion subsystem - power converter, driving wheels, suspension system, driveshaft, mechanical transmission, electric Motor, power electronics converters (DC-AC/DC-DC), electronic control unit, energy source subsystem, battery pack with battery management system, On board charger, auxiliary subsystem, power steering unit, common parts between ICE drive train and EV drive train.

UNIT-IV	HYBRID AND FUEL CELL ELECTRIC VEHICLE	9

Basic architecture of hybrid drive trains, components of HEV drive train system, classification of HEV: conventional HEV (Micro, Mild and Full hybrid- series hybrid, parallel hybrid, series-parallel hybrid, complex hybrid), Basic architecture of FCEV, components of FCEV drive train system.

Approved by BoS Chairman

UNIT-V	ENERGY STORAGE	9
Battery-based energy storage, Overview of batteries, Battery parameters, battery charging, regenerative braking, alternative novel energy sources: solar photovoltaic cells, fuel cells, super capacitors, and flywheels.		
		Total Instructional hours:45

Course Outcomes: **Students will be able to**	
CO1	Illustrate the basics of electric vehicle history and components.
CO2	Classify the different types of electric vehicles.
CO3	Apply the battery properties in an electric vehicle.
CO4	Develop the hybrid and fuel cell electric vehicle.
CO5	Illustrate the concept of energy storage devices.

Text Books	
1.	Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018.
2.	Electric & Hybrid Vehicles – Design Fundamentals – Iqbal Hussain, Second Edition, CRC Press, 2011.
3.	Electric Vehicle Battery Systems – Sandeep Dhameja, Newnes, 2000.
4.	Husain, I. (2021). Electric and Hybrid Vehicles: Design Fundamentals (3rd Edition). CRC Press.

Reference Books	
1.	Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003
2.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals – Mehrdad Ehsani,Yimin Gao, Ali Emadi, CRC Press, 2010.
3.	Chan, C. C., & Chau, K. T. (2001). Modern Electric Vehicle Technology. Oxford University Press.
4.	Larminie, J., & Lowry, J. (2023). Electric Vehicle Technology Explained (3rd Edition). Wiley.

Approved by BoS Chairman

B.E.	B23MEO501 - ROBOTICS	L	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of the basic components of a robot
2.	To apply the distinct drive systems and end effectors to control the robot actuation
3.	To study the role and application of various types of sensors and machine vision system
4.	To make use of the knowledge in the robot kinematics and to write Robot Programs
5.	To identify the social and economic challenges while implementing the robot systems

UNIT - I	FUNDAMENTALS OF ROBOT	9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions- Different Applications - A view on Global and Indian manufacturers of Robots - Need for Robots in Indian environment.

UNIT - II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9

Drives - hydraulic, pneumatic, mechanical, electrical, Servo motors, Stepper motors - salient features, application; End effectors – types; Grippers - mechanical, pneumatic, hydraulic, magnetic, vacuum - limitations, Multiple grippers.

UNIT - III	SENSORS AND MACHINE VISION	9

Requirements of sensors, principles, types and applications of Proximity (Inductive, Hall effect, Capacitive, Ultrasonic and Optical); – Range (Triangulation, Structured light approach); Speed, Position (resolvers, optical encoders); – Force – Torque – Touch sensors (binary, analog sensor). Introduction to Machine Vision; applications, functions; image processing and analysis; training the vision system.

UNIT - IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9

Forward kinematics and Reverse kinematics of manipulators; two, three degrees of freedom, homogeneous transformation matrix; introduction to manipulator dynamics, trajectory generator, manipulator mechanism, Degeneracy and Dexterity; Lead through programming, Robot programming languages; VAL programming, motion commands, sensor commands, end effecter commands, simple programs (for loading, unloading and palletizing operations), introduction to advances in Robot Programming.

Approved by BoS Chairman

UNIT - V	APPLICATION, IMPLEMENTATION AND ROBOT ECONOMICS	9
Robot cell design; types, application of robots in processing, assembly, inspection, material handling in automobile, medical, Nuclear Industries, RGV, AGV; Implementation of Robots in Industries; Safety considerations for robot operations, safety codes, Economic analysis of robots.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the concepts of industrial robots, classification, specifications and coordinate systems.
CO2	Illustrate the different types of robot drive systems as well as robot end effectors.
CO3	Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
CO4	Develop robotic programs for different operations and familiarize with the kinematics motions of robot.
CO5	Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

Text Books	
1.	Groover M.P., “Industrial Robotics - Technology Programming and Applications”, McGraw Hill, 2012.
2.	Deb S R and Deb S, Robotics Technology and Flexible Automation, Tata McGraw Hill Education Pvt. Ltd, 2010.
3.	Saha S K, Introduction to Robotics, Tata McGraw Hill Education Pvt. Ltd, 2010, 2nd Ed, 2014.

Reference Books	
1.	Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, Global Edition, 3rd Edition, 2014.
2.	Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
3.	Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 2010.

Approved by BoS Chairman

B.E / B.TECH	B23CBO501 FRONT END DEVELOPMENT	T	P	TU	C
		3	0	1	3

Course Objectives	
1.	To interpret the basics of front end development and modern development tools.
2.	To device a front end design with HTML Tags.
3.	To work with HTML Forms and Implement Layouts Using Frames and iFrames
4.	To design a dynamic webpage using CSS.
5.	To articulate client side activities on a web site using Javascript.

UNIT- I INTRODUCTION TO FRONT END DEVELOPMENT	9
Introduction to web - WWW - Web server and client, URL, URI,URN-Internet addresses and IP classes Web protocols -TCP/IP,UDP, MIME.SMTP,POP3,HTTP & HTTPS-MVC-Model, View, Controller of Web design-Role of front end developer and Modern Front end Tools.	

UNIT-II HTML (HYPERTEXT MARKUP LANGUAGE)	9
Introduction to HT ML - HTML s HTML5 - Basic HTML Structure - HTML Elements, Attributes and properties - Formatting tags - Lists & symbols -Ordered Lists -Unordered Lists- Descriptive Lists - Hyperlinks- Multimedia: Images, Audio, Video tags	

UNIT- III HTML TABLES & FORMS	9
HTML table :Table border, row, column header, rowspan & colspan, cell spacing and cell padding HTML forms: Form elements- Text, Textarea, Password field, Label-Checkbox, Radio Button. Selection List - Button -Frames & iFrames	

UNIT- IV CSS (Cascading style sheets)	9
Introduction to style sheets: Cascading style sheets-CSS properties - CSS selectors - Pseudo classes and elements - Types of CSS: Inline, Embedded, External style sheet-Case study Talwind CSS	

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UNIT- V CLIENT SIDE SCRIPTING	9
Introduction to Javascript, Javascript features -Datatypes, Variables , Literals & Operators – Control structures -Arrays - Predefine functions & User defined functions – Javascript - DOM objects - Case study- npm, NodeJs.	
Total Instructional hours: 45	

Course Outcomes: Students will be able to	
CO1	**Interpret the working of web sites, web servers and modern front-end**
CO2	Build web pages of a website with HTML
CO3	Develop web site for process and Implement Layouts Using Frames and
CO4	Construct dynamic styles using CSS.
CO5	Build client side activities with Javascript.

Text Books:

1.Uttam K.Roy,"Web Technologies" by, Oxford University Press 2010, First edition, eight impression 2014.

Reference Books :

1.Thomas Powell , "HTML& css: The Complete Reference", Fifth Edition Paperback - 1, Tata McGrawHill, July 2017.

2.. Laurence Lars Svekis , Maaike Van Putten , Rob Percival ," JavaScript from Beginner to Professional: Leam JavaScript quickly by building fun, interactive, and dynamic web apps. games, and pages", Packt, December 2021.

Approved by BoS Chairman

Open Elective - II

B.E.	B23AEO601 – UNMANNED AIRCRAFT SYSTEMS OPERATION AND MRO (Common to all Except AERO)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know the working principles of aircraft engine and fuel systems.
2.	To understand the lighting technologies and pressurization system of the aircraft cabin.
3.	To realize the warning and protection systems of the aircraft.
4.	To expose on terrain warning systems of the safety of the aircraft.
5.	To gain knowledge on FDR and anti-fire protection system.

UNIT - I	DRONE RULES & BASIC PRINCIPLES OF FLIGHT	9

International Rules- Regulations, Standards & Practices, Dos and Do not, Civil Aviation Requirements- AIPs, NOTAM, Classification & Categorization of drones, Type Certification of Drones, Registration, Sale & De-Registration of Drones, Operations of Drones, Dos and Donts, Remote Pilot Licensing, Drone Insurance Fundamentals of flight, Aerodynamics, Take-off, flight, and landing. Maneuvers, turns and circuit pattern.

UNIT - II	ATC PROCEDURES & RADIO TELEPHONY (NON FRTOL) WEATHER AND METEOROLOGY	9

Understanding ATC operations, Airspace structure and Airspace, Restrictions with knowledge of no drone zones, RT Phraseology & Communicating with ATC including Position and Altitude Reporting. Flight Planning Procedures including Altimeter setting procedures. Collision avoidance. Radio Telephony (RT) techniques, The standard atmosphere, Measuring air pressure, Heat and temperature, Wind. Moisture, cloud formation, icing and its effects. Effect of atmosphere on RPAS operation & hazardous weather avoidance, Met Terminal Aviation Routine Weather Report (METAR).

UNIT - III	FIXED-WING & ROTORCRAFT OPERATIONS AND AERODYNAMICS	9

Types of fixed wing drones, make, parts, terminology, Operation and maneuvers of fixed wing drones, Flight Performance. Intro to Mission Planning, Instrument Flying & Navigation (GCS). Applications of fixed-wing UAVs. Pros and Cons of Fixed Wing Drones Rotorcraft- Basic drone terminology & parts,

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Types of drones, material used and size of drones, Drone Anatomy: Different parts of drones, Avionics & C2 Link, Intro to Mission Planning, Instrument Flying & Navigation (GCS). Applications and operations of Multirotor, Flight Performance. Pros and Cons of Rotorcraft Drones.

UNIT - IV	HYBRID OPERATIONS, AERODYNAMICS & EQUIPMENT MAINTENANCE	9
Principles of Aerodynamics, Types of Hybrid Drones & Parts, Intro to Mission Planning, Instrument Flying & Navigation (GCS), Applications of Hybrid UAVs, Comparison with Rotorcraft & Aeroplane Drone Equipment Maintenance- Maintenance of drone, flight control box, ground station, Maintenance of ground equipment, batteries and payloads, Scheduled servicing, Repair of equipment, Fault finding and rectification.		

UNIT - V	SAFETY MANAGEMENT, PAYLOAD, & DATA & ANALYSIS	9
Drothe Emergency & Handling, Loss of C2-link, Fly-aways (Straying), Loss of power, Other Emergencies, Control surface failures, Human Performance & Pilot Incapacitation, Fail-Safe Features, Types of payloads - What to carry, what not to carry, Parts of payloads, Installation, Features of payloads, Utilization, Principles of Observation, Elements of Image & Video Interpretation, Introduction to Photogrammetry, Types of Image & Video Data, Analysis.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the Basics of Ignition and Fuel System of an Aircraft. (K2)
CO2	Illustrate the Flight Compartment Lighting Technologies and Cabin Air Conditioning system. (K2)
CO3	Identify the Warning and Protection Systems for the Ice Formation and Rain in the Airframe of the Aircraft During Flight. (K3)
CO4	Apply the Terrain Warning Systems to avoid the Terrain Collision of an Aircraft. (K3)
CO5	Examine the FDR and Fire Protection System to Monitor the Flying Performance of the Aircraft. (K4)

Text Books	
1.	“Aircraft Electrical and Electronic Systems”, Principles, operation and maintenance by Mike Tooley and David Wyatt.

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Reference Books	
1.	Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
2.	Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1993.
3.	Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000.

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B.Tech.	B23AGO601 - Environmental Management in Agriculture	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide knowledge on natural resource use and environmental sustainability in agriculture.
2.	To understand the causes and impacts of pollution from agricultural activities.
3.	To explore the principles and methods of environmental impact assessment (EIA).
4.	To study the role of waste management and resource recycling in agriculture.
5.	To introduce climate-smart agriculture and mitigation strategies for sustainable development.

UNIT I	NATURAL RESOURCES AND SUSTAINABILITY	9

Natural resources – classification and utilization in agriculture – Sustainable use of soil, water, biodiversity – Ecological footprint – Concept of carrying capacity – Environmental indicators – Role of agriculture in environmental degradation – Policies for sustainable agriculture – SDGs related to environment and agriculture.

UNIT II	AGRICULTURE AND POLLUTION	9

Agricultural pollution – causes and effects – Soil pollution due to fertilizers, pesticides and heavy metals – Water pollution: runoff, eutrophication, groundwater contamination – Air pollution: burning of residues, methane, ammonia emissions – Noise pollution from farm machinery – Agrochemical residues and food chain contamination – Preventive strategies.

UNIT III	ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	9

Concept and need for EIA – Components and stages of EIA – Screening, scoping, impact prediction, mitigation – EIA methods (checklist, matrix, network) – Public participation – Environmental Management Plan (EMP) – Environmental audit – Case studies of agricultural projects (dams, irrigation, fertilizer units).

UNIT IV	AGRICULTURAL WASTE AND RESOURCE MANAGEMENT	9

Types of agricultural waste – crop residues, livestock waste, agro-industrial waste – Collection, handling and disposal – Waste minimization – Composting, vermicomposting, biogas production – Biomass energy – Circular economy in agriculture – Integrated farming and nutrient recycling – Wastewater reuse in agriculture.

UNIT V	CLIMATE CHANGE AND SUSTAINABLE FARMING	9

Climate change: causes and impact on agriculture – GHG emissions from agriculture – Carbon sequestration – Climate-smart agriculture – Conservation agriculture – Precision farming – Agroforestry and carbon farming – Green technologies in agriculture – Institutional frameworks (UNFCCC, IPCC, ICAR).

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to

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CO1	Understand the sustainable use of natural resources in agriculture.
CO2	Identify environmental pollution sources and their impact from agriculture.
CO3	Apply EIA techniques for environmental planning in agricultural projects.
CO4	Utilize waste management techniques for environmental protection.
CO5	Implement climate-resilient and sustainable agricultural practices.

Text Books	
1.	Rattan Lal and B.A. Stewart, *Soil and Environmental Management*, CRC Press, 2020.
2.	N.T. Kumbhar, *Environmental Management in Agriculture*, Himalaya Publishing House, 2018.
3.	G.N. Tiwari and R.K. Mishra, *Environmental Pollution and Management*, Narosa Publishing House, 2015.

References	
1.	D.W. Sims, *Agricultural Waste Management*, FAO Publications.
2.	Shukla, S.K. & Pandey, P., *Climate Smart Agriculture*, Springer, 2021.
3.	EIA Guidelines – Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India.
4.	NPTEL: https://nptel.ac.in/courses/120108004

Approved by BoS Chairman

B.E/ B.TECH	B23ADO601-HUMAN COMPUTER COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To outline the basic knowledge of HCI.
2.	To classify the design process and rules.
3.	To apply the evaluation techniques and HCI models.
4.	To make use of communications and human factors.
5.	To develop the understanding of user interface.

UNIT - I	INTRODUCTION TO HCI	9

Introduction to HCI - A discipline involved in HCI- Importance of HCI - The psychology of everyday things - Principles of HCI - Input–output channels - Human memory -Thinking: reasoning and problem solving - Conceptual Models – Interface Metaphors – Interaction Types – Paradigms and Frameworks. Cognitive Aspects: Cognition – Cognitive Framework. Social Interaction – Emotional Interaction.

UNIT - II	HCI DESIGN PROCESS AND DESIGN RULES	9

The software design process - User focus – Scenarios - Navigation Design - Screen Design - Prototyping techniques - Wire-Framing - Understanding the UI Layer and Its Execution Framework, Model-View-Controller(MVC) Framework - Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics, User interface management system (UIMS).

UNIT - III	EVALUATION TECHNIQUES AND HCI MODELS	9

Goals of evaluation - Evaluation Criteria - Evaluation through expert analysis - Evaluation through user participation - Choosing an Evaluation Method - Goal and task hierarchy model - Linguistic model - Physical and device models - Cognitive architectures - Hierarchical task analysis (HTA) - Uses of task analysis - Diagrammatic dialog design notations - Computer mediated communication - Ubiquitous Computing.

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UNIT - IV	COMMUNICATION AND HUMAN FACTORS	9

Face-to-face Communication - Conversation - Text-based Communication - Group working - Dialog design notations - Diagrammatic notations - Textual dialog notations - Dialog semantics - Dialog analysis and design – Groupware - Meeting and decision support systems - Shared applications and artifacts - Frameworks for groupware Implementing synchronous groupware - Mixed - Augmented and Virtual Reality.

UNIT - V	FUTURE OF HCI AND USER INTERFACE	9

The future of HCI - perceptual interfaces, context-awareness and perception –User centered design - Interfaces: Types – Natural User Interfaces, Importance of user Interface and good design - Principles of user interface. - The graphical user interface – popularity of graphics, the concept of direct manipulation - graphical system - Characteristics - Web user – Interface popularity.

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Illustrate the importance of human computer interaction.
CO2	Explain the design process and design rules.
CO3	Develop the understanding of evaluation techniques and HCI models.
CO4	Demonstrate the concept of communication and human factors.
CO5	Apply the user centered deign methods.

Text Books	
1.	A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers,2018
2.	Wilbert O. Galitz, "The Essential Guide to User Interface Design: An Introduction to Gui Design Principles and Techniques", Third Edition, John Wiley Sons, 2017..

Reference Books	
1.	Sharp, H., Rogers, Y., and Preece, J, "Interaction Design: Beyond Human – Computer Interaction", Third Edition, John Wiley & Sons, Inc., 2021.
2.	Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2020.

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B.E / B.Tech	B23AMO601 - AI FOR SMART SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To recall the different types of AI based on capabilities and functionality
2.	To discuss the ethical implications of AI and how they affect societal impact
3.	To analyze a case study of AI-enhanced weather forecasting and evaluate its effectiveness in agricultural applications
4.	To evaluate the potential future trends and ethical dilemmas in the integration of AI in healthcare and autonomous systems
5.	To design a functional interactive AI system, such as a food delivery app, integrating AI technologies like voice recognition and user interaction design

UNIT - I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	9

Basics of AI: Definition and origins - Intelligence and its measurement - History and evolution of AI technologies - Overview of AI applications in smart systems - Types of AI: Based on Capabilities and Functionality - The Role of Ethics in AI Governance - Symbolic AI vs. Connectionist AI - Autonomous Vehicles and Intelligent Transportation Systems

UNIT – II	AI METHODOLOGIES AND TECHNIQUES	9

Introduction to Robotics and AI – Ethics of AI – Machine learning basics – Supervised learning - Unsupervised learning – AI in smart homes - Impact of AI in society

UNIT – III	ADVANCED AI TOPICS	9

Soft Computing: Overview and applications - Chat Bots and Conversational AI: Design and development - AI in Cyber-Physical Systems: Integration and challenges - AI-enabled IoT: Concepts – Case study : Agriculture: AI-Enhanced Weather Forecasting

UNIT – IV	APPLICATIONS OF AI IN SMART SYSTEMS	9

AI in Healthcare: Diagnostics and personalized medicine - AI in Automotive Systems: Autonomous vehicles - AI in Robotics: Intelligent control and navigation - Ethical considerations and future trends in AI

UNIT – V	INTERACTIVE AI SYSTEM DESIGN	9

Fundamentals of Human-AI Interaction - Role of AI in personal assistants – Interactive AI in customer service – AI in Education – Voice recognition systems - Future Trends in Interactive AI Design - Case Study: Designing an Interactive Food Delivery App

Total Instructional hours: 45

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Course Outcomes : Students will be able to	
CO1	Recall the definition and origins of AI, including its historical evolution and types based on capabilities and functionality.
CO2	Apply AI methodologies, such as machine learning, to analyze and solve problems in smart home systems.
CO3	Evaluate the effectiveness of AI in solving real-world problems.
CO4	Discuss the ethical considerations and predict future trends in the development of AI technologies.
CO5	Analyze trends in the future of interactive AI design, including advancements in voice recognition systems and their potential impact on different sectors.

Text Books	
1.	Khan, I. U., Ouaissa, M., Ouaissa, M., Fayaz, M., & Ullah, R., Artificial Intelligence for Intelligent Systems: Fundamentals, Challenges, and Applications, CRC Press, 1st Edition, 2024.
2.	Ramana, T. V., Ghantasala, G. S. P., Sathiyaraj, R., & Khan, M., Artificial Intelligence and Machine Learning for Smart Community, CRC Press, 1st Edition, 2023.

Reference Books	
1.	P, M., Kumar, M. V., & Umamaheswari, R., Machine Learning and IoT for Intelligent Systems and Smart Applications, CRC Press, 1st Edition, 2022.
2.	Venkatesh, C., Rengarajan, N., Ponmurugan, P., & Balamurugan, S., Smart Systems for Industrial Applications, Scrivener Publishing, 1st Edition, 2022.
3.	Tanwar, R., Bhatia, S., Sapra, V., & Ahuja, N. J. (Eds.). (2024). Artificial Intelligence and Machine Learning: An Intelligent Perspective of Emerging Technologies. CRC Press.
4.	Kose, U., Prasath, V. B., Mondal, M., Podder, P., & Bharati, S. (Eds.). (2022). Artificial Intelligence and Smart Agriculture Technology. *Auerbach Publications.*

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B.E / B.Tech	BM23BMO601- MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the electrode behavior and amplifiers
2.	To gain knowledge of various biopotential measurement
3.	To familiarize various electrical and non-electrical physiological parameters.
4.	To learn biochemical measurement
5.	To learn recent trends for biomedical applications

UNIT - I	BIOPOTENTIAL ELECTRODES AND AMPLIFIERS	9

Cell potential- Resting and Action potential, Electrode Electrolyte Interface, Types of electrodes, Bio signal characteristics– frequency and amplitude ranges, Bioamplifier, isolation amplifiers – transformer and optical isolation, Artifacts and removal.

UNIT - II	BIOPOTENTIAL MEASUREMENT	9

ECG – Einthoven 's triangle, standard 12 lead system, block diagram. Measurement of heart sounds - PCG. EEG – 10-20 electrode system, unipolar, bipolar and average mode, Functional block diagram. EMG – unipolar and bipolar mode, block diagram, EOG and ERG

UNIT - III	PHYSIOLOGICAL PARAMETER MEASUREMENT	9

Temperature, Respiration rate and pulse rate measurements, Plethysmography, Pulse oximetry, Blood Pressure measurement-direct and indirect method. Blood flow - Ultrasound blood flow measurement. Cardiac output measurement- Indicator dilution, dye dilution and thermodilution method, GSR Measurement, Patient Monitoring system

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UNIT - IV	BIOCHEMICAL MEASUREMENT	9
Blood gas Analyzer, Blood Glucose measurement, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyser.		
UNIT - V	**RECENT TRENDS**	**9**
Point of care devices, Endoscopy unit, Radio pill, laproscopy, Applications of Laser in medicine, cryogenic application. Biotelemetry, Telemedicine, m-health.		
Total Instructional hours : 45		

Course Outcomes: Students will be able to	
CO1	Understand the electrode behavior
CO2	Comprehend the fundamentals of Bio potential recording.
CO3	Design various bio amplifiers
CO4	Measure various electrical and non-electrical physiological parameters.
CO5	Understand different monitoring system

Text book	
1.	Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”,Pearson Education, 4th Edition, 2014.
	John G.Webster, “Medical Instrumentation Application and Design”, John Wiley and and Sons,New York, 4th Edition, 2009.

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Reference Books	
1.	Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi,3 rd Edition, 2014.
2.	Richard Aston, “Principles of Biomedical Instrumentation and Measurement” Merril PublishingCompany, 1990.
3.	L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, 3 rd Edition,John Wiley and Sons, Reprint 2008.

Program Coordinator

Approved by BOS Chairman

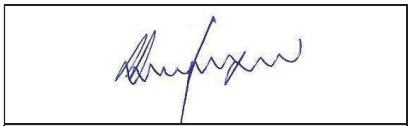
B. Tech.	B23BTO601 – BIOINFORMATICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know the knowledge of databases and its maintenance.
2.	To provide the basic concept of various algorithms
3.	To deliver the knowledge on protein designing and its interactions.

Pre-requisite (if any)
Biochemistry, Molecular Biology, Protein Engineering

UNIT 1	INTRODUCTION TO BIOINFORMATICS	9
Scope of Bioinformatics, Databases- DBMS, Biological databases-classification-importance, Sequence Databases- GenBank, NCBI, DDBJ, EMBL, UniProt, SWISS-PROT, PIR, TrEMBL, Structural Databases-PDB, SCOP, CATH, pfam.		
UNIT 2	**SEQUENCE ANALYSIS**	**9**
Sequence Alignment- Sequence Homology Vs Sequence Identity Vs Sequence Similarity, Types of Sequence alignment methods- PSA, MSA, Scoring Function and Substitution Matrices-PAM & BLOSUM, Algorithms-Needleman-Wunch & Smith-Watermann, BLAST and its types, FASTA.		
UNIT 3	**PHYLOGENETIC RELATIONSHIPS**	**9**
Introduction to Phylogenetics-Parts of Phylogenetic Tree-Types of trees, Molecular Clock Theory, Distance Based Method- UPGMA, NJ, Character Based Method- Maximum Parsimony Method, Maximum Likelihood Method, Method of evaluating phylogenetic tree- Bootstrapping, Jackknife resampling, Data perturbation.		
UNIT 4	**STRUCTURAL ANALYSIS**	**9**
Protein Structure Visualization, Structural Prediction- Primary structure & Secondary Structure, tertiary Structure-Homology Modelling, Hidden Markov Model, Threading, Ab-initio method, Validation by Ramachandran plot.		
UNIT 5	**APPLICATIONS**	**9**
System Biology-Introduction and its importance, Microarray Data analysis, Approaches to drug designing and discovery.		
Total Instructional Hours: 45		

Course Outcomes After the successful completion of the course, the students will be able to,		Knowledge Level
CO1	Examine various biological databases.	K4
CO2	Compare genomic and proteomic sequences using various bioinformatics tools.	K5
CO3	Measure the evolutionary relationship using phylogenetic methods	K5
CO4	Compare vast genomic and proteomic dataset.	K5
CO5	Develop basic bioinformatics scripts with Perl programming.	K6

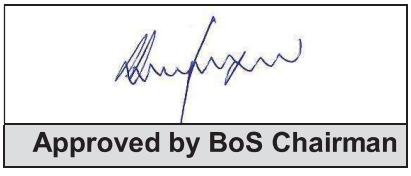


Approved by BoS Chairman

Text Books	
1.	Introduction to Bioinformatics by Arthur K. Lesk, Oxford University Press. ,4th edition 2014
2.	Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press. 1999
3.	Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, A.Krogh, G.Mitchison, Cambridge University Press. 2013
4.	Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press. 2nd edition, 2004.

Reference Books	
1.	Next Generation Sequencing Data Analysis, by Xinkun Wang CRC Press 2016

CO-PO-PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	3	3	3	2	3	3	2	3
CO2	3	2	3	3	2	2	2	3	1	3	3	3	3	2
CO3	3	3	2	2	3	3	2	2	2	3	2	2	3	3
CO4	2	3	2	3	3	3	3	3	2	2	2	3	2	3
CO5	3	3	3	2	2	3	2	3	3	3	3	3	2	2
Wt. Avg.	**2.8**	**2.6**	**2.6**	**2.4**	**2.6**	**2.6**	**2.4**	**2.8**	**2.2**	**2.6**	**2.6**	**2.8**	**2.4**	**2.6**



Approved by BoS Chairman

B.E.	B23CSO601- FOUNDATIONS OF WEB DEVELOPMENT (Except CSE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the structure of websites and fundamental web technologies such as HTML5 and CSS3.
2.	To understand basic programming concepts using Java for web development.
3.	To explore dynamic client-side functionalities using JavaScript and DHTML.
4.	To identify the role of server-side programming and databases in web applications.
5.	To apply web development knowledge for building basic interactive applications.

UNIT - I	BASICS OF WEB	9

Basics of Internet – Web Clients and Servers – HTTP Protocol – Web Communication. HTML5: Tags, Forms, Tables, Lists, Multimedia Integration (Audio, Video). CSS3: Styling Text and Layout – Inline, Embedded, External Style Sheets – Responsive Layout

UNIT - II	PROGRAMMING CONCEPTS	9

Need for Programming in Web Development – Java Overview – Simple Java Program Structure – Variables, Data Types, Operators, Control Structures – Arrays – Methods – Introduction to Classes and Objects (no inheritance). Use of Java in Web and GUI Applications

UNIT - III	JAVASCRIPT AND DYNAMIC WEB PAGES	9

JavaScript Basics: Variables, Operators, Conditional Statements, Loops – Functions. Working with Forms – Validations – DOM Manipulation – Popups and Events. DHTML: Combining HTML, CSS, JavaScript for Simple Interactions.

UNIT - IV	SERVER-SIDE PROGRAMMING BASICS	9

Overview of Server-Side Scripting – Introduction to Java Servlets – Servlet Lifecycle – Handling Form Data using GET and POST – Session Management – Basics of Cookies. Web Server Setup: Apache Tomcat (Overview and Setup).

UNIT - V	DB CONNECTIVITY AND APPLICATIONS	9

Basics of Database for Web – Introduction to JDBC – Connecting Java Applications to Databases – Sample Data Insertion and Retrieval – Use Cases in Industry and Healthcare Systems. Mini Case Study: Simple Web Application with Form Input and Database Storage.

Total Instructional hours: 45

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Course Outcomes: Students will be able to	
CO1	Outline core components of web applications including HTML5 and CSS3.
CO2	Apply basic Java programming for developing interactive functionalities
CO3	Develop dynamic client-side interactions using JavaScript and DHTML
CO4	Explain the workflow of server-side programs and sessions using Java servlets
CO5	Construct a simple web application integrating frontend, server-side logic, and database

Text Books	
1.	Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2018.
2.	Budi Kurniawan, Servlet & JSP: A Tutorial, 2nd Edition, Brainy Software Inc., 2015.

Reference Books	
1.	Deitel P.J. & Deitel H.M., Internet and World Wide Web How to Program, Pearson Education, 2020.
2.	Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2011.
3.	Herbert Schildt, Java: A Beginner's Guide, McGraw-Hill, 2018.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K3														
CO4	K2														
CO5	K3														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

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B.E / B. TECH	B23ECO601 - WIRELESS TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand Introduction about wireless Communication.
2.	Study the basic concepts of channel modeling.
3.	Learn the access schemes in wireless communication.
4.	Understand channel capacity in wireless communication system.
5.	Learn evolution of wireless technologies.

UNIT I INTRODUCTION	9
Introduction to wireless communication systems-Cellular concept – system design fundamentals Handoff Strategies- Interference and system capacity, Improving Coverage and Capacity	

UNIT II CHANNEL MODELING	9
Free space propagation model, Reflection- Diffraction — Scattering - Log-normal shadowing. Small-scale multipath propagation, Types of small-scale fading, Rayleigh and Ricean distribution, Input /output model of the wireless channel-Time and frequency coherence-Statistical channel models	
UNIT III ACCESS SCHEMES AND DIVERSITY	**9**
FDMA, TDMA, CDMA, SDMA and CSMA, OFDMA. Diversity Techniques—Frequency diversity, Time diversity, Code diversity, Antenna diversity–RAKE Receiver-SIMO, MISO, MIMO, MIMO-OFDM Technique	
UNIT IV CAPACITY OF WIRELESS CHANNELS	**9**
AWGN channel capacity — capacity of flat fading channels, Frequency-selective fading channels, Multiuser capacity, Downlink channel capacity, Uplink channel capacity, Outage capacity	
UNIT V EVOLUTION OF WIRELESS TECHNOLOGIES	**9**
Mobile Technologies - GSM, 3G, 4G (LTE) and 5G technologies, Wireless LAN Technologies and WLL.	
	Total Instructional hours: 45

Approved by BOS Chairman

Course Outcomes: Students will be able to	
CO1	Learn fundamentals of wireless communication.
CO2	Understand the concepts of channel modeling.
CO3	Study various access schemes in wireless communication.
CO4	Understand channel capacity in wireless networks.
CO5	Learn evolution of wireless technologies.

Text Books	
1.	Andrea Gold smith, " Wireless Communications", Cambridge University Press, 2012.
2.	DavidTse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2015.

Reference Books	
1.	Kamilo Feher,"Wireless Digital Communications, Modulation & Spread Spectrum Applications", PHI, 2015.
2.	William C.Y.Lee, "Mobile Communication Engineering", McGraw Hill, 2014.
3.	Theodore S.Rappaport, "Wireless Communications", Pearson Education,2017
4.	Andreas F.Molisch,"Wireless Communications", Wiley, 2011.
5.	Learn evolution of wireless technologies.

<table>
<tr><th colspan="5">Evaluation Pattern:</th></tr>
<tr><th colspan="4">Continuous Internal Assessment</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">CIA I (Theory)
(100 Marks)</td><td colspan="2">CIA II (Theory)
(100 Marks)</td><td rowspan="2">Theory End Semester Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td></tr>
<tr><td>40 Marks</td><td>60 Marks</td><td>40 Marks</td><td>60 Marks</td><td></td></tr>
<tr><td colspan="4">40 Marks</td><td>60 Marks</td></tr>
<tr><td colspan="5">Total: 100 Marks</td></tr>
</table>

- AAT - Individual Assignment/ Case Study/ Seminar/ Mini project/ MCQ/ Role Play/ Group Discussion/ Debates/ Oral Presentations/ Poster Presentations/ Technical Presentations can also be provided course coordinator can choose any one/two components based on the nature of the course.

Approved by BOS Chairman

B.E	B23EEO601 – GREEN ELECTRONICS AND SUSTAINABLE TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of Green Electronics.
2.	To explain sustainable materials and design practices.
3.	To reveal the renewable energy in Electronics.
4.	To understand the E-Waste management and recycling strategies.
5.	To explain the emerging trends in sustainable technologies.

UNIT-I	Introduction to Green Electronics	9
Overview of Green Electronics and Sustainability-Environmental Impact of Electronic Waste (E-Waste)- Energy Consumption in Electronics Manufacturing-Green Engineering Principles-Life Cycle Assessment (LCA) of Electronic Devices.		

UNIT-II	Sustainable Materials and Design	9
Eco-friendly and Biodegradable Electronic Materials-Sustainable Circuit Design Techniques-Low-power and Energy-efficient Semiconductor Technologies-Flexible and Organic Electronics-Sustainable PCB (Printed Circuit Board) Manufacturing.		

UNIT-III	Renewable Energy for Electronics	9
Solar Energy: Photovoltaics in Electronics-Energy Harvesting Techniques (Piezoelectric, Thermoelectric, etc.)- Battery Technologies and Green Energy Storage Solutions- Supercapacitors and Fuel Cells for Sustainable Electronics-Smart Grid and IoT for Energy Efficiency.		

UNIT-IV	Waste Management and Recycling of Electronics	9
E-Waste Recycling Techniques and Challenges-Circular Economy in Electronics-Regulations and Policies for Electronic Waste Management-Extended Producer Responsibility (EPR)- Case Studies on Successful E-Waste Management.		

UNIT-V	Emerging Trends and Future of Green Electronics	9
AI and IoT for Energy-efficient Systems-Sustainable Computing and Cloud Technologies-Green 5G and Communication Technologies-Carbon Footprint Reduction in Semiconductor Industries-Future Innovations in Sustainable Electronics.		
Total Instructional hours:45		

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Illustrate the concept of green electronics and sustainability.
CO2	Explain the Sustainable Materials and Design with low-power and energy-efficient semiconductor technologies.
CO3	Demonstrate green energy storage solutions such as batteries, supercapacitors, and fuel cells.
CO4	Interpret the principles of e-waste recycling and the circular economy.
CO5	Infer the advancements in green computing, energy-efficient communication, and semiconductor technologies.

Text Books	
1.	John Lamb, “Green Electronics/Green Bottom Line: A Commonsense Guide to Environmentally Responsible Engineering and Management”, CRC Press, 2007.
2.	Santosh K. Kurinec, Krzysztof Iniewski, “Energy-Efficient Computing and Electronics: Devices to Systems”, CRC Press, 2019.
3.	Sunil Kumar, Vineet Kumar, “Electronic Waste Management: Policies, Processes, Technologies, and Impact”, Wiley Publications, 2023.
4.	Wayne C. W. Chan, Alan C. L. Wong, “Sustainable Electronics and Photonics”, Wiley publications, 2021.

Reference Books	
1.	Mohammad S. Obaidat, Alagan Anpalagan, Isaac Woungang, “Handbook of Green Information and Communication Systems”, Academic Press, 2013.
2.	Kaka Ma, “Sustainable Materials and Green Processing for Energy Conversion”, Trans Tech Publications, Elsevier, 2021
3.	Muhammad Zaffar Hashmi, Ajit Varma, “Environmental Impact of Electronic Waste and Sustainable Recycling Methods”, Springer, 2019.

Approved by BoS Chairman

B.E. / B.Tech	B23MEO601 - 3D PRINTING AND TOOLING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To explore the technology used in additive manufacturing.
2.	To develop CAD models for 3D printing.
3.	To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4.	To select a 3D printing process for an application.
5.	To produce a product using 3D Printing or Additive Manufacturing (AM).

UNIT - I	INTRODUCTION TO ADDITIVE MANUFACTURING (AM)	9

Overview – History – Need – classification - Additive Manufacturing Technology in product development – Materials for Additive Manufacturing.

UNIT - II	CAD AND REVERSE ENGINEERING	9

Basic concept – 3D scanning – digitization techniques – Model reconstruction – data processing for reverse engineering - Additive Manufacturing Technology : CAD model preparation – Part orientation and support generation – Model slicing – Tool path generation.

UNIT - III	LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING	9

Classification – liquid based system – stereo lithography apparatus (SLA) – principle, process, advantages and applications – solid based system – Fused Deposition Modeling – principle, process, advantages.

UNIT - IV	LASER BASED ADDITIVE MANUFACTURING SYSTEMS	9

Selective laser sintering – principles of SLS process – process, advantages and applications, 3D Printing - principle, process, advantages - Laser Engineered Net Shaping (LENS).

Approved by BoS Chairman

UNIT - V	RAPID TOOLING AND APPLICATIONS OF ADDITIVE MANUFACTURING	9
Principles and typical process for quick batch production of plastic and metal parts through quick tooling – applications for Aerospace, defence, automobile, Bio-medical and general engineering industries		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the importance of Additive Manufacturing.
CO2	Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
CO3	Define the various process used in Additive Manufacturing.
CO4	Identify and select suitable process used in Additive Manufacturing.
CO5	Understand the basic concept of quick tooling and additive manufacturing application.

Text Books	
1.	Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies : Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2.	Andreas Gebhardt, “Understanding Additive Manufacturing : Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
3.	Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.

Reference Books	
1.	J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
2.	Dougles Bryden, “CAD and Prototyping for Product Design”, 2014.
3.	CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.

Approved by BoS Chairman

B.E / B.TECH	B23CBO601 DATA SCIENCE FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of Data Science.
2.	To understand the Analytics Life Cycle.
3.	To understand the process of acquiring Business Intelligence & various types of analytics for Business Forecasting
4.	To model the supply chain management for Analytics.
5.	To apply analytics for different functions of a business

UNIT- I Introduction to Data Science	9
Need for Data Science – Benefits and uses – Facets of data – Types of data- Organization of data - Data Science process- Data Science life cycle- Role of Data Science - Big Data – sources and characteristics of Big Data	

UNIT-II Introduction to Business Analytics	9
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration	

UNIT- III Business Intelligence & Forecasting	9
Data Warehouses and Data Mart – Knowledge Management –Types of Decisions – Decision-Making Process – Decision Support Systems – Business Intelligence –OLAP – Analytic functions - Introduction to Business Forecasting and Predictive analytics – Logic and Data-Driven Models – Data Mining and Predictive Analysis Modeling –Machine Learning for Predictive analytics.	

Approved by BoS Chairman

UNIT- IV HR & Supply Chain Analytics	9
Human Resources – Planning and Recruitment – Training and Development – Supply chain network – Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain. Apply HR Analytics to make a prediction of the demand for hourly employees for a year.	

UNIT- V Marketing & Sales Analytics	9
Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales. Do predictive analytics for customers' behaviour in marketing and sales.	
Total Instructional hours: 45	

Course Outcomes: Students will be able to	
CO1	Understand the data science basics and its life cycle.
CO2	Understand the role of data science in business decision-making and strategy formulation.
CO3	Apply business intelligence tools and analytic functions.
CO4	Apply analytics in various HR functions such as recruitment, planning, and training.
CO5	Use predictive analytics to interpret and forecast customer behavior in marketing and sales contexts.

Text Books:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Efrain Turban, Jay E.Aronson, Teng-Peng Liang, Ramesh Sharada "Decision Support Systems and Intelligent Systems" 8th Edition, Pearson Education, 2007.

Reference Books :

1. R. Evans James, Business Analytics, 2017.
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2017.
3. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016.

Approved by BoS Chairman

MANDATORY COURSE I

B.E / B.Tech	B23MCT501- Environmental Sustainability (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand ecosystems and the environment**,** including how they work and their importance.
2.	To learn about biodiversity and ways to protect endangered species.
3.	To Identify causes and solutions for pollution and waste management.
4.	To explore natural resources and how human activities affect them.
5.	To discuss global issues like climate change, population growth, and sustainable living.

SYLLABUS:

UNIT - I	ENVIRONMENT AND ECOSYSTEM	6

Scope and importance of environment - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem - food chains and food webs – structure and function of the (a) forest ecosystem (b) desert ecosystem (c) aquatic ecosystems (pond & marine).

UNIT - II	BIODIVERSITY	6

Introduction to Biodiversity: Genetic, species and ecosystem diversity. Value of biodiversity - hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT - III	ENVIRONMENTAL POLLUTION	6

Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) soil pollution - solid waste management: causes, effects and control measures of municipal solid wastes.

Approved by BoS Chairman

UNIT - IV	NATURAL RESOURCES	6
Forest resources: Use and over-exploitation, deforestation - Water resources: Use and over-utilization of surface and ground water - Land as a resource, land degradation, man induced landslides, soil erosion and desertification.		

UNIT - V	HUMAN POPULATION, SOCIAL ISSUES AND THE ENVIRONMENT	6
Population growth, variation among Nations – Population explosion. climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.		
	TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Explain the structure and function of various ecosystems and explain the flow of energy through food chains and food webs.
CO2	Relate the types, values, and threats to biodiversity and differentiate between in-situ and ex-situ conservation methods.
CO3	Summarize the causes and impacts of major types of environmental pollution and suggest appropriate control measures.
CO4	Interpret the usage and over-exploitation of natural resources and analyse their environmental consequences.
CO5	Outline the impact of human population growth and social issues on environmental degradation and global climate phenomena.

Text Books	
1.	Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nedition,Pearson Education, 2004.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006

Reference Books	
1.	G.Tyler Miller and Scott E. Spoolman, —'Environmental Science',Cengage LearningIndia Pvt, Ltd, Delhi, 2014
2.	Erach Bharucha, —Textbook of Environmental Studies‖, Universities Press (I) PVT, LTD, Hydrabad, 2015.

Approved by BoS Chairman

B.E / B.Tech	B23MCT502 - ELEMENTS OF LITERATURE (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand and identify key literary elements in various texts.
2.	To analyze how authors use literary devices to convey themes and messages.
3.	To examine how character, setting, plot, and other elements contribute to the overall meaning of a work.
4.	To appreciate the different forms and genres of literature.
5.	To develop writing and analytical skills through discussions, essays, and presentations.

UNIT-I	INTRODUCTION TO LITERARY ELEMENTS	6

- **Overview of Literary Elements:** Definition and significance of literary elements
- **Introduction to the core components:** plot, setting, character, theme, and conflict
- Understanding literary genres (fiction, poetry, drama, nonfiction)

UNIT-II	PLOT AND STRUCTURE	6

- The five stages: Exposition, Rising Action, Climax, Falling Action, Resolution
- Types of conflict (man vs. man, man vs. self, man vs. nature, etc.)
- Plot devices (foreshadowing, flashbacks, etc.)

UNIT-III	CHARACTERIZATION	6

- **Types of Characters:** Protagonist, antagonist, dynamic, static, round, flat, etc. Direct vs. indirect characterization
- **Character Development:**
- How characters change or grow throughout a story
- Analyzing motivations, conflicts, and relationships

UNIT-IV	SETTING	6

- **Understanding Setting:**
- The time, place, and social environment of a story
- How setting influences plot and character development
- Symbolism and mood created through setting

Approved by BoS Chairman

UNIT-V	ANALYZING LITERARY WORKS	6
• **Close Reading and Analysis:** • Developing analytical skills through in-depth examination of texts • Understanding the role of diction, syntax, and tone in literature • **Comparative Analysis:** • Comparing works of literature across genres or time periods • Drawing connections between themes, characters, and literary devices		
		Total Instructional hours:30

Course Outcomes: Students will be able to	
CO1	Identify and Interpret Literary Elements. (K2)
CO2	Analyze Literary Devices. (K4)
CO3	Evaluate Narrative Structure. (K5)
CO4	Explore various literary forms and genres. (K3)
CO5	Develop Critical Thinking and Writing Skills. (K6)

Text Books	
1.	Narayan RK, “Malgudi Days”, Indian Thought Publications, New York, 2015
2.	Shaw, George Bernard, “Greatest works of George Bernard Shaw”, Maple Press, 2010
3.	Nair, Anita, “Ladies Coupe-A Novel in Parts”, Penguin Books, 2014

Reference Books	
1.	Abram, “A Glossary of Literary Terms”, Thomson India, 2008
2.	Trivedi, “India’s Shakespeare”, Pearson, 2008
3.	Orwell, George “Animal Farm”, Penguin Books Press, India, March 2011.
4.	Shakespeare, William “As You Like It”, Om Books International published, 2025.
5.	Allan Poe, Edgar, “The Raven”, Penguin Books Press, India, Oct 2013
6.	O. Henry, “The Gift Of The Magi”, Arcadia Publishing, December 2024

B.E / B.Tech	B23MCT503 - FOUNDATIONS OF YOGA	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To introduce the fundamental concepts and philosophy of Yoga and its relevance to modern life.
2.	To develop awareness of the physical, mental, and emotional benefits of Yoga through an understanding of its principles.
3.	To impart knowledge about the ethical and moral foundations of Yoga as described in Patanjali's Yoga Sutras (Yama, Niyama, etc.).
4.	To promote a healthy and disciplined lifestyle by integrating Yogic practices and values into daily routines.
5.	To enable students to manage stress and enhance concentration through the theoretical understanding of pranayama, meditation, and yogic relaxation techniques.

SYLLABUS:

UNIT - I	INTRODUCTION TO YOGA	6

- Definition, origin and evolution of Yoga.
- Aim, objectives, and relevance of Yoga in modern life.
- Different schools of Yoga (Raja Yoga, Karma Yoga, Bhakti Yoga, Jnana Yoga, Hatha Yoga).

UNIT - II	HEALTH AND YOGA	6

- Concept of health in Yoga.
- Holistic approach of Yoga to health and well-being.
- Role of Yoga in stress management.
- Yoga as preventive and therapeutic tool.

UNIT - III	YOGIC LIFESTYLE	6

- Yogic principles of food and diet.
- Importance of discipline (Yama, Niyama) in daily life.
- Daily routine and time management.
- Positive thinking and mental hygiene through Yoga.

Approved by BoS Chairman

UNIT - IV	ASANAS	6

- Standing Asanas: Tadasana, Trikonasana, Vrikshasana.
- Sitting Asanas: Padmasana, Vajrasana, Ardha Matsyendrasana.
- Lying Asanas: Bhujangasana, Shalabhasana, Sarvangasana, Savasana.
- Benefits and precautions.

UNIT - V	MEDITATION AND RELAXATION	6

- Basics of Meditation.
- Guided Meditation Techniques.
- Yoga Nidra / Deep Relaxation Technique (DRT).
- Stress management through meditation.

TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Illustrate the origin, definition, and philosophy of Yoga and its significance in holistic well-being.
CO2	Explain the principles and practices of Ashtanga Yoga as outlined by Patanjali.
CO3	Outline the role of Yoga in promoting physical health, mental clarity, and emotional stability.
CO4	Interpret the ethical and lifestyle principles of Yoga (Yama and Niyama) for personal development.
CO5	summarize how Yogic practices help in stress management and enhancing concentration in daily life.

Text Books	
1.	Light on Yoga – B.K.S. Iyengar. Publisher: HarperCollins,1966
2.	Patanjali Yoga Sutras – Swami Vivekananda commentary, Publisher: Advaita Ashrama, 1896.

Reference Books	
1.	Yoga for Health – Swami Kuvalayananda. *Publisher: Kaivalyadhama, Lonavala 1931.*
2.	Common Yoga Protocol – Ministry of AYUSH, Govt. of India, 2015

Approved by BoS Chairman

B.E /B.Tech	B25MCT504- EXPORT IMPORT MANAGEMENT (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To learn the basics of international trade and its importance for businesses.
2.	To understand how goods are transported, paid for, and insured in global trade.
3.	To know how to choose the right products and markets for export.
4.	To get hands-on knowledge of export-import documents and procedures.
5.	To use digital tools and government support to grow your export business.

SYLLABUS:

UNIT - I	Introduction to Export and Import	6

Overview of International Trade, Importance of Export and Import in Business, International Trade Bodies and Local Regulatory Authorities, Export-Import Cycle: Step-by-Step Process, Online IEC (Import Export Code) Application, Myths and Opportunities in Global Trade.

UNIT - II	Logistics, Transportation & Payment Terms	6

Types of Transportation in International Trade, Containers, Packaging, and Shipment Handling, IncoTerms: Delivery Terms, Costs & Risks, Payment Terms: Modes of Payment & Risk Involved, Insurance and Risk Management in Trade.

UNIT - III	Product & Market Selection, Buyer Identification	6

Selecting the Right Product for Export, Market Research and Identifying Potential Markets, Importance of Trade Fairs & Exhibitions, Finding Genuine Buyers & Verification Process, Effective Communication with International Buyers.

UNIT - IV	Export & Import Documentation and Procedures	6

Understanding Proforma Invoice & Letter of Credit (LC), Pre & Post Shipment Documents, GST, Customs Clearance & Compliance Procedures, How to Fill Pre & Post Shipment Documents – Practical Exercise, Import Documentation and Procedures.

Approved by BoS Chairman

UNIT - V	Marketing, Incentives & Digital Trade Strategies	6
Export Incentives and Government Benefits, Pricing Strategies & Preparing Export Quotations, B2B Listing and Online Marketplaces, Digital Marketing & Social Media for Export Promotion, Buyer Calling, Data Collection & Product Portfolio Development.		

Course Outcomes: Students will be able to	
CO1	Explain the fundamentals of international trade, the role of trade bodies, and the complete export-import process. (K2)
CO2	Outline various transportation methods, Incoterms, packaging, payment terms, and risk management in international trade. (K2)
CO3	Apply knowledge to select suitable products and markets for export, identify genuine buyers, and effectively communicate in global trade. (K3)
CO4	Develop the ability to prepare and process export/import documentation, customs clearance, and GST compliance. (K3)
CO5	Utilize digital marketing, government incentives, and online platforms to develop export strategies and expand business opportunities. (K3)

Text Books	
1.	Thomas E. Johnson & Donna L. Bade, *Export/Import Procedures and Documentation*, 8th Edition, Ashgate Publishing, 2016.
2.	S. Tamer Cavusgil, Gary Knight, John R. Riesenberger, *International Business: The New Realities*, 3rd Edition, Pearson, 2017.
3.	P.K. Khurana, *Export-Import Theory, Practices, and Procedures*, 1st Edition, Atlantic Publishers & Distributors, 2016.
4.	Warren J. Keegan, Mark C. Green, *Global Marketing Management*, 9th Edition, Pearson, 2017.
5.	Francis Cherunilam, *International Trade and Export Management*, 9th Edition, Himalaya Publishing House, 2020

Approved by BoS Chairman

Reference Books	
1.	Anders Grath, *The Handbook of International Trade and Finance*, 3rd Edition, Kogan Page, 2020.
2.	Francis Cherunilam, *International Trade and Export Management*, 9th Edition, Himalaya Publishing House, 2020.
3.	V.K. Bhalla, *International Business: Theories and Practices*, 2nd Edition, Anmol Publications, 2020.
4.	S.K. Bhatia, *Export Management*, 1st Edition, Vikas Publishing House, 2018.
5.	R. Palaniappan, *International Trade and Export Management*, 1st Edition, Oxford University Press, 2019.

Approved by BoS Chairman

MANDATORY COURSE II

B.E / B.Tech	B23MCT601 – EDUCATION PSYCHOLOGY (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To enable students to acquire knowledge about various methods of psychology.
2.	To gain knowledge about the concept of learning and its related theories.
3.	To understand motivation and its influence on human behaviour.
4.	To comprehend in-depth concepts of intelligence and creativity.
5.	To explain the concepts and theories of personality.

SYLLABUS:

UNIT - I	EDUCATIONAL PSYCHOLOGY AND HUMAN GROWTH AND DEVELOPMENT	6
Psychology: Meaning - Educational psychology: Meaning, scope and significance - Dimensions of human growth and development: Physical, cognitive, emotional, social, moral and language.		

UNIT - II	ATTENTION AND MEMORY	6
Attention: Meaning, nature and determinants of attention - Memory: Meaning, types of memory and Strategies for improving memory.		

UNIT - III	MOTIVATION AND LEARNING	6
Motivation: Meaning and definitions - Level of aspiration learning: Theories of learning and its educational implications Cognitive Theory: Jean Piajet, Behaviourist Theory- Pavlov's Classical, Conditioning.		

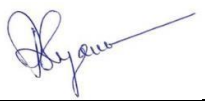
UNIT - IV	INTELLIGENCE AND CREATIVITY	6
Intelligence: Meaning, and types - Theories of Intelligence: Two factor, Thurston's Group factor - Intelligence Quotient (IQ) - Creativity: Concept, factors and process - Strategies for fostering creativity.		

UNIT - V	PERSONALITY	6
Personality: Meaning, definitions, and determinants of personality - Theories of Personality: Type, trait, and psychoanalytic Assessment of personality: Projective and non-projective techniques.		
TOTAL INSTRUCTIONAL HOURS		30

Course Outcomes: Students will be able to	
CO1	Explain various methods of psychology.
CO2	Describe the concept of learning and its related theories.
CO3	Discuss motivation and its influence on human behaviour.
CO4	Summarize the concepts of intelligence and creativity.
CO5	Interpret the concepts and theories of personality.

Text Books	
1.	Bert Laura, E. (2014). Child development. New Delhi: PHI Learning
2.	Chauhan, S. S. (2002). Advanced educational psychology. New Delhi: Vikas Publishing house.
3.	Hurlock, Elizabeth, B. (2015). Child development. New Delhi: McGraw Hill Education.
4.	Mangal, S.K. (2002). Advanced educational psychology. New Delhi: Prentice Hall of India.
5.	Matthews. G., Deary, L. J., & Whiteman, M.C. (2009). (2nd ed.). Personality: Theory and research. New York: Guilford Publications.

Reference Books	
1.	AnithaWoolfolk. (2004). Educational psychology. Singapore: Pearson Education.
2.	Cloninger, S.C. (2008) (5thed.). Theories of personality: Understanding persons. Englewood Cliffs, New Jersey: Prentice Hall.
3.	Schunk, D.H. (2007) (5thed.). Learning theories: An educational perspective. New York: Prentice Hall of India.
4.	Skinner, C.E. (2003) (4thed.). Educational psychology. New Delhi: Prentice Hall of India.
5.	Sprint Hall Norman, A, & Sprint Hall, Richard, C. (1990) (5thed.). Educational psychology: A developmental approach. New Delhi: McGraw Hill.



Approved by BoS Chairman

B.E / B.Tech	B23MCT602- Life Style Education (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand the importance of a healthy lifestyle and its impact on overall well-being.
2.	To learn about balanced nutrition, the role of essential nutrients, and healthy eating habits.
3.	To explore the benefits of regular exercise and different types of physical activities.
4.	To identify common lifestyle diseases and strategies for their prevention.
5.	To develop mental wellness through stress management, mindfulness, and better sleep habits.

UNIT - I	Introduction to a Healthy Lifestyle	6

- Definition & importance of a healthy lifestyle
- Nutrition, exercise, sleep, and mental well-being.
- Assessing current lifestyle habits.

UNIT - II	Nutrition & Balanced Diet	6

- Macronutrients & micronutrients: Their roles and sources.
- Healthy eating habits and meal planning.
- Importance of hydration.
- Harmful effects of processed food and unhealthy eating habits.

UNIT - III	Physical Fitness & Exercise	6

- Benefits of regular exercise on physical and mental health.
- Types of workouts: Cardio, strength training, yoga, and flexibility exercises.
- Designing a personalized fitness routine.

UNIT - IV	Lifestyle Diseases & Prevention	6

- Causes and prevention of obesity, diabetes, heart disease, and hypertension.
- Role of diet, exercise, and mental health in disease prevention.
- Importance of regular health check-ups.

UNIT - V	Mental Health & Stress Management	6

- Understanding stress, anxiety, and depression.
- Techniques for relaxation: Meditation, deep breathing, and mindfulness.
- Importance of sleep for overall health.
- Tips for improving sleep hygiene.

TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Explain the importance of a healthy lifestyle and its key aspects like nutrition, exercise, sleep, and mental well-being.
CO2	Describe the role of nutrients, healthy eating habits, and the effects of processed food.
CO3	Summarize different types of exercises and their benefits for physical and mental health.
CO4	Identify common lifestyle diseases, their causes, and ways to prevent them.
CO5	Discuss stress, anxiety, and sleep issues, along with techniques to manage them.

Text Books	
1.	*Francesc García, Héctor,Miralles*, Ikigai: The Japanese Secret to a Long and Happy Life, Penguin Audio, 2017.
2.	Relationship, wellbeing and behaviour, Harry T. Reis, World Library of Psychological series, Reutledge, Taylor and Francis Group, 2018.

Reference Books	
1.	Shawn Achor, The Happiness Advantage: How a Positive Brain Fuels Success in Work and Life, Crown Currency, 2018.
2.	James Clear, Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones, Penguin Audio, 2018.

Approved by BoS Chairman

B.E / B.Tech	B25MCT603 STARTUP AND VENTURE FUNDING (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand new venture creation opportunities, its resources, and requirements for Enterprise Start-up
2.	To understand the legal environment.
3.	To learn about the start-up environment and survival.
4.	To study the various funding availabilities for startups.
5.	To analyse the venture capital funding and its stages.

UNIT - I	Start-up An Overview	6

Introduction to start ups - The rise of startup economy – Ideation- Venture Choices - The Start-up Equation – The Entrepreneurial Ecosystem – Entrepreneurship in India. Government Initiatives.

UNIT - II	Start-up Capital Requirements and Legal Environment	6

Identifying startup capital requirements - estimating startup cash requirements - Startup financing metrics – Risk mitigation strategies - The legal framework for startups - Incorporation and commencement of businesses and registration of a company.

UNIT - III	Start-up Survival and Growth	6

Feasibility Study - Stages of growth of start-ups – Reasons for new start up failures- Scaling new ventures – preparing for change - Leadership succession. Support for growth and sustainability of the venture.

UNIT - IV	Funding of Start Up Ventures	6

Financing Opportunities for startups – Equity investment process – Angel Investors - Funding startups with bootstrapping- crowd funding- strategic alliances.

UNIT - V	Venture Capital Funding	6
Venture Capital – Meaning and features – Seed capital – Financing various stages of startup ventures – Exit strategy for venture capital funds.		

Course Outcomes: Students will be able to	
CO1	Implement entrepreneurship concepts in a start-up idea. (K3)
CO2	Use budgeting and legal setup processes for the venture. (K3)
CO3	Demonstrate feasibility through market and financial analysis. (K3)
CO4	Execute funding strategies suited for a new business. (K3)
CO5	Apply suitable funding methods for different stages of a new business using basic financial models and strategies. (K3)

Text Books	
1.	Kathleen R Allen, Launching NewVentures, An Entrepreneurial Approach, Cengage Learning, 2016.
2.	AnjanRaichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International, 2010.
3.	S. R. Bhowmik& M. Bhowmik, Entrepreneurship, New Age International, 2007.

Reference Books	
1.	Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016.
2.	Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur's Road Map, 2e, Routledge, 2017.
3.	Vijay Sathe, Corporate Entrepreneurship, 1e, Cambridge, 2009.

Approved by BoS Chairman

B.E / B.Tech	B23MCT604 – INDIAN KNOWLEDGE SYSTEM	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To introduce the scope and significance of Indian Knowledge Systems in the context of modern education and engineering.
2.	To explore ancient Indian contributions in science, mathematics, technology, and architecture.
3.	To understand core Indian philosophies, ethics, and values and their relevance in personal and professional life.
4.	To connect traditional practices with modern innovations through case studies and project-based learning.
5.	To promote sustainable thinking and design approaches inspired by indigenous knowledge and practices.

SYLLABUS:

UNIT - I	INTRODUCTION TO INDIAN KNOWLEDGE SYSTEM	6

- Meaning and scope of IKS
- Importance of IKS in modern education
- Relevance of IKS to science, technology, and engineering.

UNIT - II	SCIENCE AND TECHNOLOGY IN ANCIENT INDIA	6

- Contributions in mathematics (e.g., zero, decimal system, algebra – Aryabhata, Bhaskara)
- Ancient metallurgy (e.g., Iron Pillar of Delhi, zinc extraction)
- Astronomy and calendar systems (e.g., Surya Siddhanta, Jantar Mantar)
- Ayurveda and traditional health sciences.

UNIT - III	ENGINEERING AND ARCHITECTURE	6

- Vastu Shastra and ancient Indian architecture
- Temple construction and civil engineering marvels
- Water management systems (step wells, tanks, canals)
- Town planning in Harappan civilization.

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UNIT - IV	INDIAN PHILOSOPHY, ETHICS & VALUE SYSTEM	6

- Core concepts of Indian philosophy (Dharma, Karma, Yoga)
- Ethical principles in Indian tradition
- Role of values in professional and personal life
- Indian view on environmental sustainability.

UNIT - V	ARTS, CULTURE, AND LITERATURE	6

- Overview of Indian classical music and dance
- Ancient literature (Vedas, Upanishads, Ramayana, Mahabharata)
- Sanskrit and its scientific relevance
- Cultural practices and their scientific background.

	TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Explain the meaning, scope, and importance of Indian Knowledge Systems in the context of modern education.
CO2	Outline the key scientific and technological advancements of ancient India in fields like mathematics, metallurgy, and astronomy.
CO3	Interpret traditional Indian architectural and engineering practices, including Vastu Shastra and water management systems.
CO4	Illustrate the ethical values and philosophical principles of Indian traditions and their relevance in contemporary life.
CO5	Summarize the applications of IKS in modern innovation, entrepreneurship, and sustainable engineering practices.

Text Books	
1.	Introduction to Indian Knowledge Systems: Concepts and Applications, B. Mahadevan, Publisher: PHI Learning Pvt. Ltd. 2016.
2.	Science and Technology in Ancient India,: Roshen Dalal,Publisher: Penguin Books.2003
3.	Foundations of Indian Culture, Govind Sadashiv Ghurye, Publisher: Popular Prakashan. 1951

Reference Books	
1.	Indian Knowledge Systems – Volume 1, Kapil Kapoor & Michel Danino Publisher: Central Sanskrit University & Bharatiya Vidya Bhavan, 2021.
2.	The Argumentative Indian, By: Amartya Sen, Publisher: Picador, 2005.

Approved by BoS Chairman