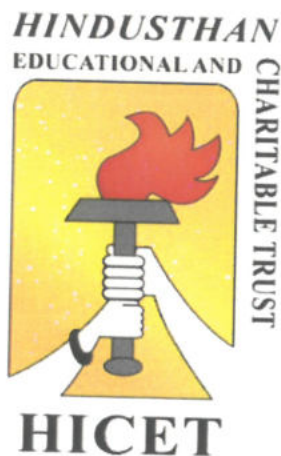


HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. AGRICULTURE ENGINEERING



Curriculum & Syllabus

2021-2022

CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

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

MISSION

1M1: To provide academic excellence in technical education through novel teaching methods.

1M2: To empower students with creative skills and leadership qualities.

1M3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION


To become a department of excellence in agricultural engineering by producing socially conscious professionals with good technical knowledge and innovative skill sets.

MISSION

MI: To impart strong technical knowledge in agricultural engineering through conducive learning environment.

M2: To empower students with innovative skill sets to address agricultural issues.

M3: To produce socially responsible agricultural professionals and provide sustainable solutions


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AGRI - HiCET




Dean (Academics)
HiCET

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- PO 1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO 2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering Sciences.
- PO 3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.


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

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

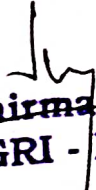
PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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


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

PO 11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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


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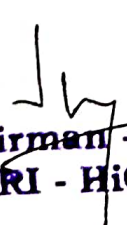

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PROGRAM SPECIFIC OUTCOMES (PSOs)


- PSO 1. Ability to understand agricultural scenario in World and India and superimpose agricultural engineering technologies for uplifting the agriculture.
- PSO 2. Ability to solve various issues in agriculture by infusing farm mechanization, conservation strategies for soil, water and renewable energy, advanced irrigation techniques and post harvest technology.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1. Graduates shall exhibit their sound theoretical, practical skills and knowledge for being a successful professional.
- PEO 2. Graduates shall be creative with leadership qualities and lifelong learning skills.
- PEO 3. Graduates shall hold high ethical values and be able to devise sustainable solutions to address agricultural issue.


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CURRICULUM



Hindusthan College of Engineering and Technology
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 Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. AGRICULTURE ENGINEERING

REGULATION-2016 & 2019

REGULATION-2019

For the students admitted during the academic year 2021-2022 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	3	0	0	3	40	60	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100
3	21ME1101	Basics of Civil and Mechanical Engineering	HS	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
4	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
5	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
6	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8	21HE1072	Career Guidance Level – I	EEC	2	0	0	0	100	0	100



		Personality, Aptitude and Career Development									
Total :			17	1	8	20	470	330	800		

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	3	0	0	3	40	60	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	40	60	100
3	21AG2104	Principles of Food Science	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
4	21PH2151	Material Science	BS	2	0	2	3	50	50	100
5	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
6	21IT2151	Programming in C	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	60	40	100
8	21HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total :				18	1	12	22	630	370	1000



For the students admitted during the academic year 2020-2021 and onwards
SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2	19AG3201	Soil Science and Engineering	PC	3	0	0	3	25	75	100
3	19AG3202	Fluid Mechanics and Hydraulics	PC	3	1	0	4	25	75	100
4	19AG3203	Principles and Practices of Crop Production	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG3251	Unit Operations in Agricultural Processing	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AG3001	Field Crop Production Practical	PC	0	0	3	1.5	50	50	100
7	19AG3002	Soil Science Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9	19HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total:				19	2	8	20	550	450	1000

SEMESTER IV

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



5	19AG4251	Bio Energy Resource Technology	PC	2	0	2	3	50	50	100
6	19AG4252	Surveying and Leveling	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19AG4001	Irrigation Field Lab	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	100	0	100
9	19HE4072	Career Guidance Level – IV: Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total				21	0	10	21	575	425	1000

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG5201	Farm Machinery and Equipment	PC	3	0	0	3	25	75	100
2	19AG5202	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
3	19AG5203	Theory of Machines	PC	3	0	0	3	25	75	100
4	19AG53XX	Professional Elective-I	PE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG5251	Groundwater and Well Engineering	PC	2	0	2	3	50	50	100
6	19AG5252	Soil and Water Conservation Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19AG5001	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5	50	50	100
8	19AG5002	CAD for Agricultural Engineering	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total				18	1	10	24	500	500	1000



SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG6201	Hydrology and Water Resources Engineering	PC	3	0	0	3	25	75	100
2	19AG6202	Solar and Wind Energy Engineering	PC	3	1	0	4	25	75	100
3	19AG6181	Professional Ethics	HS	3	0	0	3	25	75	100
4	19AG63XX	Professional Elective-II	PE	3	0	0	3	25	75	100
5	19XX64XX	Open Elective-I	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										
6	19AG6251	Food and Dairy Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19AG6001	ICT in Agricultural Engineering	PC	0	0	4	2	50	50	100
8	19AG6701	Industrial Training	EEC	0	0	0	1	0	100	100
MANDATORY COURSES										
9	19HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
Total				19	1	6	24	425	575	1000

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19AG5301	Systems Analysis and Soft Computing in Agricultural Engineering	PC	3	0	0	3	25	75	100
2	19AG5302	Sustainable Agriculture and Food Security	PC	3	0	0	3	25	75	100
3	19AG5303	CDM and Carbon Trading Technology	PC	3	0	0	3	25	75	100
4	19AG5304	IOT in Agricultural Systems	PC	3	0	0	3	25	75	100
5	19AG5305	Ergonomics and Safety in Agricultural Engineering	PC	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	19AG6301	Climate change and adaptation	PC	3	0	0	3	25	75	100



2	19AG6302	Heat and Mass Transfers for Agricultural Engineers	PC	3	0	0	3	25	75	100
3	19AG6303	Disaster Management	PC	3	0	0	3	25	75	100
4	19AG6304	Horticultural Crop Processing	PC	3	0	0	3	25	75	100
5	19AG6305	Organic Farming Technologies	PC	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVE										
AGRICULTURE ENGINEERING										
S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ES E	TOTAL
1	19AG6401	Modern Agricultural Practices	OE	3	0	0	3	25	75	100

For the students admitted during the academic year 2018-2019 and onwards

SEMESTER VII

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16AG7201	Groundwater and Well Engineering	PC	3	0	0	3	25	75	100
2	16AG7202	Remote Sensing and Geographical Information System	PC	3	0	0	3	25	75	100
3	16AG7203	Solar and Wind Energy Engineering	PC	3	0	0	3	25	75	100
4	16AG7204	Agricultural Extension	PC	3	0	0	3	25	75	100
5	16AG73XX	Professional Elective -III	PE	3	0	0	3	25	75	100
6	16AG73XX	Professional Elective -IV	PE	3	0	0	3	25	75	100
7	16XX74XX	Open Elective - II	OE	3	0	0	3	25	75	100
PRACTICAL										
8	16AG7001	GIS Laboratory for Agricultural Engineers	PC	0	0	2	1	50	50	100
9	16AG7002	Renewable Energy	PC	0	0	4	2	50	50	100



		Laboratory								
10	16AG7003	ICT in Agricultural Engineering Laboratory	PC	0	0	4	2	50	50	100
11	16AG7701	Industrial Training / Technical Seminar	EEC	0	0	0	2	0	100	100
Total				21	0	10	28	325	775	1100

SEMESTER VIII

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16AG83XX	Professional Elective – V	PE	3	0	0	3	25	75	100
2	16AG83XX	Professional Elective-VI	PE	3	0	0	3	25	75	100
PRACTICAL										
7	16AG8901	Project Work	EEC	0	0	20	10	100	100	200
Total				6	0	20	16	150	250	400

PROFESSIONAL ELECTIVE – III

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	16AG7301	Industrial Waste Water Management	PC	3	0	0	3	25	75	100
2	16AG7302	Ergonomics and Safety in Agricultural Engineering	PC	3	0	0	3	25	75	100
3	16AG7303	On Farm Water Management	PC	3	0	0	3	25	75	100
4	16AG7304	Watershed Hydrology and Management	PC	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – IV

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	16AG7305	Application of Drone and Robotics Technology in Agriculture	PC	3	0	0	3	25	75	100
2	16AG7306	Dairy Process Technology	PC	3	0	0	3	25	75	100
3	16AG7307	Storage and Packaging Technology	PC	3	0	0	3	25	75	100



4	16AG7308	Process Engineering of Fruits and Vegetables	PC	3	0	0	3	25	75	100
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PROFESSIONAL ELECTIVE – V

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	16AG8301	Agricultural Business Management and Entrepreneurship	PC	3	0	0	3	25	75	100
2	16AG8302	Agricultural Economics and Farm Managements	PC	3	0	0	3	25	75	100
3	16AG8303	Intellectual Property Rights	PC	3	0	0	3	25	75	100
4	16AG8304	Agricultural Waste Management	PC	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – VI

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	16AG8305	Special Farm Equipment	PC	3	0	0	3	25	75	100
2	16AG8306	Mechanics of Tillage and Traction	PC	3	0	0	3	25	75	100
3	16AG8307	Micro Irrigation System	PC	3	0	0	3	25	75	100
4	16AG8308	Automation in Irrigation	PC	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVE

AGRICULTURE ENGINEERING

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	16AG7401	Emerging Technologies in Food Process Engineering	OE	3	0	0	3	25	75	100



CREDIT DISTRIBUTION – R 2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	25	23	19	24	28	16	187

CREDIT DISTRIBUTION – R 2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165



Chairman, Board of Studies

**Chairman - BoS
AGRI - HiCET ,**



Dean – Academics

**Dean (Academics)
HiCET**



Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032



SYLLABUS

SEMESTER I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	3	0	0	3
Course Objective	<ul style="list-style-type: none"> • It facilitates students to communicate effectively with coherence. • The student will get trained in descriptive communication. • The trainee will be introduced to professional communication. • It enhances knowledge and provides the information on corporate environment. • The learner will equip with problem solving skills. 					

Unit	Description	Instructional Hours
I	Listening and Speaking – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) Reading –Reading an article from newspaper, Reading comprehension Writing Chart analysis, process description, Writing instructions Grammar and Vocabulary - Tenses, Regular and irregular verb, technical vocabulary	9
II	Listening and Speaking - listening to product description, equipment & work place (purpose, appearance, function) Reading - Reading technical articles Writing - Letter phrases, writing personal letters, Grammar and Vocabulary -articles, Cause & effect, Prepositions.	9
III	Listening and Speaking - - listening to announcements Reading - Reading about technical inventions, research and development Writing - Letter inviting a candidate for interview, Job application and resume preparation Grammar and Vocabulary - Homophones and Homonyms.	9
IV	Listening and Speaking - - Practice telephone skills and telephone etiquette (listening and responding, asking questions). Reading - Reading short texts and memos Writing - invitation letters, accepting an invitation and declining an invitation Grammar and Vocabulary - Modal verbs, Articles, Collocation, Conditionals, Subject verb agreement.	9
V	Listening and Speaking - listening to technical group discussions and participating in GDs Reading -reading biographical writing - Writing - Proposal writing, Writing definitions, Grammar and Vocabulary - Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs, Idioms.	9
	Total Instructional Hours	45
Course Outcome	CO1- Trained to maintain coherence and communicate effectively. CO2- Practiced to create and interpret descriptive communication. CO3- Introduced to gain information of the professional world CO4- acquired various types of communication and etiquette. CO5- Taught to improve interpersonal and intrapersonal skills.	

TEXT BOOKS:

T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate".Cambridge University Press.14

T2 Ian Wood and Anne Williams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS:

- R1 Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009
- R2 Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, 2005.
- R3 Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II". Orient Blackswan,2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MA1102	CALCULUS AND LINEAR ALGEBRA (COMMON TO AERO, AUTO, MECH, MECHT, FOOD, AGRI & CIVIL)	3	1	0	4

Course Objective	
	1. Understand the concept of differentiation.
	2. Evaluate the functions of several variables which are needed in many branches of engineering.
	3. Understand the concept of double integrals.
	4. Understand the concept of triple integrals.
	5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.

Unit	Description	Instructional Hours
	DIFFERENTIAL CALCULUS	
I	Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
	MULTIVARIATE CALCULUS (DIFFERENTIATION)	
II	Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
	DOUBLE INTEGRATION	
III	Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parallelepiped.	12
	TRIPLE INTEGRATION	
IV	Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parallelepiped.	12
	MATRICES	
V	Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
Total Instructional Hours		60

Course Outcome	
	CO1: Apply the concept of differentiation in any curve.
	CO2: Identify the maximum and minimum values of surfaces.
	CO3: Apply double integrals to compute area of plane curves.
	CO4: Evaluation of triple integrals to compute volume of solids.
	CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes.

TEXT BOOKS:

- T1 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
- T2 Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

- R1 Thomas & Finney "Calculus and Analytic Geometry", Sixth Edition, Narosa Publishing House, New Delhi
- R2 Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
- R3 Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21ME1101	BASICS OF CIVIL AND MECHANICAL ENGINEERING	3	0	0	3
Course Objective	1. To learn about the working principles of IC engines and detailed explanation of components of power plant units. 2. To study Refrigeration and Air Conditioning system. 3. To impart basic knowledge on Civil and Mechanical Engineering 4. To study materials used for the construction of civil structures. 5. To gain knowledge on the fundamentals of construction of structure					
Unit	Description					Instructional Hours
A – MECHANICAL ENGINEERING						
IC ENGINES						
I	Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.					9
POWER PLANT ENGINEERING						
II	Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits –Power Transmission in conveyor systems-Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.					9
REFRIGERATION AND AIR CONDITIONING SYSTEM						
III	Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.					9
B – CIVIL ENGINEERING						
SURVEYING AND CIVIL ENGINEERING MATERIALS						
IV	Surveying: Objects – types – classification – principles – measurements of distances Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections-Woods-Plastics.					9
BUILDING COMPONENTS AND STRUCTURES						
V	Foundations: Types, Bearing capacity – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.					9
Total Instructional Hours					45	
COURSE OUTCOMES	Upon completion of the course, the students will be able to CO1: Demonstrate working principles of petrol and diesel engine. CO2: Identify the components used in power plant cycle CO3: Explain the components of Refrigeration and Air conditioning cycle. CO4: Explain the usage of construction material and proper selection of construction materials. CO5: Understand the building structures.					
TEXT BOOKS:						
T1	Venugopal K. and Prabhu Raja V., —Basic Mechanical EngineeringI, Anuradha Publishers, Kumbakonam, 2010.					
T2	Shanmugam G and Palanichamy M S, —Basic Civil and Mechanical EngineeringI, Tata M Graw Hill Publishing Co., New Delhi, 2000					

REFERENCE BOOKS:

- R1 Ramamrutham S., — Basic Civil Engineeringl, Dhanpat Rai Publishing Co. (P) Ltd.2004.
R2 Seetharaman S., — Basic Civil Engineeringl, Anuradha Agencies, 2005.
R3 Shantha Kumar S R J., — Basic Mechanical Engineeringl, Hi-tech Publications,


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21PH1151	APPLIED PHYSICS	2	0	2	3

Course Objective	The student should be able to
	1. Enhance the fundamental knowledge in properties of matter
	2. Analysis the oscillatory motions of particles
	3. Extend the knowledge about wave optics
	4. Gain knowledge about laser and their applications
	5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	PROPERTIES OF MATTER Elasticity – Hooke’s law – Stress-strain diagram - Poisson’s ratio – Bending moment – Depression of a cantilever – Derivation of Young’s modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young’s modulus by uniform bending method	3
II	OSCILLATIONS Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum	3
III	WAVE OPTICS Conditions for sustained Interference – air wedge and it’s applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh’s criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
IV	LASER AND APPLICATIONS Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein’s coefficients (A&B) – Type of lasers – Nd:YAG laser and CO ₂ laser- Laser Applications – Holography – Construction and reconstruction of images.	6
	Determination of Wavelength and particle size using Laser	3
V	FIBER OPTICS AND APPLICATIONS Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
Total Instructional Hours		45

COURSE OUTCOMES	After completion of the course the learner will be able to
	CO1: Illustrate the fundamental properties of matter
	CO2: Discuss the Oscillatory motions of particles
	CO3: Analyze the wavelength of different colors
	CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field	

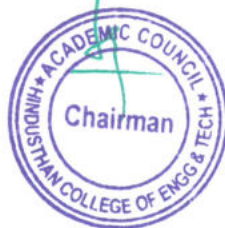
TEXT BOOKS:

- T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
- T2 Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, DhanpatRai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

- R1 Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
- R2 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi 2016
- R3 Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016


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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	21CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	WATER TECHNOLOGY Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. Estimation of total, permanent and temporary hardness of water by EDTA.	6 +3=9
II	POLYMER & COMPOSITES Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	ELECTROCHEMISTRY AND CORROSION Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using BaCl₂ and Na₂SO₄. Estimation of Ferrous iron by Potentiometry.	6+9 =15
IV	ENERGY SOURCES AND STORAGE DEVICES Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H ₂ -O ₂ fuel cell applications.	6
V	ANALYTICAL TECHNIQUES Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).	6+3
Total Instructional Hours		45

Course Outcome

- CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
- CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.
- CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.
- CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.
- CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

- T1 -P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, Chennai (2019).
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCE BOOKS

- R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).


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Programme	Course code	Name of the course	L	T	P	C
B.E.	21CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

- COURSE OBJECTIVES**
1. To know the basics of algorithmic problem solving
 2. To read and write simple Python programs
 3. To develop Python programs with conditionals and loops and to define Python functions and call them
 4. To use Python data structures — lists, tuples, dictionaries
 5. To do input/output with files in Python

Unit	Description	Instructional hours
I	ALGORITHMIC PROBLEM SOLVING Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
II	DATA, EXPRESSIONS, STATEMENTS Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.	7+2(P)
III	CONTROL FLOW, FUNCTIONS Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.	5+4(P)
IV	LISTS, TUPLES, DICTIONARIES Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.	3+6(P)
V	FILES, MODULES, PACKAGES Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages. Illustrative programs: word count, copying file contents.	5+4(P)
Total instructional hours		45

**COURSE
OUTCOMES**

After the completion of the course, the learner will be able to
CO1 - Develop algorithmic solutions to simple computational problems
CO2 - Read, write, execute by hand simple Python programs
CO3 - Structure simple Python programs for solving problems and Decompose a Python program into functions
CO4 - Represent compound data using Python lists, tuples, dictionaries
CO5 - Read and write data from/to files in Python Programs.

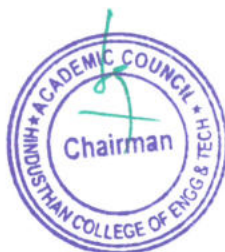
TEXT BOOKS:

- T1 Guido van Rossum and Fred L. Drake Jr. An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).
T2 S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

REFERENCE BOOKS:

- R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
R2: Timothy A. Budd, —Exploring Python1, Mc-Graw Hill Education (India) Private Ltd., 2015
R3: Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE-I (COMMON TO ALL BRANCHES)	0	0	2	1
Course Objective	<ul style="list-style-type: none"> ✓ To enhance student language competency ✓ To train the students in LSRW skills ✓ To develop student communication skills ✓ To empower the trainee in business writing skills. ✓ To train the students to react to different professional situations 					

Unit	Description	Instructional Hours
Listening		
I	Listening to technical group discussions and participating in GDs. listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
Reading		
II	Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
Writing		
III	E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
Speaking		
IV	To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
Speaking		
V	Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
Total Instructional Hours		15

Course Outcome	CO1- Trained to maintain coherence and communicate effectively. CO2- Practiced to create and interpret descriptive communication. CO3- Introduced to gain information of the professional world. CO4- acquired various types of communication and etiquette. CO5- Taught to improve interpersonal and intrapersonal skills.
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TEXT BOOKS:

- T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS:

- R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.


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Programme	Course code	Course title	L T P C
B.E.	21HE1072	CAREER GUIDANCE LEVEL - I Personality, Aptitude and Career Development	2 0 0 0

Course Objectives:

- Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO 1]
- Train students on essential grammar for placements [SLO 2]
- Introduce students on scientific techniques to pick up skills [SLO 3]
- Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one's career with placements in mind [SLO 4]

Expected Course Outcome:

Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

Student Learning Outcomes 1, 2, 3 and 4
(SLO):

Module:1 Lessons on excellence **2hours** **SLO:3**
Skill introspection, Skill acquisition, consistent practice

Module:2 Logical Reasoning **11 hours** **SLO:1**
Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Module:3 Quantitative Aptitude **11 hours** **SLO:1**
Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4 Recruitment Essentials 2hours SLO:4

Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5 Verbal Ability 4hours SLO:2

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

Total Lecture hours: 30hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)


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SEMESTER II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE2101	BUSINESS ENGLISH FOR ENGINEERS	3	0	0	3
(COMMON TO ALL BRANCHES)						
Course Objective	<ol style="list-style-type: none"> 1. The learner gets started with business communication. 2. It trains the students to react to different professional situations. 3. The student will get familiarize to managerial skills 4. It empowers business writing skills. 5. The trainee will learn to interpret and expertise different content. 					
Unit	Description					Instructional Hours
I	Listening and Speaking – listening and discussing about programme and conference arrangement Reading –reading auto biographies of successful personalities Writing Formal & informal email writing, Recommendations Grammar and Vocabulary - Editing a passage(punctuation and spelling), Adjectives & adverbs					9
II	Listening and Speaking - listening to TED talks Reading - Making and interpretation of posters Writing - Business letters: letters giving good and bad news, Thank you letter, Grateful & pleased Grammar and Vocabulary - Active & passive voice, Spotting errors (Teses, . Preposition, Articles)					9
III	Listening and Speaking -travel arrangements and experience Reading - travel reviews Writing - Business letters (Placing an order, making clarification & complaint letters). Grammar and Vocabulary - Direct and Indirect speech,					9
IV	Listening and Speaking - Role play - Reading - Sequencing of sentence Writing - Business report writing (marketing, investigating) Grammar and Vocabulary - Connectors, Gerund & infinitive					9
V	Listening and Speaking - Listen to Interviews & mock interview Reading - Reading short stories, reading profile of a company - Writing - Descriptive writing (describing one's own experience) Grammar and Vocabulary - Business vocabulary.					9
Total Instructional Hours						45

COURSE OUTCOMES

After the completion of the course, the learner will be able to
 CO1: Introduced to different modes and types of business communication.
 CO2: Practiced to face and react to various professional situations efficiently.
 CO3: learnt to practice managerial skills.
 CO4: Familiarized with proper guidance to business writing.
 CO5: Trained to analyze and respond to different types of communication

TEXT BOOKS:

- T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2014.)
 T2 Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009

REFERENCE BOOKS:

- R1 Rajeevan kaval. "English Grammar just for you", Oxford University Press 2015.
 R2 Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES (AERO, AUTO, MCT, MECH, CIVIL, FT & AGRI)	3	1	0	4

- Course Objectives**
1. Describe some methods to solve different types of first order differential equations.
 2. Solve ordinary differential equations of certain types using Wronskian technique.
 3. Use the effective mathematical tools for the solutions of partial differential equations.
 4. Describe the construction of analytic functions and conformal mapping.
 5. Illustrate Cauchy's integral theorem and calculus of residues

Unit	Description	Instructional Hours
	FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	
I	Equations of the first order and of the first degree – Homogeneous equations – Exact differential equations – Linear equations – Equations reducible to the linear form – Bernoulli's equation .	12
	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER	
II	Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers.	12
	PARTIAL DIFFERENTIAL EQUATIONS	
III	Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form $f(p,q)=0$, Clairaut's type : $z = px+qy +f(p,q)$ – Lagrange's linear equation.	12
	COMPLEX DIFFERENTIATION	
IV	Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping $w = A+z$, Az , $1/z$ and bilinear transformations.	12
	COMPLEX INTEGRATION	
V	Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem.	12
Total Instructional Hours		45+15

- COURSE OUTCOMES**
- CO1: Apply few methods to solve different types of first order differential equations.
CO2: Develop sound knowledge of techniques in solving ordinary differential equations.
CO3 Solve Partial Differential Equations using various methods.
CO4: Infer the knowledge of construction of analytic functions and conformal mapping.
CO5: Evaluate real and complex integrals over suitable closed paths or contours.

TEXT BOOKS:

- T1 Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
- T2 Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS:

- R1 Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
- R2 Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
- R3 Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.
- R4 Erwin kreyszig., Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons, 2006.
- R5 Wylie & Barrett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG2104	PRINCIPLES OF FOOD SCIENCE	3	0	0	3

Course Objectives
1. To give Introduction on Food Science
2. To understand various cooking methods.
3. To learn about Cooking qualities
4. To Study about food additives and quality tests

Unit	Description	Instructional Hours
I	Introduction to Food Science Definition of food. Nutrients - macro and micro constituents. Functions of foods. Food groups. Food Science - Definition - objectives and applications.	9
II	Methods of cooking and sensory evaluation of foods Methods of cooking - moist heat, dry heat and combination methods. Nutrient losses during cooking and processing. Sensory evaluation of foods - methods and applications.	9
III	Cooking qualities of foods Nutritive value, Factors affecting during cooking of foods- Cereals, pulses, nuts and oilseeds, vegetables, milk, meat, fish, egg and poultry. Spices and condiments – types – use in cookery	9
IV	Properties of foods Gelatinization, denaturation, colloids, emulsion, foam, sol, gel, fermentation, crystallization, enzymatic and non - enzymatic browning of foods. Antinutritional factors in foods	9
V	Food additives Classification and role - preservatives, antioxidants, chelating agents, flour improvers, artificial sweeteners, flavours, colours, nutrient enhancement, stabilizers, emulsifier firming agent, leavening and releasing agent. Food fortification - enrichment - need - application in foods. Cooking quality tests - cereals, pulses, vegetables, meat, poultry and fish - Gelatinization of starch - Denaturation of protein, stages of sugar cookery – formation of emulsion - enzymatic and non-enzymatic browning. Leavening agents - clarifying agents - foam and its stability. Food enrichment.	9
Total Instructional Hours		45

COURSE OUTCOMES
The students completing the course will have:
CO1: The students will be able to learn about food science, cooking methods and its quality
CO2: The students will be able to identify the preservation techniques in various food.
CO3: Understand the importance of Cooking qualities of foods
CO4: Understand the Properties of foods and its role
CO5: Understand the Classification and role food additives.

TEXT BOOKS:

T1	Potter, N. 2005. Food Science, CBS Publishers and Distributors, Delhi.
T2	Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi

REFERENCE BOOKS:

- R1 Benion, M. 1970. Introductory Foods, 8th Edn., The MacMillan Co.London
- R2 Swaminathan, M. 1995. Food Science and Experimental Foods, Ganesh and Co., Madras.
- R3 Bernard, W.M. 1997. Chocolate, cocoa and confectionery : Science and Technology (Third Edition) CBS Publishers and distributors, New Delhi.
- R4 Meyer, L.H. 1991, Food Chemistry, Affiliated East-West Press Pvt.Ltd., New Delhi.
- R5 Desrosier, N.W. and J.N. Desrosier.2002.The technology of food preservation (4th edition). CBS Publishers and Distributors. New Delhi.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21PH2151	MATERIAL SCIENCE	2	0	2	3

Course Objective	The student should be able to
	1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
	2. Extend the knowledge about the magnetic materials
	3. Explore the behavior of super conducting materials
	4. Gain knowledge about Crystal systems
	5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
	SEMICONDUCTING MATERIALS	
I	Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative).	6
	Determination of band gap of a semiconductor	3
	Determination of acceptance angle and numerical aperature in an optical fiber	3
	MAGNETIC MATERIALS	
II	Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
	B – H curve by Magnetic hysteresis experiment	3
	SUPERCONDUCTING MATERIALS	
III	Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors –High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
	CRYSTAL PHYSICS	
IV	Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ULTRASONICS	
V	Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system.	6
	Determination of velocity of sound and compressibility of liquid – Ultrasonic wave	3
	Determination of Coefficient of viscosity of a liquid –Poiseuille’s method	3
	Total Instructional Hours	45

COURSE OUTCOMES	After completion of the course the learner will be able to
	CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor

- CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
CO3: Discuss the behavior of super conducting materials
CO4: Illustrate the types and importance of crystal systems
CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

- T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 T2- Gaur R.K. and Gupta S.L.. Engineering Physics, 8th edition, DhanpatRai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

- R1 Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
R2 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi 2016
R3 Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

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Programme B.E.	Course Code 21CY2151	Name of the Course ENVIRONMENTAL STUDIES	L 2	T 0	P 2	C 3
Course Objective	<ol style="list-style-type: none"> 1. To study about the natural resources, exploitation and its conservation 2. To gain knowledge on the importance of environmental education, ecosystem and biodiversity. 3. To acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution. 4. To find and implement scientific, technological, economic and political solutions to environmental problems. 5. To be aware of the national and international concern for environment and its protection. 					
Unit	Description	Instructional Hours				
I	<p>NATURAL RESOURCES</p> <p>Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources, use of alternate energy sources – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and Desertification- role of an individual in conservation of natural resources.</p>	6				
II	<p>ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY</p> <p>Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem - energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.</p>	6				
III	<p>ENVIRONMENTAL POLLUTION</p> <p>Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Marine pollution - Nuclear hazards – role of an individual in prevention of pollution</p>	6				
IV	<p>SOCIAL ISSUES AND THE ENVIRONMENT</p> <p>From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal solid waste. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management.</p>	6				

HUMAN POPULATION AND THE ENVIRONMENT

V	Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health – Case studies.	6
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Total Instructional Hours 45

COURSE OUTCOMES

After completion of the course the learner will be able to
CO1: Develop an understanding of different natural resources including renewable resources.
CO2: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO3: Understand the causes of environmental pollution and hazards due to manmade activities.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

- T1 Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age
T2 S. Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2018

REFERENCE BOOKS:

- R1 Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.Ltd. Hyderabad, 2015
R2 G.Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013


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Programme	Course code	Name of the course	L	T	P	C
B.E.	21IT2151	PROGRAMMING IN C	2	0	2	3

Course objectives
1. To develop C Programs using Basic programming constructs
2. To develop C programs using Arrays and Strings
3. To develop applications in C using Functions, Pointers and Structures
4. To do Input / Output and File handling in C
5. To develop C Programs using Basic programming constructs

Unit	Description	Instructional hours
I	Basics of C Programming Structure of C program - C programming: Data Types –Keywords – Variables - Operators: Precedence and Associativity - Expressions – Input / Output statements Decision making statements - Looping statements – Pre-processor directives - Compilation process Programs using decision - making and Looping Constructs.	5+4(P)
II	Arrays And Strings Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations and String functions Programs Using Arrays and string functions.	5+4(P)
III	Functions And Pointers Introduction to functions: Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers — Pointer to pointers – pointer to strings Programs Using Functions and Pointers Structures and Unions	5+4(P)
IV	Structure - Nested structures – Pointer to Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Typedef-Unions – Union of Structures Programs Using Structures and Unions.	7+2(P)
V	File Processing Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file – Command line arguments Programs Using File concepts	7+2(P)
Total instructional hours		45

COURSE OUTCOMES	After completion of the course the learner will be able to
	CO1 - Select appropriate data types and control structures for solving a given problem.
	CO2 - Develop applications using arrays and strings
	CO3 - Understand the importance of functions, pointers and dynamic memory allocation.
	CO4 - Understand the Concepts of structures to develop applications in C using

TEXT BOOKS:

- T1 Balagurusamy – “Programming in ANSI C”, Tata McGraw Hill, 7th Edition,201. ISBN 13: 9789339219666
- T2 ReemaThareja, — “Programming in C”, Oxford University Press, Second Edition, 2016. ISBN 9780199456147

REFERENCE BOOKS:

- R1 Ashok.N.Kamthane,RajKamal ,“ Computer Programming and IT”, Pearson Education (India),2012, ISBN - 9788131799604
- R2 Paul Deitel and Harvey Deitel, —”C How to Program”, Eighth edition,2012, Pearson PublicationISBN– 9780132990448
- R3 Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2012 ISBN 13: 9789332549449
- R4 Yashavant P. Kane tkar. “ Let Us C”, BPB Publications, 15th Edition , July 201, ISBN-13:978-8183331630

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Programme	Name of the Course	L	T	P	C
B.E.	21ME2001 ENGINEERING PRACTICES	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

GROUP A (CIVIL & MECHANICAL)

S.No	Description of the Experiments
CIVIL AND MECHANICAL ENGINEERING PRACTICES	
1	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2	Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
3	Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
4	Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5	Practice on sheet metal Models– Trays and funnels
6	Hands-on-exercise in wood work, joints by sawing, planing and cutting.
7	Practice on simple step turning, taper turning and drilling.
8	Demonstration on Smithy operation.
9	Demonstration on Foundry operation.
10	Demonstration on Power tools.

GROUP B (ELECTRICAL)

S.No	Description of the Experiments
ELECTRICAL ENGINEERING PRACTICES	
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5	Measurement of energy using single phase energy meter.
6	Soldering practice using general purpose PCB.
7	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8	Study of Energy Efficient Equipment's and Measuring Instruments.

Total Practical Hours 45

COURSE OUTCOMES

After completion of the course the learner will be able to
 CO1:Fabricate wooden components and pipe connections including plumbing works.
 CO2:Fabricate simple weld joints.
 CO3:Fabricate different electrical wiring circuits and understand the AC Circuits.
 CO4:Determine the level of DO in a water sample.
 CO5:Identify and estimate the different types of alkalinity in water sample.
 CO6:Estimate the amount of copper in a water sample.
 CO7:Determine the metal ion content using instrumental methods

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective	
	✓ To introduce to business communication.
	✓ To train the students to react to different professional situations.
	✓ To make the learner familiar with the managerial skills
	✓ To empower the trainee in business writing skills.
	✓ To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	Listening and Speaking – listening and discussing about programme and conference arrangement Reading –reading auto biographies of successful personalities Writing Formal & informal email writing, Recommendations Grammar and Vocabulary - Business vocabulary, Adjectives & adverbs.	3
II	Listening and Speaking - listening to TED talks Reading - Making and interpretation of posters Writing - Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success” Grammar and Vocabulary - Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	Listening and Speaking -travel arrangements and experience Reading - travel reviews Writing - Business letters (Placing an order, making clarification & complaint letters). Grammar and Vocabulary - Direct and Indirect speech.	3
IV	Listening and Speaking - Role play - Reading - Sequencing of sentence Writing - Business report writing (marketing, investigating) Grammar and Vocabulary - Connectors, Gerund & infinitive.	3
V	Listening and Speaking - Listen to Interviews & mock interview Reading - Reading short stories, reading profile of a company - Writing - Descriptive writing (describing one’s own experience) Grammar and Vocabulary - Editing a passage(punctuation, spelling & number rules).	3
Total Instructional Hours		15

Course Outcome	
	CO1- Introduced to different modes and types of business communication.
	CO2- Practiced to face and react to various professional situations efficiently.
	CO3- learnt to practice managerial skills.
	CO4- Familiarized with proper guidance to business writing.
	CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. “Pass Cambridge BEC Preliminary”, Cengage Learning press 2015.

REFERENCE BOOKS :

R1 - Michael Mc Carthy, “Grammar for Business”, Cambridge University Press, 2009.

R2- Bill Mascull, “Business Vocabulary in use: Advanced 2nd Edition”, Cambridge University Press, 2009.

R3- Frederick T. Wood. “Remedial English Grammar For Foreign Students”, Macmillan publishers, 2001.


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Programme	Course code	Course title	L T P C
B.E.	21HE2072	CAREER GUIDANCE LEVEL - II Personality, Aptitude and Career Development	2 0 0 0

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

Expected Course Outcome:

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes 6, 7, 8
(SLO):

Module:1 Logical Reasoning **8 hours** **SLO:6**
Word group categorization questions
 Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2 Quantitative Aptitude **12 hours** **SLO:7**
Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3 Verbal Ability **10hours** **SLO:8**
Essential grammar for placements

- Prepositions
- Adjectives and Adverbs

- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: 30hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE2073	Entrepreneurship & Innovation	1	0	0	0

- Course Objective
1. To acquire the knowledge and skills needed to manage the development of innovation.
 2. To recognize and evaluate potential opportunities to monetize these innovations.
 3. To plan specific and detailed method to exploit these opportunities.
 4. To acquire the resources necessary to implement these plans.
 - 5: To make students understand organizational performance and its importance.

Module	Description	Instructional Hours
1.	Entrepreneurial Thinking	
2.	Innovation Management	
3.	Design Thinking	
4.	Opportunity Spotting / Opportunity Evaluation	
5.	Industry and Market Research	
6.	Innovation Strategy and Business Models	
7.	Financial Forecasting	
8.	Business Plans/ Business Model Canvas	
9.	Entrepreneurial Finance	
10.	Pitching to Resources Providers / Pitch Deck	
11.	Negotiating Deals	
12.	New Venture Creation	
13.	Lean Start-ups	
14.	Entrepreneurial Ecosystem	
15.	Velocity Venture	
Total Instructional Hours		15

- Course Outcome
- CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3: Remember effectively and efficiently the potential of new business opportunities.
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment.

TEXT BOOKS:

- T1: Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition(2016).

REFERENCE BOOKS:

- R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition 2007
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second (2017).
R3: Jonahan Wilson "Essentials of Business Research", Sage Publication, First Edition, (2010).

WEB RESOURCES:

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>
W2: <https://blof.forgeforward.in/tagged/entrepreneurship>
W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>

W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>

W5: <https://blof.forgeforward.in/tagged/innovation>

W6: <https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwlwn7fdnXe>

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SYLLABUS

SEMESTER III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA3102	FOURIER ANALYSIS AND TRANSFORMS (EEE, ECE, E&I, AGRI, BIO MEDICAL & FOOD TECHNOLOGY)	3	1	0	4

- Course Objective**
1. Analyze Fourier series which is central to many applications in engineering.
 2. Apply the effective tools for the solutions of one-dimensional boundary value problems.
 3. Apply the effective tools for the solutions of two dimensional heat equations.
 4. Apply Fourier transform techniques in various situations.
 5. Analyze Z transform techniques for discrete time systems.

Unit	Description	Instructional Hours
I	FOURIER SERIES Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	BOUNDARY VALUE PROBLEMS Classification of PDE - Solutions of one-dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	TWO-DIMENSIONAL HEAT EQUATIONS Steady state solution of two-dimensional equation of heat conduction in infinite plate and semi circular plate.	12
IV	FOURIER TRANSFORMS Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity(Statement only).	12
V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem (excluding proof)– Solution of difference equations using Z – transform.	12
Total Instructional Hours		60

- COURSE OUTCOMES**
- After completion of the course the learner will be able to
- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
 - CO2: Employ Fourier series in solving the boundary value problems.
 - CO3: Understand Fourier series in solving the two dimensional heat equations.
 - CO4: Apply Fourier transform techniques which extend its applications.
 - CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems

TEXT BOOKS:

- T1 Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.

T2 Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

REFERENCE BOOKS:

- R1 C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, Mc Graw Hill Education India Private Limited, New Delhi 2003
- R2 Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996.
- R3 Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.
- R4 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3201	SOIL SCIENCE AND ENGINEERING	3	0	0	3

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

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

COURSE OUTCOMES

After completion of the course the learner will be able to

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

TEXT BOOKS:

- T1 Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008
- T2 Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

REFERENCE BOOKS:

- R1 Edward J. Plaster., "Soil Science". Cengage Learning India Ltd, New Delhi, 2009.
- R2 Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2007
- R3 Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007
- R4 Sehgal, S.B., "Text Book of Soil Mechanics", CBS Publishers and Distributors New Delhi, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3202	FLUID MECHANICS AND HYDRAULICS	3	1	0	4

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

Unit	Description	Instructional Hours
	PROPERTIES OF FLUIDS	
I	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 principles –buoyancy - metacentre – metacentric height.	12
	FLUID FLOW ANALYSIS	
II	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.	12
	FLOW MEASUREMENT	
III	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	12
	OPEN CHANNEL FLOW	
IV	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.	12
	DIMENSIONAL ANALYSIS AND PUMPS	
V	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 lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristic curves - submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump- Hydraulic ram.	12
	Total Instructional Hours	60

COURSE Upon successful completion of the course, students shall have ability to

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

TEXT BOOKS:

- T1 Streeter V.L., Wylie E. B. and Bedford K. W., "Fluid Mechanics", Tata McGraw Hill Publishing Co. Ltd., 2017.
- T2 Modi P. N. and Seth S M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2013
- T3 Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

REFERENCE BOOKS:

- R1 Garde, R. J., "Fluid Mechanics through problems", New Age International Publishers (P) Ltd., New Delhi, 2002.
- R2 Kumar .K.L., "Engineering Fluid Mechanics", Eurasia Publishing House, 2002.
- R3 Jagdish Lal, "Hydraulic Machines". Metropolitan Book House, New Delhi, 2000.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3203	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	3	0	0	3

- Course Objective**
- To introduce the students to principles of agricultural and horticultural crop production and to introduce the production practices of crops.
 - To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

Unit	Description	Instructional Hours
	AGRICULTURE AND CROP PRODUCTION	
I	Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture; Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices	9
	CROP SELECTION AND ESTABLISHMENT	
II	Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing	9
	CROP MANAGEMENT	
III	Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.	9
	PRODUCTION PRACTICES OF AGRICULTURAL CROPS	
IV	Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, and fiber crops, and special purpose crops such as those grown for green manure and fodder.	9
	PRODUCTION PRACTICES OF HORTICULTURAL CROPS	
V	Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops; Cultivation practices of representatives of each group; Special features of production of horticultural crops - green house cultivation.	9
	Total Instructional Hours	45

COURSE OUTCOMES

- Upon successful completion of the course, students shall have ability to
- CO1: Students completing this course would have acquired knowledge on crop selection, crop production crop management.
- CO2: The students will have the required knowledge in the area of production of agricultural and horticultural crops
- CO3: Understanding the important of Crop water Management and Crop nutrition management in crop cultivation.
- CO4: Understanding the field crop production practices in Tamil Nadu.
- CO5: Understand the role of greenhouse cultivation in future.

TEXT BOOKS:

- T1 S S Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.
- T2 Reddy T. Sankara G.H. Yellamanda Reddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 2005.
- T3 Handbook of Agriculture. ICAR Publications, New Delhi, 2011

REFERENCE BOOKS:

- R1 Bose T. K. and L.P.Yadav. Commercial Flowers, Naya Prakash, Calcutta.1989.
- R2 Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005
- R3 Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. Introduction to spices, plantation crops, medicinal and aromatic plants. Rajalakshmi Publications, Nagercoil. 1993.
- R4 Kumar, N., "Introduction to Horticulture", Rajalakshmi Publications. Nagercoil, 7th edition, 2015.
- R5 Shanmugavel, K.G. Production Technology of Vegetable Crops. Oxford India Publications, New Delhi. 1989


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3251	UNIT OPERATIONS IN AGRICULTURAL PROCESSING	2	0	2	3

Course Objective

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

Unit	Description	Instructional Hours
	EVAPORATION AND CONCENTRATION	
I	Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless ratios- evaporation – definition – liquid characteristics – single and multiple effect evaporation- performance of evaporators and boiling point elevation – capacity – economy and heat balance- types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator	9
	MECHANICAL SEPARATION	
II	Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press- sedimentation – gravitational sedimentation of particles in a fluid – Stoke’s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.	9
	SIZE REDUCTION	
III	Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger’s, Bond’s and Kick’s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.	9
	CONTACTEQUILIBRIUM SEPARATION	
IV	Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium equilibrium concentration relationships – operating conditions-calculation of separation in contact equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment-properties of tower packing – types – construction – flow through packed towers- extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing –equipment	9
	CRYSTALLISATION AND DISTILLATION	
V	Crystallization-Equilibrium –Rate of crystal growth stage-Equilibrium crystallization-Crystallizers- Equipment-Classification- Construction and operation – Crystallizers-Tank-Agitated batch- Swenson-Walker and Vacuum crystallizers-Distillation-Binary mixtures-Flash and differential distillation-Steam distillation –Theory-Continuous distillation with rectification –Vacuum distillation - Batch distillation-Operation and process-Advantages and limitation-Distillation equipments- Construction and operation-Factors influencing the operation.	9
	Total Instructional Hours	45

**COURSE
OUTCOMES**

At the end of the study the student will have knowledge on
CO1: Fundamentals of various unit operations of Agricultural Processing.
CO2: Understand the liquid characteristics and performance of single and multiple effect evaporation
CO3: Classify the filter media types and its requirements and sedimentation of particles in a fluid.
CO4: Size reduction equipment and calculating the power requirements
CO5: Understand the equilibrium separation processes and importance of crystallisation and distillation in agricultural processing.

TEXT BOOKS:

- T1 Earle, R.L., "Unit operations in Food Processing", Pergamon Press, Oxford, U.K, 1985.
T2 McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.
T3 Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th Edition, Prentice Hall, 2003.

REFERENCE BOOKS:

- R1 Coulson, J.M and J.F. Richardson. Chemical Engineering. Volume I to V. The Pergamon Press. New York, 1999..
R2 Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press LLC, Florida, 2003..


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3001	FIELD CROP PRODUCTION PRACTICAL	0	0	3	1.5

Course Objective

- To study about field crops and cultivation aspects.
- To learn the management of crops including soil management and to control the diseases to increase the food production
- To acquire the knowledge on the nursery production of herbaceous and woody plants for landscape design and management.

Ex. No.	List of Experiments	Instructional Hours
1.	Identification of different crops, seeds, manures and fertilizers	3
2.	Practicing cultivation of rice / maize / pulse crops to raise in new Agri. field area from seed to harvest	3
3.	Identification of farm tools and implements, primary and secondary tillage	3
4.	Practicing different methods of sowing and planting	3
5.	Irrigation, fertilizer application and weed management practices	3
6.	Biometric Observation of field crops	3
7.	Working out Problems on seed rate, Fertilizer dose, Yield estimation	3
8.	Assessing maturity indices for harvesting of agricultural crops	3
9.	Workout the cost of cultivation of major field crops.	3
10	Harvesting and post – harvest technology in field crops.	3
Total instructional hours		30

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

CO1: Possess the knowledge on the agronomic practices for raising different crops and intensive cultivation through use of improved varieties and the liberal use of irrigation and fertilizers to increase the food production.

COURSE OUTCOMES

CO2: Utilize the knowledge on rainfed and dry land agriculture and precision farming.

CO3: Possess the knowledge on the commercial production of high-value horticultural crops such as fruits, vegetables, cut flowers, potted plants, bedding plants, and bulbs and floral design.

CO4: Possess the knowledge on harvesting methods, pre cooling, packaging and storage of horticultural crops.

CO5: To calculate cost of cultivation for various field crop

REFERENCE BOOKS:

- R1 SP. Palaniappan, and S. Sivaraman, Cropping systems in the tropics- Principles and Management, New Age international publishers, New Delhi, (2nd edition), 1998.
- R2 S.Sankaran and V.T Subbaiah Mudaliar, Principles of Agronomy, The Bangalore Printing and Pub. Co., Bangalore, 1993.
- R3 P.Balasubramain and SP. Palniappan, Principles and Practices of Agronomy, Agrobios publishers, Ludhiana, 2001.
- R4 T.Yellamanda Reddy and G.H. Sankara Reddi, Principles of Agronomy, Kalyani publishers, Ludhiana, 2005
- R5 B.Chandrasekaran, B., K. Annadurai and E. Somasundaram, A Text book of Agronomy, Scientific publishers, Jodhpur, 2007.
- R6 George Acquaaah, Horticulture-principles and practices, Prentice-Half of India Pvt. Ltd., New Delhi, 2002.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG3002	SOIL SCIENCE LABORATORY	0	0	3	1.5

Course Objective Students should be able to verify various quality aspects of soil and water studied in theory by performing experiments in lab

Ex. No.	List of Experiments	Total Instructional Hours
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1. Identification of rocks and minerals
2. Collection and processing of soil samples
3. Determination of soil moisture, EC and pH
4. Field density determination by Core Cutter and Sand Replacement method
5. Specific gravity determination by Pycnometer
6. Textural analysis of soil by International Pipette method
7. Grain size analysis by using Mechanical shaker
8. Determination of Organic carbon
9. Estimation of Gypsum requirements
10. Specific gravity determination by Pycnometer

Total instructional hours 30

Course Outcome

The students completing the course will have

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

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

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

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

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

REFERENCE BOOKS:

- R1 Punmia, B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publishers, New Delhi. 2007
- R2 Laboratory Manual, Centre for Water Resources, Anna University, Chennai. 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MC3191	INDIAN CONSTITUTION	2	0	0	0

- Course Objective
1. Sensitization of student towards self, family (relationship), society and nature.
 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
 3. Strengthening of self reflection.
 4. Development of commitment and courage to act.

Unit	Description	Instructional Hours
	BASIC FEATURES AND FUNDAMENTAL PRINCIPLES	
I	Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
	FUNDAMENTAL RIGHTS	
II	Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
	PARLIAMENTARY FORM OF GOVERNMENT	
III	The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.	4
	LOCAL GOVERNANCE	
IV	Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article 21 – scope of the right to life and personal liberty under article 21.	4
	INDIAN SOCIETY	
V	Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
Total Instructional Hours		20

Course Outcome
 CO1: Understand the functions of the Indian government
 CO2: Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

- T1- Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2197.
 T2- R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi,2197.
 T3-Maciver and Page, " Society: An Introduction Analysis", Laxmi Publications,2007.
 T4-K.L.Sharma, "Social Stratification in India: Issues and Themes",SAGE Publications Pvt. Ltd, 2197.

REFERENCE BOOKS:

- R1-Sharma, Brij Kishore, " Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2017.
 R2-U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar,2198.
 R3-R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd,2182.


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Course code	Course title	L	T	P	C
19HE3072	Career Guidance Level - III	2	0	0	0
Pre-requisite	Personality, Aptitude and Career Development				
	None				Syllabus version

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Display good writing skills while dealing with essays [SLO 12]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 12

Module:1 Logical Reasoning 6 hours SLO:6
Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Module:2 Quantitative Aptitude 7 hours SLO: 7
Time and work

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on races

Profit and loss, Partnerships and averages

- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average

Module:3 Verbal Ability 5 hours SLO: 8
Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Sentence Completion and Para-jumbles

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Module:4 Writing skills for placements

2 hours

SLO: 12

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE3073	Leadership Management Skills	1	0	0	0

Course Objective

1. To know about the leadership skills that is to be acquired for success.
2. To become a teamwork expert, real world problem solver, your views will be challenged
3. To gain global perspective and becoming an effective communicator
4. To understand about learning, negotiation and decision making
- 5: To get first hand information about the skills we possess and to work on improvement.

Module	Description	Instructional Hours
1.	Strategic thinking skills	
2.	Planning and Delivery skills	
3.	People management skills (Delegation)	
4.	Change management and Innovation skills	
5.	Communication skills	
6.	Persuasion and influencing skills	
7.	Learning Agility	
8.	Motivation	
9.	Personality	
10.	Emotions	
11.	Perception	
12.	Negotiation	
13.	Decision making	
14.	Problem solving	
15.	Building trust	
Total Instructional Hours		15

Course Outcome

- CO1: To practice essential leadership skills in day to day operations
- CO2: To work on leadership skills in the study environment
- CO3: To understand and develop the skills consciously.
- CO4: To know about the real worth of all the skills for success
- CO5: To Analyze the real worth of the person and suggestion for improvement

TEXT BOOKS

T1: A REVIEW OF LEADERSHIP THEORY AND COMPETENCY FRAMEWORKS, Bolden, R., Gosling, J., Marturano, A. and Dennison, P. June 2003

T2: LEADING FROM WITHIN: Building Organizational Leadership Capacity-David R. Kolzow, PhD, 2014

REFERENCE BOOKS

R1: Seven habits of highly effective people – Stephen R.Covey

R2: The Art of Business Leadership: Indian Experiences – G.Balasubramaniam

R3: DEVELOPING the LEADER WITHIN YOU-JOHN C. MAXWELL


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SEMESTER IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4201	FARM TRACTORS	3	0	0	3

- Course Objective**
1. To introduce the students about basics of tractor which include classification of tractors and components of the engine.
 2. To retrieve basic knowledge about engine systems and working principles of cooling system, lubrication system, fuel systems and electrical systems of tractors.
 3. To study about working principle of transmission system of tractor and its components.
 4. To learn about components of hydraulic system of tractor and its working principle.
 5. To acquire knowledge on Power tiller, Bull dozers, testing of tractors, performance of various machines

Unit	Description	Instructional Hours
	TRACTORS	
I	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.	9
	ENGINE SYSTEMS	
II	Valves-inlet and outlet valves – valve timing diagram. Air cleaner- exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor- electrical system.	9
	TRANSMISSIONSYSTEMS	
III	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.	9
	HYDRAULIC SYSTEMS	
IV	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.	9
	POWER TILLER, BULL-DOZER AND TRACTOR TESTING	
V	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.	9
	Total Instructional Hours	45

- Course Outcome**
- At the end of the study the student will have knowledge on
- CO1: The students will be able to understand the various equipment’s and mechanizations used in the farm
- CO2: The students will have the knowledge on earth moving machineries, tractor classification and tillage implements.
- CO3: The students will able to understand various engine systems and its working principle.
- CO4: The student will able to understand various implements used in agriculture farm for various purposes
- CO5: The students will get basic idea about testing procedures of various farm machinery equipment’s.

TEXT BOOKS:

T1 Jain, S.C. and C.R. Rai. "Farm tractor maintenance and repair". Standard publishers and distributors, New Delhi, 1999

REFERENCE BOOKS

R1 Barger, E.L., J.B. Liljedahl and E.C. McKibben, "Tractors and their Power Units". Wiley Eastern Pvt. Ltd., New Delhi, 1997

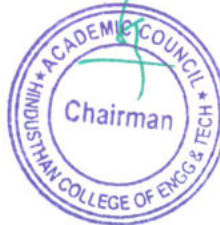
R2 Domkundwar A.V. "A course in internal combustion engines". Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi, 1999

R3 Black, P.O. "Diesel engine manual". Taraporevala Sons & Co., Mumbai, 1996.

R4 Grouse, W.H. and Anglin, D.L. "Automotive mechanics". Macmillan McGraw- Hill, Singapore, Indian Standard Codes for Agricultural Implements Published by ISI, New Delhi, 1993.

R5 Jagadeeshwar Sahay, "Elements of Agricultural Engineering", Standard Publishers Co., New Delhi, 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4202	THERMODYNAMICS	3	0	0	3

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

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

- Course Outcome**
- CO1: Classify mechanisms and inversions and determine mobility of a mechanism.
- CO2: Construct cam profiles for various followers and turning moment diagram for flywheel.

- CO3: Classify various gear trains and apply to automation.
CO4: Apply friction principles to clutches, belt, brake and screw.
CO5: Evaluate the sensitivity of governor

TEXT BOOKS:

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

REFERENCE BOOKS:

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


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4203	IRRIGATION AND DRAINAGE ENGINEERING	3	0	0	3

- Course Objective**
- At the completion of the course the students should be able to understand the necessity of planning an irrigation system to provide water at the right time and right place.
 - To understand the basic concepts for planning, design and management of land drainage works in cultivated areas

Unit	Description	Instructional Hours
	WATER RESOURCES AND IRRIGATION REQUIREMENT	
I	Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation – duty and delta - Rooting characteristics - Moisture use of crop, Evapotranspiration - ET plot – Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.	9
	METHODS OF IRRIGATION	
II	Methods of Irrigation – Surface and Subsurface methods – Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible, Kennedy’s and Lacey’s theories, Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system	9
	DIVERSION AND IMPOUNDING STRUCTURES	
III	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.	9
	CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT	
IV	Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes – Lining and maintenance of canals - Excess irrigation and waterlogging problem - Command area - Concept, Components of CADP - On Farm Development works, Farmer’s committee - its role for water distribution and system operation - rotational irrigation system	9
	AGRICULTURAL DRAINAGE	
V	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.	9
Total Instructional Hours		45

- The students completing the course will have
- Course Outcome**
- CO1: The students will have knowledge and skills on Planning, design, operation and management of reservoir system.
- CO2: The student will gain knowledge on different methods of irrigation
- CO3: The student will able to understand various diversion and impounding structures.
- CO4: The student will grab knowledge about the command area development and canal irrigation system.
- CO5: The students will retrieve basic idea about reclamation of the soils under water logged conditions and salinity problems.

TEXT BOOKS:

- T1 Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
T2 Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi,2008
T3 Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi,2008
T4 Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands,1994.

REFERENCE BOOKS

- R1 Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi,2008.
R2 Murthy, V.V.N. "Land and water management", Kalyani publishing, New Delhi,1998.
R3 Bhattacharya, A.K., and Michael, A.M., "Land Drainage – Principles, Methods and Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.
R4 "Irrigation water Management", Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organisation, Rome1996
R6 Kessler, J., "Drainage Principles and Applications", Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands,1979

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA4152	STATISTICS & NUMERICAL METHODS (AGRI, BIO MEDICAL & FOOD TECHNOLOGY)	3	0	2	4

- Course Objective
- Introduce Correlation concept to identify the linear relationship between two variables.
 - Provide the necessary basic concepts of some statistical methods.
 - Manipulate different kinds of problems occurring in engineering and technology by applying the design of experiments.
 - Apply various methods to find the intermediate values for the given data.
 - 5. Be Familiar with the concepts of numerical differentiation and numerical integration of the Unknown functions.

Unit	Description	Instructional Hours
I	CORRELATION AND REGRESSION Correlation – Karl Pearson’s correlation coefficient – Spearman’s Rank Correlation – Regression lines(problems based on Raw data only).	9
II	HYPOTHESIS TESTING Tests based on t (for single mean and difference of means) - F distribution – for testing difference of variance, Chi – Square test for Contingency table (Test for Independency) – Goodness of fit	9
III	ANALYSIS OF VARIANCE Introduction, analysis of variance, completely randomized design, randomized block design, Latin square design.	9
IV	INTERPOLATION Interpolation: Newton’s forward and backward difference formulae Lagrangian interpolation for unequal intervals – Divided differences- Newton’s divided difference formula.	9
V	NUMERICAL DIFFERENTIATION AND INTEGRATION Differentiation using interpolation formula – Newton’s forward and backward interpolation formulae for equal intervals – Newton’s divided difference formula for unequal intervals - Numerical integration by Trapezoidal and Simpson’s 1/3 rules.	9
Total Instructional Theory Hours		45

LAB COMPONENTS USING R-STUDIO(any 5 experiments)

1. Introduction to R programming
2. Application of descriptive statistics – Mean, Median, Mode, variance and Box plot
3. Applications of Correlation and Regression
4. Application of Student t- test
5. Application of F test
6. Application of Chi – square test
7. ANOVA – completely randomized design
8. ANOVA – randomized block design

Instructional Hours - Lab	15
Total Instructional Hours	60 Hours

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

- OUTCOMES**
- CO1: Compute correlation between variables, and predict unknown values using regression.
 - CO2: Acquire skills in analyzing statistical methods.
 - CO3: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
 - CO4: Understand the concept of interpolation in both cases of equal and unequal intervals.
 - CO5: Express the information from discrete data set through numerical differentiation and summary information through numerical integration.

TEXT BOOKS:

- T1 Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 2011.
- T2 M.K.Jain,S.R.K.Iyengar, R.K.Jain “Numerical methods for Scientific and Computation”, Fifth Edition, New Age International publishers 2010

REFERENCE BOOKS:

- R1 Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
- R2 Grewal B.S. and Grewal J.S. “ Numerical Methods in Engineering and Science “, 6th Edition , Khanna publishers, New Delhi 2004.
- R3 S.K.Gupta, Numerical Methods for Engineers” , New Age Internationalm Pvt.Ltd Publishers,2015


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4251	BIO ENERGY RESOURCE TECHNOLOGY	2	0	2	3

Course Objective

- To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.
- Alcohol and ethanol production and Energy and Environment

Unit	Description	Instructional Hours
I	BIO RESOURCE - AN INTRODUCTION Bio resource – origin – biomass types and characteristics- biomass conversion technology- Biodegradation - steps in biogas production- parameters affecting gas production- Types of biogasplants- Construction details- operation and maintenance	9
II	BIO ENERGY Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.	9
III	BIO REACTORS AND FERMENTORS Bio reactors/ fermentors – Batch type – continuous stirred tank reactors- Biological waste water treatment- Activated sludge process- Downstream Processing-Recovery and purification of products.	9
IV	ALCOHOL PRODUCTION Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis - Antibioticsenzymes- principles of thermochemical conversion – combustion - pyrolysis- Gasification – types of gasifiers.	9
V	ENERGY AND ENVIRONMENT Principles of operation- chemical reaction- cleaning and cooling - Utilization- Improved wood burning stove - Energy plantations- Biomass briquetting - co generation- Impact on Environment — Bioenergy policy	9
Total Instructional Hours		45

Course Outcome

- CO1: The students will be able to understand the concepts of bio energy sources and its applications.
- CO2: Possess the knowledge on biochemical conversion technology and biofuels
- CO3: Possess the knowledge on reactors
- CO4: Possess the knowledge on thermal conversion technologies
- CO5: Students understand the concepts of chemical reaction

TEXT BOOKS:

- T1 Rai G.D, "Non-conventional sources of Energy", Khanna publishers, New Delhi, 1995.
- T2 Bouley James. E & David Follis, "Biochemical Engineering Fundamentals", Mc Graw-Hill publishing company, Tokyo.1986

REFERENCE BOOKS:

- R1 Chawla O.P, "Advances in Biogas Technology", ICAR publication New Delhi 1986

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4252	SURVEYING AND LEVELLING	2	0	2	3

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

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

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

TEXT BOOKS:

- T1 Punmia, B. C., "Surveying", Vol.1, Laxmi Publications, New Delhi, 2015.
T2 Chandra A.M., "Plane Surveying", New Age International Publishers, 2015

REFERENCE BOOKS:

- R1 Alak De, "Plane Surveying", S. Chand & Company Ltd., 2000.
R2 Bannister and S. Raymond, R. Baker "Surveying", 7th Edition, Pearson Education Ltd., 2009.
R3 Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG4001	IRRIGATION FIELD LAB	0	0	4	2

Course Objective

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

Ex. No.	List of Experiments	Total Instructional Hours
1.	To study various instruments in the Meteorological Laboratory	4
2.	Determination of infiltration rate using double ring and digital infiltrometer	4
3.	Determination of soil moisture wetting pattern for irrigation scheduling	4
4.	Design of Drip irrigation system	4
5.	Design of sprinkler irrigation system	4
6.	Measurement of flow properties in open irrigated channels (flumes, notches)	4
7.	Evaluation of surface irrigation	4
8.	Determination of uniformity coefficient for drip irrigation system	4
9.	Determination of uniformity coefficient for sprinkler system (catch can method)	4
10	To conduct experiment on disc filter for micro irrigation systems	4
Total instructional hours		48

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1.	Meteorological lab with Cup counter anemometer, Sunshine recorder, Open pan vaporimeter, Stevenson's screen - Dry bulb, wet bulb thermometers, recording and non-recording type rain gauge etc	Each 1
2.	Double ring infiltrometer	1
3.	Digital infiltrometer	1
4.	Parshall flume, cut throat flume	Each 1
5.	V notch, Rectangular notch and trapezoidal notch	Each 1
6.	Drip irrigation system with all accessories	1
7.	Sprinkler irrigation system with all accessories	1
8	Required number of stop watches	3
9	Weight balance	1
10	Catch cans, measuring jars – required numbers	5

Course Outcome

The students completing the course can

CO1: gain the knowledge on various meteorological instruments and understanding the concept of different irrigational systems in the laboratory tests.

CO2: understand concept of different methods for estimation of evapotranspiration


CO3: understand about irrigation management
CO4: design various irrigation system
CO5: able to schedule irrigation system

REFERENCE BOOKS

- R1 Michael, A.M., "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.
R2 Asawa, G.L., "Irrigation Engineering", New Age International Private Limited, New Delhi, 1996.
R3 Laboratory Manual, Centre for Water Resources, Anna University, Chennai.


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B.E. 19MC4191 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE 2 0 0 0

- Course Objective
1. The course aims at imparting basic principles of thought process, reasoning and inferencing.
 2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
 3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
 4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	4
Total Instructional Hours		20

- Course Outcome
- CO1: Ability to understand the structure of Indian system of life.
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

- R1 -V.Sivaramakrishna (Ed.), "Cultural Heritage of India-Course Material", Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
R2 - Swami Jitmananda, "Modern physics and Vedanta", Bharatiya Vidya Bhavan, 2186.
R3 - Fritjof Capra, The Tao of Physics
R4- Fritjof Capra, The wave of Life.
R5- V N Jha, Tarkasangraha of Annambhatta, International Chinmaya Foundation, Vellianad, Ernakulam.
R6- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
R7- GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
R8- RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
R9- P R Sharma (English translation), Shodashang Hridayam.


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Course code	Course title	L	T	P	C
19HE4072	CAREER GUIDANCE LEVEL – IV: PERSONALITY, APTITUDE AND CAREER DEVELOPMENT	2	0	0	0
Pre-requisite	None				

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Crack mock interviews with ease [SLO 13]
- Be introduced to problem-solving techniques and algorithms [SLO 14]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 13, 14

Module:1 Logical Reasoning **3 hours** **SLO:6**
 Logical connectives, Syllogism and Venn diagrams

- Logical Connectives
- Syllogisms
- Venn Diagrams – Interpretation
- Venn Diagrams - Solving

Module:2 Quantitative Aptitude **6 hours** **SLO: 7**
Logarithms, Progressions, Geometry and Quadratic equations

- Logarithm
- Arithmetic Progression
- Geometric Progression
- Geometry
- Mensuration
- Coded inequalities
- Quadratic Equations

Permutation, Combination and Probability

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation
- Circular Permutations
- Computation of Combination
- Probability

Module:3 Verbal Ability **2 hours** **SLO: 8**
 Critical Reasoning

- Argument – Identifying the Different Parts (Premise, assumption, conclusion)
- Strengthening statement
- Weakening statement
- Mimic the pattern

Module:4 Recruitment Essentials 1 hour SLO: 12

Cracking interviews - demonstration through a few mocks

Sample mock interviews to demonstrate how to crack the:

- HR interview
- MR interview
- Technical interview

Cracking other kinds of interviews

- Skype/ Telephonic interviews
- Panel interviews
- Stress interviews

Resume building – workshop

A workshop to make students write an accurate resume

Module:5 Problem solving and Algorithmic skills 8 hours SLO: 12

- Logical methods to solve problem statements in Programming
- Basic algorithms introduced

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, Mock interviews, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council

Date


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE4073	IDEATION SKILLS	1	0	0	0

- Course Objective**
- To study the importance of ideation.
 - To learn about the various tools for Ideation.
 - To provide an insight in Prototyping and its significance.

Unit	Description	Instructional Hours
	IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY	
I	Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
	IDEATION: TOOLS FOR IDEATION	
II	Various resources to kindle new ideas for innovation. Explore the types of ideas in the past – Effect of the ideas and innovation of past on the world – Innovation Thinking – Case studies.	4
	IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY	
III	Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
	PROTOTYPING AND PRODUCT IDEATION	
IV	Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype – Prototyping tools	3
Total Instructional Hours		15

- Course Outcome**
- Upon completion of the course, students will be able to
- CO1: Develop a strong understanding and importance of ideation
CO2: Learn about the different kinds of tools for Ideation.
CO3: Learn the need and significance of prototyping and its significance.

TEXT BOOKS:

- T1 - Mark Baskinger and William Bardel, "Drawing Ideas: A Hand-Drawn Approach for Better Design", 2013
T2 - Nigel Cross, "Design Thinking", Kindle Edition

REFERENCE BOOKS:

- R1 - Kurt Hanks and Larry Belliston, "Rapid Viz : A New Method for the Rapid Visualization of Ideas", 2008.
R2 - Kathryn McElroy , "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.

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SYLLABUS

SEMESTER V

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5201	FARM MACHINERY AND EQUIPMENT	3	0	0	3
	Course Objective	<ol style="list-style-type: none"> 1. To introduce the students to the working principles of farm Machinery tillage implements. 2. To get thorough knowledge about the feasibility of primary and secondary tillage implements. 3. To gain knowledge about the sowing and fertilizer application methodologies 4. To acquire basic knowledge in the field of Weeding and Harvesting. 5. To expose the students to farm mechanization prospects and constraints alongside Cooperative Farming for shared usage of machinery. 				

Unit	Description	Instructional Hours
	FARM MECHANIZATION	
I	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.	9
	PRIMARY AND SECONDARY TILLAGE IMPLEMENTS	
II	Mould board plough- attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough. Cultivators - types - construction. Disc harrows - Bund former - ridger – leveler-Basin lister-Wetland preparation - Puddling and Trampling implements.	9
	SOWING AND FERTILIZING EQUIPMENT	
III	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.	9
	WEEDING AND PLANT PROTECTION EQUIPMENT	
IV	Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders Sprayers –types-classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.	9
	HARVESTING MACHINERY	
V	Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper, combine harvesters, threshers, tractor on top combine harvester, combine losses.	9
	Total Instructional Hours	45

Course Outcome

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

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

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

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

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

TEXT BOOKS

- T1 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors
- T2 Jain S. C. and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi
- T3 Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi
- T4 Yadav, R., and Solanki, H. B. 2009. Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture. New India Publishing Agency, New Delhi.
- T5 Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributors Pvt. Ltd, New Delhi

REFERENCE BOOKS

- R1 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributors, Delhi. 99, 1997.
- R2 Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.
- R3 Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990
- R4 Singh, S., and Verma, S. R. 2009. Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi
- R5 Kirpal Singh. 2013. Automobile Engineering Vol. I. Standard Publishers Distributors, Delhi


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5202	REFRIGERATION AND COLD CHAIN MANAGEMENT	3	1	0	4

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

Unit	Description	Instructional Hours
	REFRIGERATION PRINCIPLES	
I	Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - refrigeration components – compressor, condenser Expansion device and evaporators – types, construction and working.	9
	REFRIGERANTS, VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE	
II	Refrigerants – properties – classification – comparison and advantages – chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants. Simple vapour compression cycle – T-S diagram – P-H chart - application of refrigeration. Vapour absorption cycle – theoretical - deviation in practice - Electrolux refrigerator and Lithium bromide refrigeration– construction and principles.	9
	PSYCHROMETRIC PROCESS AND COOLING LOAD CALCULATION	
III	Representation of various psychrometric processes on psychrometric chart and their analysis. by-pass factor, Thermal comfort; Cooling and heating load Calculations- sensible heat factor, latent heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, and apparatus dew point.	9
	AIR CONDITIONING SYSTEM AND COLD STORAGE DESIGN	
IV	Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter. summer and year- round air conditioning system-unitary and central air conditioning system. Domestic refrigerator and freezer. Basic design requirements for cold storage, insulation materials properties and types. Cold storage design for fruits and vegetables.	9
	SHELF – LIFE & COLD CHAIN MANAGEMENT	
V	Defining overall Shelf-life. importance of shelf- life; remaining shelf life in the context of Chilled & Frozen foods; The premises of cold chain - Need for the chain for chilled / frozen food item. various links of the chain; Storage of frozen foods; Chilling and freezing; freeze drying, Chilling injury; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators (TTI); Time –temperature –correlation-the kinetic approach, effective temperature; Transportation regulations.	9
	Total Instructional Hours	45

Course Outcomes

- CO1: Introduction of basic principle of different refrigerating systems
CO2: Students will be able to understand the effect of different components on therefrigerating machines.
CO3: Upon completion of this course, the students will be able to demonstrate the operations in different Refrigeration & cold storage systems
CO4: They will also able to design Refrigeration & Cold storage systems to increase the shelflife of different agricultural commodities.
CO5: Students will be able to understand various aspects of cold chain management and able to rectify chilling injuries.

TEXT BOOKS

- T1 Anand, M.L. "Refrigeration& Air-Conditioning". Asian Books Pvt., Ltd., 2002.
T2 Sun, Da-Wen. "Advances in Food Refrigeration". Leatherhead Publishing, 2001.
T3 Kennedy, Christopher J. "Managing Frozen Foods". CRC / Woodhead Publishing, 2000.
T4 Ballney P. L. 1994. Thermal Engineering, Khanna Publishers, New Delhi.
T5 Khurmi R S. 1992. Engineering Thermodynamics. S Chand and Co. Ltd., Ram Nagar, New Delhi.

REFERENCE BOOKS

- R1 Evans, Judith. "Frozen Food Science and Technology". Wiley-Blackwell , 2008.
R2 Hui, Y.H. etal., " Handbook of Frozen Foods". Marcel Dekker, 2004.
R3 James, S.J. and C. James. " Meat Refrigeration". CRC / Woodhead Publishing, 2002.
R4 Stringer, Mike and C. Dennis. "Chilled Foods: A Comprehensive Guide". 2nd Edition, CRC / Woodhead Publishing, 2002.
R5 Nag P K. 1995. Engineering Thermodynamics. Tata McGraw Hill Publishing Co.Ltd., 12/4 Asaf Ali Raod, New Delhi.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5203	THEORY OF MACHINES	3	0	0	3

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

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

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

TEXT BOOKS

- T1 Rattan S B. 1993. Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.
- T2 Bevan Thomas. 1984. Theory of Machines. CBS Publishers and Distributors, Delhi.
- T3 Ballaney P L. 1985. Theory of Machines. Khanna Publishers, 2-B Nath Market, NaiSarak, New Delhi.
- T4 Khurmi R S and Gupta J K. 1994. Theory of Machines. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.
- T5 LalJagdish. 1991. Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 NetajiSubashMarg, New Delhi..

REFERENCE BOOKS

- R1 Shigley.J.E, and Uicker.J.J, "Theory of Machines and Mechanisms", McGraw Hill, 1995.
- R2 Ghosh.A, and Mallick.A.K, "Theory of Mechanisms and Machines", Affiliated East-West Pvt Ltd., New Delhi, 1988.
- R3 Rao.J.S, and Dukupati.R.V, " Mechanism and Machine Theory" , Wiley-Eastern Ltd., New Delhi, 1995
- R4 Khurmi R.S., "Theory of Machines" Khanna Publishers, Delhi, 2006.
- R5 Sadhu Singh "Theory of Machines: Kinematics and Dynamics", Pearson; 3rd edition (12 December 2011).


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5251	GROUNDWATER AND WELL ENGINEERING	2	0	2	3

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

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

- Course Outcome**
- CO1: Students' knowledge base gets enriched with the technical aspects of groundwater, its availability, assessment and utilization
- CO2: Student get nourished with the knowledge of well hydraulics in different types of aquifers
- CO3: Students will get a thorough idea about different types of wells.
- CO4: Students will gain notion about construction of well

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

TEXT BOOKS

- T1 Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.
- T2 Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.
- T3 Tang Y, Zhou J, Yang P, Yan J, Zhou N. Groundwater engineering. Springer Singapore; 2017.
- T4 Delleur JW, editor. The handbook of groundwater engineering. CRC press; 2006 Nov 16.
- T5 Cushman JH, Tartakovsky DM, editors. The handbook of groundwater engineering. CRC Press; 2016 Nov 25.

REFERENCE BOOKS

- R1 Rastogi, A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008
- R2 David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007
- R3 Fletcher, G. Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987
- R4 Walton WC. Principles of groundwater engineering. CRC press; 2020 Jul 24.
- R5 Howsam P, editor. Water Wells-Monitoring, Maintenance, Rehabilitation: Proceedings of the International Groundwater Engineering Conference, Cranfield Institute of Technology, UK. CRC Press; 1990 Aug 30.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5252	SOIL AND WATER CONSERVATION ENGINEERING	2	0	2	3

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

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

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

- CO2: Students will obtain the knowledge of estimating soil erosion.
- CO3: They get enriched with knowledge on Hydrologic, Hydraulic and Structural designs of soil and water conservation measures
- CO4: Students can able to design Rainwater harvesting systems.
- CO5: Students will receive concepts of sedimentation and detention tanks.

TEXT BOOKS

- T1 Suresh, R., "Soil and Water Conservation Engineering", Standard Publication, New Delhi, 2007.
- T2 Ghanshyam Das. "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
- T3 "Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.
- T4 Troeh FR, Hobbs JA, Donahue RL. Soil and water conservation for productivity and environmental protection. Prentice-Hall, Inc.; 1980.
- T5 Pierce FJ. Advances in soil and water conservation. CRC Press; 1998 Feb 1.

REFERENCE BOOKS:

- R1 Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.
- R2 Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.
- R3 Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002
- R4 Sidle RC, Pearce AJ, O'Loughlin CL. Hillslope stability and land use. American geophysical union; 1985.
- R5 Ohlig CP, editor. Integrated Land and Water Resources Management in History: Proceedings of the Special Session on History, May 16th, 2005. BoD-Books on Demand; 2005.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5001	OPERATION AND MAINTENANCE OF FARM MACHINERY LABORATORY	0	0	3	1.5

Course Objective

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

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

S.NO	LIST OF EXPERIMENTS	Instructional Hours
1	Identification of major systems of a tractor and general guidelines on preliminary check measures.	3
2	Identification of components of power tiller and general guidelines on preliminary check measures.	3
3	Field operation and adjustments of ploughs	3
4	Field operation of seed cum fertilizer drill and calibration	3
5	Field operation of plant protection equipment	3
6	Field operation on weeder and mowers	3
7	Studies on methods of repair, maintenance and off-season storage of farm equipment	3
8	To measure Draft and wheel slip with load and no-load condition.	3
9	Hitching of agricultural implements and trailers	3
10	Study and calculate harvesting losses of combine harvester and thrasher	1.5
11	Study and operation of bulldozer/laser leveler and its roll in agriculture practices	1.5
Total Instructional Hours		30

Course Outcome During this course, students have an ability

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

S.NO	LIST OF EQUIPMENTS	REQUIRED QUANTITY
1	Tractor	1
2	Power tiller	1
3	Disc plough	1
4	Disc harrow	1

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

TEXT BOOKS

- T1 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors
- T2 Jain S. C. and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi
- T3 Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi
- T4 Yadav, R., and Solanki, H. B. 2009. Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture. New India Publishing Agency, New Delhi.
- T5 Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributors Pvt. Ltd. New Delhi

REFERENCES

- R1 Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard publishers and Distributors, New Delhi, 1999.
- R2 Herbert L. Nichols Sr., Moving the Earth, D. Van Nostrand company Inc. Princeton, 1959.
- R3 John A Havers and Frank W Stubbs, Hand book of Heavy Construction, McGraw – Hill book Company, New York, 1971.
- R4 Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.
- R5 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributors, Delhi. 99, 1997.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5002	CAD FOR AGRICULTURAL ENGINEERING	0	0	3	1.5

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

S.NO	LIST OF EXPERIMENTS	Instructional Hours
1	Study on Basics of engineering drawing (Scale, Views and Projections)	1.5
2	Study on Basics of AUTOCAD	1.5
3	Creating 2D drawings with general steps and assembly of simple machines	3
4	Drawing of objects in 3D with general steps	3
5	Drawing of shafts, bearing, bolt and nut, keys and hubs.	3
6	Drawing of shaft coupling, splines, Gears and connecting road.	3
7	Preparation of assemblies in 3D	3
8	Design and Drawing of Underground pipeline system	3
9	Design and Drawing of Check dam	3
10	Design and Drawing of Mould board plough, Disk plough and sprayers	3
11	Design and Drawing of Biogas plant.	3
12	Draw a simple building in 2D and 3D.	3

Course Outcome

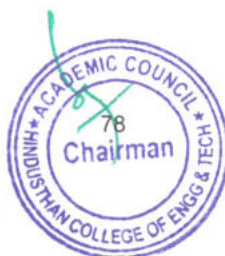
CO1: Understand of basic of engineering drawing and software usage
CO2: The students also will be able to design and draw the components using computer aided methods.
CO3 The student will be able to understand the plan and layout of underground pipes, farm implements
CO4: Practicing to draw internal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

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

REFERENCES

- R1 Michael, A.M. "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.
R2 Rai, G.D. "Nonconventional Sources of Energy", Khanna publishers, New Delhi, 1995.
R3 Srivastava, A.C. "Elements of Farm Machinery", Oxford and IBH Publications Co., New Delhi, 1990.

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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE5071	SOFT SKILLS - I	1	0	0	1

Course Objectives:

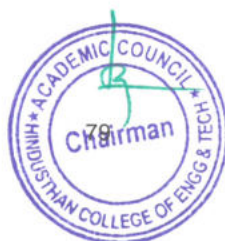
- 1.To employ soft skills to enhance employability and ensure workplace and career success.
- 2.To enrich students' numerical ability of an individual and is available in technical flavor.
- 3.To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	Introduction to Soft Skills: Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	Art of Communication: Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	World of Teams: Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	Quantitative Aptitude: Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	Logical Reasoning: Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2
Course Outcome:	CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.	
	CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others	
	CO3: Students will understand how teamwork can support leadership skills	
	CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.	
	CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.	

REFERENCE BOOKS:

- R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz
- R2: How to prepare for data interpretation for CAT by Arun Sharma.
- R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
- R4: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
- R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE5072	DESIGN THINKING	1	0	0	1

- Course Objective**
1. To expose students to the design process
 2. To develop and test innovative ideas through a rapid iteration cycle.
 3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
DESIGN ABILITY		
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
DESIGNING TO WIN		
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
DESIGN TO PLEASE AND DESIGNING TOGETHER		
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
DESIGN EXPERTISE		
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	3
Total Instructional Hours		15

Course Outcome

Upon completion of the course, students will be able to

CO1: Develop a strong understanding of the Design Process

CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.

CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.

R2 - 3. Tim Brown, "Change by Design", 2009.

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VI SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6201	HYDROLOGY AND WATER RESOURCES ENGINEERING	3	0	0	3

Course Objective

- To study occurrence movement, distribution and management of water for effective irrigation
- To know the basic principles and movement of ground water flow.
- To know the agricultural droughts influencing crop production

Unit	Description	Instructional Hours
PRECIPITATION AND ABSTRACTIONS		
I	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.	9
RUNOFF		
II	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	9
FLOOD AND DROUGHT		
III	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)	9
RESERVOIRS		
IV	Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.	9
GROUNDWATER AND MANAGEMENT		
V	Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas	9
Total Instructional Hours		45

COURSE OUTCOMES

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

- CO1: An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
- CO2: Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.
- CO3: Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs
- CO4: Understand the concept and methods of ground water management
- CO5: An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments.

TEXT BOOKS

- T1 Subramanya.K. "Engineering Hydrology"- Tata McGraw Hill, 2010
- T2 Jayarami Reddy.P. "Hydrology", Tata McGraw Hill, 2008.
- T3 Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

REFERENCE BOOKS

- R1 David Keith Todd. "Groundwater Hydrology". John Wiley & Sons. Inc. 2007
- R2 Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology". McGraw Hill International Book Company, 1998.
- R3 Raghunath .H.M.. "Hydrology", Wiley Eastern Ltd., 1998.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6202	SOLAR AND WIND ENERGY ENGINEERING	3	1	0	4

Course Objective

- To visualize the solar and wind energy available in nature.
- Learn the fundamental concepts about solar and wind energy systems.
- To illustrate Design parameters of wind mill and solar PV system.
- To know about applications of solar and wind energy for water pumping and electricity generation.

Unit	Description	Instructional Hours
SOLAR ENERGY		
I	Introduction-Solar constant- solar radiation measurements -Solar collectors and classification- -Applications of Solar Energy- solar water heater- Solar Cooker - Solar dryer- Solar distillation –Solar stills - Solar pond -solar greenhouse - PV powered water pumping – Hybrid system -Solar refrigeration.	9
CONCENTRATING COLLECTORS DESIGN		
II	Solar Thermal Energy Storage- Sensible storage- Latent heat storage-Thermo-chemical storage – Design and performance parameters of concentrating collector - tracking systems- Compound parabolic concentrators, parabolic trough concentrators, Concentrators with point focus, Heliostats.	9
III	SOLAR PV TECHNOLOGY Solar photovoltaic technology –introduction – solar cell basics – Types of solar cells and modules– Design of solar PV system- Fabrication technology for solar Cells.	9
WIND ENERGY		
IV	Introduction- The nature of wind- power in the wind- Forces on the Blades -Site Selection considerations-Basic components of a wind energy conversion system (WECS)- Economics of Wind energy Utilization- Wind energy Programm in India.	9
WIND MILL TYPES AND APPLICATIONS		
V	Wind turbines (Wind mill) -Horizontal Axis wind mill-Vertical Axis wind mill- Water pumping - Hybrid systems –Design parameters of wind mill- Wind mill safety and environmental aspects.	9
Total Instructional Hours		45

COURSE OUTCOMES

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

- CO1: Understand the need of energy conversion and the various methods of energy storage
- CO2: student able to explain the field applications of solar energy
- CO3: understanding Winds energy as alternate form of energy and to know how it can be tapped

CO4: Illustrate the concepts of Direct Energy Conversion systems & their applications.

CO5: Select engineering approach to problem solving when implementing the projects on renewable sources.

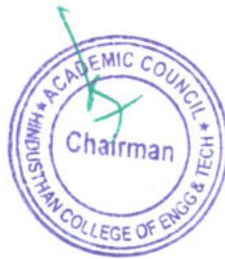
TEXT BOOKS:

- T1 Rai., G.D. "Solar Energy Utilization " Khanna publishers, New Delhi, 2002
- T2 More, H.S and R.C. Maheshwari, "Wind Energy Utilization in India" CIAE Publication – Bhopal, 1982
- T3 Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, Delhi, 2000.

REFERENCE BOOKS:

- R1 Mathew Buresch, Photovoltaics Energy Systems. McGraw-Hill Book Company, London, 1986.
- R2 Jui Sheng Hsieh. Solar Energy Engineering, Prentice Hall, London, 1986.
- R3 Tany Burtar, Hand book of wind energy. John Wiley and Sons, 2001,
- R4 J.G.Mc Gowan, Manwell, J.F. and A.L.Rogers. Wind Energy Explained – Theory Design and Application, John Wiley and Sons Ltd, 2004.
- R5 Rai. G.D. "Non-Conventional Sources of Energy", Khanna Publishers, New Delhi, 2002.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6181	PROFESSIONAL ETHICS	3	0	0	3

- Course Objective**
1. To enable the students' minds to get an awareness on Engineering Ethics and Human Values
 2. To instill Moral and to uphold Social Values in appreciation to the on par rights of others.

Unit	Description	Instructional Hours
	HUMAN VALUES	
I	Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	9
	ENGINEERING ETHICS	
II	Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.	9
	SOCIAL EXPERIMENTATION	
III	Engineering with societal Experimentation – Engineers as responsible Experimenters – Calibration Codes of Engineering Ethics – A Balanced Outlook on Law.	9
	SAFETY, RESPONSIBILITY AND RIGHTS ISSUES	
IV	Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.	9
	GLOBAL ISSUES	
V	Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.
- CO2: To learn Calibration Codes of Engineering Ethics
- CO3: Understand the Intellectual Property Rights (IPR) for new invention
- CO4: Assessment of Safety and Risk in effective way.

CO5: Understand the importance of Corporate Social Responsibility.

TEXT BOOKS

- T1 Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
T2 Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS

- R1 Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
R2 Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
R3 John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
R4 Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6251	FOOD AND DAIRY ENGINEERING	2	0	2	3

- Course Objective**
1. To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry
 2. To expose the students to the fundamental knowledge of food, its properties and different methods of food processing.

Unit	Description	Instructional Hours
	BASIC PROPERTIES OF FOOD MATERIALS	
I	Constituents of food -physical, mechanical, thermal, rheological, electrical and physico-chemical properties of food materials- texture of food materials. Moisture content - - equilibrium moisture content - water activity - sorption behaviour of foods- isotherm models - monolayer value, BET and GAB model isotherms. effect of water activity on food quality and stability-phase transition phenomena in foods- Gordon-Taylor equation and WLF equation.	9
	PROCESSING AND PRESERVATION OF FOODS	
II	Thermal processing of foods - cooking, blanching, sterilization, pasteurization, drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration. 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.	9
	REACTION KINETICS AND QUALITY CONTROL	
III	Introduction, General Considerations, Basic Chemical Kinetics, order of reaction, first-order rate processes, determining kinetic parameters, temperature dependence of reaction kinetics- Arrhenius model, thermal death time model, Q10 model, food spoilage- kinetics of microbial destruction - decimal reduction time - Arrhenius equation - thermal death time curves-loss of nutrient in Newtonian and non-Newtonian liquid foods-batch and continuous sterilization equipment. Quality control of processed food - Factors affecting quality	9
	PROPERTIES AND PROCESSING OF MILK	
IV	Physical, chemical, thermal and rheological properties of milk, Method of raw milk procurement, preservation and testing of milk - Processing -Staining - Filtering and Clarification - cream separation - Pasteurization - Homogenization -sterilization, LTLT, UHT processing and aseptic packaging - emulsification - Fortification, milk types	9
	DAIRY PRODUCTS	
V	Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk - Buttermilk - 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.	9

Total Instructional Hours

45

**COURSE
OUTCOMES**

After successful completion of this course students are expected to be able to:

CO1: The students will gain knowledge about Dairy and Food process engineering

CO2: Understand the process of manufacturing of dairy products and thermal processing of food.

CO3: Understand the importance of quality control and food preservation and packaging.

CO4: Understand the Basic Chemical Kinetics during the milk process

CO5: Understand the various milk products and effluent treatment and disposal process.

TEXT BOOKS

- T1 Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.
- T2 Walstra. P., Jan T. M. Wouters., Tom J. Geurts "Dairy Science and Technology", CRC press, 2005.
- T3 Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1999.

REFERENCE BOOKS

- R1 Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.
- R2 Toledo, R.T., "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 1997.
- R3 Tufail Ahmed., "Dairy Plant Engineering and Management", Kitab Mahal Publishers, Allahabad, 1997.
- R4 Dairy Science and Technology Handbook, Volumes 1-3, John Wiley & Sons, 1993.
- R5 Charm, S.E., "Fundamentals of Food Engineering", AVI Pub.Co.Inc, New York, 1997.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6001	ICT IN AGRICULTURAL ENGINEERING	0	0	4	2

Course Objective
Understanding the importance of using ICT tools for increasing crop production.
To gain practical knowledge on effective using of electric and electronic component and software for controlling agricultural input and output.
To gain practical knowledge on various technologies in information and communication for agricultural engineering applications.

S.NO	LIST OF EXPERIMENTS	Instructional Hour
1	Study on Various ICT tools used in agriculture and its application.	1.5
2	Study on open-source crop simulation models for yield estimation.	1.5
3	Study on use of coding language and mobile app for controlling or triggering an agricultural system.	3
4	Experience with solenoid valves for irrigation water tank filling	3
5	Employing PLC for controlling or triggering water level in irrigation tank	3
6	Using LAB View for Agro meteorological measurements like Temperature and soil moisture	3
7	Using LAB View for Agro meteorological measurements like humidity and stability	3
8	Using PID SCAD controller for irrigation water level control	3
9	Using PID SCAD controller for irrigation water flow control	3
10	Using PID SCAD controller for irrigation water pressure control	3
11	Image processing as tool for biotic and abiotic stress identification	3
12	Exposing cloud resources for agricultural applications	3
Total hours		30

Course Outcome
By the end of the course, the students will be able to
CO1: Gain practical knowledge on various technologies in information and communication for agriculture.
CO2: Learning the crop simulation models and coding language and mobile app usage in agriculture.
CO3: Gain practical knowledge on using LAB View and PID SCAD for controlling agricultural input and output.
CO4: Gain practical knowledge on using MATLAB for Image processing
CO5: Understand about cloud resources for agricultural applications

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Timing devices and small pumps for simulations – required nos.	1
2	Solenoid valves and layout of drip or sprinkler system – required nos.	1
3	Time Domain Reflectometer (TDR)	1
4	Digital thermometer	1
5	Breadboards, relays etc.	1
6	LAB View PID SCAD and MATLABORATORY software	1
7	Open source Crop simulation models – any one for demonstration	1
8	Other facilities for cloud resources, agro advisory systems etc.	1

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- R2 De Silva, H. and Ratnadiwakara, D., 2008. Using ICT to reduce transaction costs in agriculture through better communication: A case-study from Sri Lanka. LIRNEasia, Colombo, Sri Lanka, Nov
- R3 Gelb, E. and Voet, H., 2009. ICT Adoption Trends in Agriculture: A summary of the EFITA ICT Adoption Questionnaires (1999-2009). Abrufbar unter: <http://departments.agri.huji.ac.il/economics/voet-gelb.pdf>. Letzter Zugriff, 20. p.2010.
- R4 Tolulope Kehinde, K.A., Agwu, D. and Edwin, M., 2015. Application of ICT to Agriculture as a Panacea to Unemployment in Nigeria
- R6 Taragola, N. and Gelb, E., 2005. Information and Communication Technology (ICT) adoption in horticulture: A comparison to the EFITA baseline. ICT in agriculture: Perspectives of technological innovation.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6701	INDUSTRIAL TRAINING	0	0	0	1

Course Objective

1. To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering
2. The students individually undertake training in reputed engineering companies / Govt organizations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration.

Course Outcome	CO1: Understand the working culture in industries/NGO and human relationship.
	CO2: Understand the variables involved in process sequence and optimization of process parameters.
	CO3: To analyze the research problem and formulate methodology to find a solution.
	CO4: Understanding the manufacturing processes and marketing strategies.
	CO5: To get the exposure in testing and evaluation of tools, equipment and machinery and preparing a test report.


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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE6071	SOFT SKILLS-II	1	0	0	1

Course Objectives:

1. To make the students aware of the importance, the role and the content of softskills through instruction, knowledge acquisition, demonstration and practice.
2. To learn everything from equations to probability with a completely different approach.
3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	Group Discussion & Presentation Skills: GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	Interview Skills and Personality Skills: Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	Business Etiquette & Ethics: Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3
IV	Quantitative Aptitude: Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3
V	Logical Reasoning: Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2

Course Outcome:

CO1: Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.

CO2: Students will Actively participate meetings. Group Discussions / interviews and prepare & deliver presentations

CO3: Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment

CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.

CO5: Students will excel in complex reasoning.

REFERENCE BOOKS:

- R1: Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent- Bruce Tulgan
R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
R3: How to crack test of Reasoning - Jaikishan and Premkishan
R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj


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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objectives:

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3. To disseminate knowledge on copyrights and its related rights and registration aspects.
4. To disseminate knowledge on trademarks and registration aspects.
5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
I	INTRODUCTION TO INTELLECTUAL PROPERTY Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
II	PATENTS Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
III	COPYRIGHTS Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
IV	TRADEMARKS Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks - Registration of Trademarks.	3
V	DESIGN AND GEOGRAPHICAL INDICATION Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3

Course Outcome:

- CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
- CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
- CO4: Identify different types of trademarks and procedure for registration
- CO5: Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOKS:

- T1- Neeraj, P., & Khushdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCE BOOKS:

- R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
- R2-Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.


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PROFESSIONAL ELECTIVE - 1

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5301	SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING	3	0	0	3

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

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

Course Outcome Upon completion of the course,
CO 1: Student will acquire the knowledge on system concepts

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

CO3: Students will get knowledge about how to simulate various natural processes.

CO4: Students can simulate various natural processes by using ANN.

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

TEXT BOOKS

- T1 Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
- T2 Robert M Peart and W David Shoup, Agricultural Systems Management – Optimizing efficiency and performance, CRC Press, 2013.
- T3 Gupta, P.K., and Man Mohan, “Problems in Operations Research”, (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.
- T4 Razmjoooy, Navid, and Vania Vieira Estrela, eds. *Applications of image processing and soft computing systems in agriculture*. IGI Global, 2019.
- T5 Ram, Mangey, and Suraj B. Singh. *Soft Computing: Techniques in Engineering Sciences (Volume 1)*. De Gruyter, 2020.

REFERENCE BOOKS

- R1 Chaturvedi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi, 1997.
- R2 Taha, H.A., “Operations Research”, McMillan Publication Co., New York, 1995.
- R3 Hiller, F.S., and Liebermann, G.J., “Operations Research”, CBS Publications and Distributions, New Delhi, 1992.
- R4 Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
- R5 S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5302	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	3	0	0	3

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

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

water and trade - Sustainable food Security Action Plan – Regulations of Terrace Gardening product Market

Total Instructional Hours

45

Course Outcome	CO1: Upon completion of this course, the students will gain knowledge on the need for sustainable agriculture
	CO2: They will be able to comprehend the need for food security on global level and the Nutritional Security.
	CO3: The students will be able to demonstrate how ecological balance is required for sustainability of agriculture.
	CO4: The students will be capable of understanding the applicability of rural and urban farming.
	CO5: The students will be able to identify various policies and programmes related to sustainable agriculture and food security.

TEXT BOOKS

- T1 M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.
- T2 B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.
- T3 Dhanarajan, Arulbalachandran, ed. Sustainable Agriculture Towards Food Security. Springer Singapore, 2017.
- T4 Hatfield, Jerry L., David D. Songstad, and Dwight Thomas Tomes. Convergence of food security, energy security and sustainable agriculture. Springer, 2014.
- T5 Campanhola, Clayton, and Shivaji Pandey, eds. Sustainable food and agriculture: an integrated approach. Academic Press, 2018.

REFERENCE BOOKS

- R1 Swarna S.Vepa et al., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.
- R2 Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.
- R3 Tanji, K. K., and Yaron, B. Management of water use in agriculture, Springer Verlag, Berlin, Germany, 1994.
- R4 Earles, Richard, and Paul Williams. Sustainable Agriculture an Introduction. ATTRA, 2005.
- R5 Shetty, P. K., S. Ayyappan, and Monkombu Sambasivan Swaminathan. Climate change and sustainable food security (NIAS Books and Special Publications No. SP4-2013). NIAS; ICAR, 2013.


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Program	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5303	CDM AND CARBON TRADING TECHNOLOGY	3	0	0	3

- Course Objective**
- To grab the basic idea about impact of greenhouse effect in environment.
 - To acquire knowledge about various policies and programmes related to reduce the impacts of greenhouse effect.
 - To know the basics, importance of clean development mechanism (CDM)
 - To know the concept of carbon trading
 - To introduce the alternatives for reducing the greenhouse effect.

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

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

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

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

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

CO5: Compare the alternate techniques for lowering carbon emission.

TEXT BOOKS

- T1 MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book- Vol.1, UNEP publication, 2005
- T2 Myungkyoon Lee, Information and Guide Book - the UNEP project CD4CDM-UNEP publication, June 2004.
- T3 Yamin F. Climate change and carbon markets: A handbook of emissions reduction mechanisms. Routledge; 2012 Apr 27.
- T4 Platonova-Oquab A, Spors F, Gadde H, Godin J, Oppermann K, Bosi M. CDM Reform: Improving the efficiency and outreach of the Clean Development Mechanism through standardization. World Bank; 2012.
- T5 Hillebrand J. Carbon Credits and Global Emissions Trading: A Viable Concept for the Future?. GRIN Verlag; 2008 Sep 22.

REFERENCE BOOKS

- R1 Manual for project developers and policy makers-UNFCCC Publication, 2007
- R2 Aukland L, Bass S, Hug S, Landell Mals N, Tipper R, Laying the Foundations for clean Development, Preparing the Land use sector London, 2002
- R3 Carbon sequestration in dryland soils, World Soil Resources report No.102, Food and Agriculture Organization, Rome, 2004.
- R4 Lokey E. Renewable energy project development under the clean development mechanism: a guide for Latin America. Routledge; 2012 May 16.
- R5 Chevallier J. Econometric analysis of carbon markets: the European Union emissions trading scheme and the clean development mechanism. Springer Science & Business Media; 2011 Sep 21.


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Program	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5304	IOT IN AGRICULTURAL SYSTEMS	3	0	0	3

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

Unit	Description	Instructional Hours
	BASIC ELECTRONICS CIRCUITS	
I	Passive devices -semiconductor devices - transistors - diode circuits - amplifier circuits- oscillator circuits- thyristor circuits-Integrated circuits and operational amplifier - logic gates - flip flop – counters digital to analog - analog to digital converters microprocessor introduction	9
	PRECISION FARMING	
II	Precision agriculture and agricultural management-Ground based sensors, Remote sensing, GPS, GIS and mapping software -Yield mapping systems, Crop production modeling.	9
	ENVIRONMENT CONTROL SYSTEM	
III	Artificial light systems - management of crop growth in greenhouses, simulation of CO ₂ consumption in greenhouses, on-line measurement of plant growth in the greenhouse - models of plant production and expert systems in horticulture. Understanding and predicting world's climate system.	9
	AGRICULTURAL SYSTEMS MANAGEMENT	
IV	Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources - Linear programming, Project scheduling - Artificial intelligence and decision support systems.	9
	E-GOVERNANCE IN AGRICULTURAL SYSTEMS	
V	Concept of Information Technology (IT) and its application potential - Role of IT in natural resources management - Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications - Technology enhanced learning systems and solutions, e-learning, Rural development and information society - Internet application tools and web technology.	9
	Total Instructional Hours	45

During this course, students will be trained:

CO1: To know the Basic of Electric Circuits

- Course** CO2: To understand the importance of Precision Farming.
- Outcome** CO3: To manage the favourable conditions required for every crops separately
- CO4: To solve the problems related to agriculture engineering by providing optimal conditions.
- CO5: Understand about e-governance and agricultural systems management.

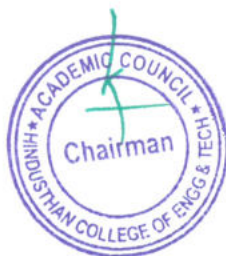
TEXT BOOKS

- T1 Hammer, G.L., Nicholls, N., and Mitchell, C., Applications of Seasonal Climate, Springer, Germany, 20
- T2 Peart, R.M., and Shoup, W. D., Agricultural Systems Management, Marcel Dekker, New York, 2004.
- T3 Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
- T4 Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.
- T5 Pierce FJ, Clay DE, editors. GIS applications in agriculture. New York: CRC Press; 2007 Feb 13.

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- R1 National Research Council, Precision Agriculture in the 21st Century, National Academies Press, Canada, 1997.
- R2 H. Krug, Liebig, H.P. International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation, 1989.
- R3 Gupta, P.K., and Man Mohan. "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.
- R4 Srinivasan A, editor. Handbook of precision agriculture: principles and applications. CRC press; 2006 Sep 6.
- R5 Clay DE, Clay SA, Bruggeman SA. Practical mathematics for precision farming. John Wiley & Sons; 2020 Jan 22.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG5305	ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	3	0	0	3

Course Objective

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

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

Course Outcome

By the end of the course student will be able

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

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

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

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

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

TEXT BOOKS:

- T1 Mark S.Senders,ErnestJ.Mccormick (1975) human factors in Engineering Design.
- T2 McGraw Hill Book co., New York 2. Wesley E.Woodson (1981),Human factors design hand book.
- T3 Gite LP. 2009. Anthropometric and strength data of Indian Agricultural Workers for farm equipment design. AICRP on ESA. CIAE, Bhopal.
- T4 Astrand, P.O and Rodahl, K.1977. Text book of work physiology, McGraw Hill, New York

- T5 Dul J and Weerdmeester B.1993.Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.
- T6 Kroemer, K.H.E., Kroemer.H.J. and K.E.Kroemer-Elbert. 1997. Engineering Physiology: bases of human factors/ergonomics, VAN NOSTRAND REINHOLD, New York.

REFERENCE BOOKS:

- R1 Robert W.Bailey (1992).Human performance Engineering .PTR Prentice Hall, Englewood cliffs, New Jersey.07632.
- R2 Bridger, R.S,1995. Introduction to Ergonomics, McGraw Hill, New York
- R3 Rodal, K.1989.The Physiology of work. Taylor and Francis, London.
- R4 K.U.E. Kroemer and E. Grandjean. 2001. Fitting the Task to the Human: A textbook of Occupational Ergonomics. Taylor and Francis.
- R5 Mark S. Sanders and Ernest James McCormick,1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.


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PROFESSIONAL ELECTIVE – II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6301	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

Course Objective	
	1. To know the basics, importance of global warming
	2. To know the concept of mitigation measures against global warming
	3. To learn about the global warming and climate change.

Unit	Description	Instructional Hours
EARTH'S CLIMATE SYSTEM		
I	Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect - Radioactive effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.	9
ATMOSPHERE AND ITS COMPONENTS		
II	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 - inversion on pollution dispersion.	9
IMPACTS OF CLIMATE CHANGE		
III	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.	9
OBSERVED CHANGES AND ITS CAUSES		
IV	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 – on a Global Scale and in India .	9
CLIMATE CHANGE MITIGATION MEASURES		
V	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.	9
Total Instructional Hours		45

COURSE After successful completion of this course students are expected to be able to:

- OUTCOMES
- CO1: Demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale
 - CO2: Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts
 - CO3: Understand and critically evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation.
 - CO4: Demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale
 - CO5: Effective utilization of MSW and bio waste

TEXT BOOKS

- T1 Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
- T2 Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003
- T3 Dash Sushil Kumar, Climate Change – An Indian Perspective, Cambridge University Press India Pvt. Ltd, 2007

REFERENCE BOOKS

- R1 Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
- R2 Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
- R3 IPCC Fourth Assessment Report – The AR4 Synthesis Report


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Program	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6302	HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERS	3	0	0	3

- Course Objective**
1. To impart the knowledge on heat transfer mechanisms in fluids and solids, and their applications in various heat transfer equipment
 2. To introduce non-dimensional numbers and their effects in governing various modes of mass transfer
 3. To analyze heat exchangers and methods of evaluating the performance

Unit	Description	Instructional Hours
	CONDUCTION	
I	Basic concepts - Mechanism of Heat transfer. Conduction - Fourier's Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems.	9
	CONVECTION	
II	Basic Concepts - Heat transfer coefficients, boundary layer concept. Types of convection - Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent.	9
	RADIATION	
III	Radiation heat transfer - concept of black and grey body-Laws of Radiation - Stefan-Boltzmann Law. Kirchhoff's Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields	9
	HEAT EXCHANGERS	
IV	Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient	9
	MASS TRANSFER	
V	Mass transfer- introduction - Fick law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases- diffusion through a varying cross-sectional area- diffusion coefficients for gases - molecular diffusion in liquids.	9
	Total Instructional Hours	45

- COURSE OUTCOMES**
- After successful completion of this course students are expected to be able to:
- CO1: Understand conduction, students will able to in different geometries
 - CO2: Asses the concepts and types of convection in heat transfer mechanism
 - CO3: Recognize the radiation problems in various geometries
 - CO4: Analyze the performance of heat exchangers and evaporators
 - CO5: Understand the diffusion through a varying cross-sectional area

TEXT BOOKS

- T1 R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International private limited, New Delhi, 2010
- T2 Yunus A. Cengel, Heat and Mass Transfer: a Practical Approach, Tata McGraw Hill publishing Company private limited, New Delhi, 2007

REFERENCE BOOKS

- R1 J. P. Holman, Heat Transfer, Tata McGraw Hill publishing Company private limited, New Delhi, 2009
- R2 C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014
- R3 Heat and Mass Transfer, S Chand and Company, New Delhi, 2009


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6303	DISASTER MANAGEMENT	3	0	0	3

- Course Objective**
1. To provide students an exposure to disasters, their significance and types.
 2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
 3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
 4. To enhance awareness of institutional processes in the country and develop rudimentary ability to respond to their surroundings with potential disasters.

Unit	Description	Instructional Hours
	SITUATIONAL DISASTERS	
I	Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc -Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.	9
	DISASTER RISK REDUCTION (DRR)	
II	Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.	9
	VULNERABILITIES, IMPACTS AND DEVELOPMENTS	
III	Factors influencing Disaster Vulnerabilities - differential impacts - Development projects - dams, embankments, Highways - Land use – Electricity Power Lines - Industrialization - Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.	9
	DISASTER RISK MANAGEMENT	
IV	Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.	9

CATEGORICAL CASE STUDIES

V	Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.	9
Total Instructional Hours		45

Course Outcome	The students will be able to CO1: Differentiate the types of disasters, causes and their impact on environment and society CO2: Assess vulnerability and various methods of risk reduction measures as well as CO3: Draw the hazard and vulnerability profiles and Scenarios in the Indian context for Disaster damage assessment and management. CO4: Knowledge in appropriate technology and local resource for disaster management CO5: Involving case studies and collect the data from formers related to disaster management.
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TEXT BOOKS

- T1 Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN
- T2 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN
- T3 Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
- T4 Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

REFERENCE BOOKS

- R1 Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
- R2 Government of India, National Disaster Management Policy, 2009.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6304	HORTICULTURAL CROP PROCESSING	3	0	0	3

- Course Objective**
1. To impart knowledge and skill to the students on different unit operations in processing of horticultural crops
 2. To make the students understand the working principles of different machineries used for processing of fruits, vegetables and spices
 3. To prompt them get sufficient knowledge in the basics of selection of appropriate machines/ equipment.

Unit	Description	Instructional Hours
	PROCESSING OF HORTICULTURAL CROPS	
I	Characteristics and properties of horticultural crops - Importance of processing - fruits and vegetables - spices and condiments - important for processing; Preservation Technology: General methods of preservation- physical/ chemical and other methods of preservation – advantages and limitations – Nutritive values and Health factors.	9
	PRELIMINARY PROCESSING SEQUENCES	
II	Flowcharts for preparation of different finished products - Food supply chain - Sorting and grading equipments - Peeling: Different peeling methods and devices (manual peeling, mechanical peeling, chemical peeling, and thermal peeling) - Slicing of horticultural crops: equipment for slicing, shredding, crushing, chopping, juice extraction, etc. - Blanching: Importance and objectives - blanching methods - effects on food (nutrition, colour, pigment, texture).	9
	CHILLING AND FREEZING PRELUDES	
III	Chilling and freezing: Application of refrigeration in different perishable food products - Thermophilic, mesophilic & Psychrophilic micro-organisms - Chilling requirements of different fruits and vegetables - Freezing of food - freezing time calculations – slow paced and fast freezing - Equipment for chilling and freezing (mechanical & cryogenic) - Effect on food during chilling and freezing, Cold Storage - heat load calculations - cold storage design - refrigerated vehicle and cold chain system.	9
	DRYING AND PACKAGING	
IV	Dryers for fruits and vegetables, Osmo-dehydration; Handling and transportation of fruits and vegetables, Pack house technology, Minimal processing; Common methods of storage, Low temperature storage, evaporative cooled storage, Controlled atmospheric storage, Modified atmospheric packaging; Post harvest management and equipment for spices; Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials commonly used for raw and processed fruits and vegetables products, bulk and retail packages and packaging machines.	9
	GRADES AND QUALITY CONTROL	
V	Quality control in Fruit and vegetable processing industry - Study of fruit graders, Study of peeler and slicer, Study of juicer and pulper - Study of blanching equipment, Testing adequacy of blanching - Study of cold storage and its design - Study of CAP and MAP storage - Minimal processing of vegetables - Preparation of value added products.	9

Total Instructional Hours 45

**COURSE
OUTCOMES**

After successful completion of this course students are expected to be able to:
CO1: Use the different types of sorting, grading, peeling, slicing, blanching and other equipment for processing of fruits and vegetables
CO2: Identify the suitable equipment, materials and methods for storage, processing, packaging and value addition of fruits and vegetables
CO3: Develop at least 4 types of value added products from fruits and vegetables
CO4: Understand the technical and management aspects of operation of fruits and vegetable processing industries
CO5: Understand the quality control processing industry

TEXT BOOKS:

- T1 Pandey, R.H. 1997. Post harvest Technology of fruits and vegetables (Principles and practices). Saroj Prakashan, Allahabad
T2 Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of horticultural crops. New india Publishing House.

REFERENCE BOOKS

- R1 Lal Giridhari, Siddappa and Tondon. 2001. Preservation of fruits and vegetables. ICAR, New Delhi
R2 Srivastava and Sanjeev Kumar. 2008. Fruit and vegetable preservation: principles and practices. Kalyani Publishers
R3 Fellows, P. 2008. Food Processing Technology. Woodhead


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6305	ORGANIC FARMING TECHNOLOGIES	3	0	0	3

Course Objective	Description
	1. To study the historical, physio chemical, biological and ecological basis of organic farming including various crop and soil management practices
	2. To study the agronomic practices and techniques for different crops, cropping systems under organic farming
	3. To introduce the concepts related to the legislation, inspection certification and marketing of organic produces

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture;	9
	ORGANIC ECOSYSTEM AND CONCEPTS	
II	Organic ecosystem and its components; Concepts of Organic ecosystem; Biotic and abiotic factors and their role; Current issues related to ecosystem and their effects; Strategies to maintain ecosystem organic; Organic resources available Laboratory level in the ecosystem and their management.	9
	NUTRIENTS, PESTS AND DISEASE MANAGEMENT	
III	Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production;	9
	CERTIFICATION PROCESS	
IV	Operational structure of NPOP; Certification process; standards of organic farming; Criteria	9
	ECONOMICS	
V	Processing, leveling, economic considerations and viability, marketing and export potential of organic products- Cost estimation and evaluation	9
	Total Instructional Hours	45

COURSE OUTCOMES	Description
	After successful completion of this course students are expected to be able to:
	CO1: Students gained knowledge on the concepts of organic farming
	CO2: Students gained the knowledge on the crop management practices and technologies of various crops and cropping systems
	CO3: Students learnt the standards, certification process and marketing strategy of organic produces.
	CO4: Student able to calculate cost economics for cultivation practices

CO5: Understanding the marketing and export potential of organic products

TEXT BOOKS:

- T1 Das, D .K., 2011. Introductory Soil Science (3rd Edition), Kalyani Publisher, Ludhiana (India).
T2 walkar K S, Agarwal JP and Bokde S, 1992. Manures and Fertilizers. Agri. Horticultural Publishing House, Nagpur

REFERENCE BOOKS:

- R1 Mengel, et al., 2001. Principles of Plant Nutrition (5th Edition), Springer.
R2 Havlin et al. 2014. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (8th Edition), PHI Learning Pvt. Ltd., Delhi.


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OPEN ELECTIVE – 1

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG6401	MODERN AGRICULTURAL PRACTICES	3	0	0	3

Course Objective

- To get thorough knowledge about the Marden farming system and it important.
- To expose the students to farm mechanization prospects and constraints alongside Cooperative Farming for shared usage of agricultural implements.
- To contribute future invention and innovation in agriculture.

Unit	Syllabus before correction	Instructional Hours
I	MODERN AGRICULTURE Introduction to agriculture -Factors affecting crop production and Crop management. -Marden Farming System and types – advantages -disadvantage.	9
II	FARM IMPLEMENTS Tillage - objectives– Primary and secondary tillage implements-Improved sowing, planting and fertilizing equipment-VRT- weeding and plant protection equipment.	9
III	IRRIGATION SYSTEM Irrigation types –Micro irrigation- Drip and sprinkler irrigation-advantage - Mobile application for control of irrigation practices.	9
IV	HARVESTING MACHINERY Types of harvesting machinery- Threshers and combine harvesters– fruits and vegetable harvester.	9
V	CURRENT TECHNOLOGY IN AGRICULTURE Robotics and Drone usage in Agriculture -GIS and RS for Crop Mapping and Surveying -Application -Research gape in agriculture and Improvement.	9
Total Instructional Hours		45

Course Outcome

- CO1: The students will be able to perceive the role and significance of mechanization in sustaining agricultural production
- CO2: The students will get acquainted the contextual usage of various equipment used in the farm for different field operations.
- CO3: The students will able to understand the working principle of every farm equipment's used from sowing to harvesting.
- CO4: The students will equip with technical knowledge and skills required for the operation, maintenance of agricultural machineries
- CO5: To develop skills in the students required to develop and modification of indigenous farm machines as per the need of the area and farmers

TEXT BOOKS


- T1 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors
T2 Jain S. C. and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi
T3 Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi
T4 Yadav, R., and Solanki, H. B. 2009. Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture. New India Publishing Agency, New Delhi.
T5 Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributors Pvt. Ltd, New Delhi

REFERENCE BOOKS

- R1 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributors, Delhi. 99, 1997.
R2 Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.
R3 Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990
R4 Singh, S., and Verma, S. R. 2009. Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi
R5 Kirpal Singh. 2013. Automobile Engineering Vol. I. Standard Publishers Distributors, Delhi


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SYLLABUS

SEMESTER VII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7201	GROUNDWATER AND WELL ENGINEERING	3	0	0	3

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

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

Course Outcome
CO1: Students’ knowledge base gets enriched with the technical aspects of groundwater, its availability, assessment and utilization
CO2: Student get nourished with the knowledge of well hydraulics in different types of aquifers
CO3: Students will get a thorough idea about different types of wells.
CO4: Students will gain notion about construction of well
CO5: Better exposure to the theory behind well design, construction and water quality management is ensured.

TEXT BOOKS

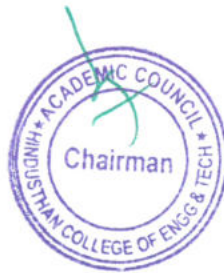
T1 Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.

- T2 Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.
- T3 Tang Y, Zhou J, Yang P, Yan J, Zhou N. Groundwater engineering. Springer Singapore; 2017.
- T4 Delleur JW, editor. The handbook of groundwater engineering. CRC press; 2006 Nov 16.
- T5 Cushman JH, Tartakovsky DM, editors. The handbook of groundwater engineering. CRC Press; 2016 Nov 25.

REFERENCE BOOKS

- R1 Rastogi, A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008
- R2 David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007
- R3 Fletcher.G.Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987
- R4 Walton WC. Principles of groundwater engineering. CRC press; 2020 Jul 24.
- R5 Howsam P, editor. Water Wells-Monitoring, Maintenance, Rehabilitation: Proceedings of the International Groundwater Engineering Conference, Cranfield Institute of Technology, UK. CRC Press; 1990 Aug 30.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7202	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	3	0	0	3

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

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

- Course Outcome**
- CO1: The students will understand the remote sensing principles, remote sensing systems satellite data processing and available data products.
- CO2: Describe the process of data acquisition of satellite images and their characteristics
- CO3: Compute an image visually and digitally with digital image processing techniques.
- CO4: The students will understand decision making process using DBMS and utilization of these advanced techniques in addressing the real world problems
- CO5: Compute knowledge of remote sensing and GIS in different agriculture engineering application

TEXT BOOKS:

- T1 Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderabad, 2001
- T2 Lillesand, T. M., and Kiefer. R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.
- T3 Bhatta, B., 2010. Remote Sensing and GIS, Oxford University Press, New Delhi, pp. 7-8, 64-96.
- T4 Liu, J.G., and Mason, P.J. (2009). Mason P.J, Essential Image Processing and GIS For Remote Sensing; Imperial college, London,UK
- T5 Lillesand, T. M., Kiefer, R. W., 2002, Remote Sensing and Image Interpretation. Fourth Edition, pp. 310-319.

REFERENCE BOOKS:

- R1 Bettinger, P., and Michael, G.W., "Geographical Information System: Applications in Forestry and Natural Resources Management," Tata McGraw-Hill Higher Education, New Delhi, 2003
- R2 Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.
- R3 Jeffery Star and John Estes, "Geographical Information System – An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.
- R4 Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers, Jodhpur 1992
- R5 www.isro.org/satellites/earthobservationsatellites.aspx: July 27, 2012

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7203	SOLAR AND WIND ENERGY ENGINEERING	3	0	0	3

Course Objective To understand the renewable source of energy, available in nature and to expose the students on sources of energy crisis and the alternates.

Unit	Description	Instructional Hours
I	SOLAR ENERGY Introduction-Solar constant- solar radiation measurements -Solar collectors and classification- -Applications of Solar Energy- solar water heater- Solar Cooker - Solar dryer- Solar distillation -Solar stills - Solar pond -solar greenhouse - PV powered water pumping – Hybrid system -Solar refrigeration.	9
II	CONCENTRATING COLLECTORS DESIGN Solar Thermal Energy Storage- Sensible storage- Latent heat storage-Thermo-chemical storage – Design and performance parameters of concentrating collector - tracking systems- Compound parabolic concentrators, parabolic trough concentrators. Concentrators with point focus, Heliostats.	9
III	SOLAR PV TECHNOLOGY Solar photovoltaic technology –introduction – solar cell basics – Types of solar cells and modules– Design of solar PV system- Fabrication technology for solar Cells.	9
IV	WIND ENERGY Introduction- The nature of wind- power in the wind- Forces on the Blades -Site Selection considerations-Basic components of a wind energy conversion system (WECS)- Economics of Wind energy Utilization- Wind energy Programm in India.	9
V	WIND MILL TYPES AND APPLICATIONS Wind turbines (Wind mill) -Horizontal Axis wind mill-Vertical Axis wind mill-Water pumping - Hybrid systems –Design parameters of wind mill- Wind mill safety and environmental aspects.	9
Total Instructional Hours		45

Course Outcome

CO1: Understand the need of energy conversion and the various methods of energy storage
CO2: To know solar energy applications in Agriculture production
CO3: Identify Winds energy as alternate form of energy and student able to know how it can be fully utilized.
CO4: Understand wind mill types and applications in energy storage
CO5: Understand the concepts of energy conversion systems and their applications.

TEXT BOOKS:

- T1 Rai., G.D. "Solar Energy Utilization" Khanna publishers, New Delhi, 2002.
- T2 More, H.S and R.C. Maheshwari, " Wind Energy Utilization in India" CIAE Publication – Bhopal, 1982.
- T3 Solanki, C.S. "Renewable Energy Technologies: A Practical guide for beginners". PHI learning Pvt. Ltd, New Delhi. 2008.
- T4 Fundamentals of Solar Cells: PV Solar Energy Conversion by AL Fahrenbruch and RH Bube, Academic Press, New York.
- T5 Solar Photovoltaics. Fundamental Technologies and Application by Chetan Singh Solanki, PHI Publication.

REFERENCE BOOKS:

- R1 Solanki, C.S. "Solar Photovoltaic Technology and Systems", PHI learning Pvt. Ltd., New Delhi, 2013.
- R2 Rai. G.D. "Non Conventional Sources of Energy", Khanna Publishers, New Delhi, 2002.


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- R3 Rao. S and B.B. Parulekar. "Energy Technology – Non conventional, Renewable and Conventional".
Khanna Publishers, Delhi, 2000.
- R4 Rajput. R.K. "Non- Conventional Energy Sources and Utilization", S. Chand & Company Pvt. Ltd, New
Delhi, 2013.
- R5 <http://www.tatapower.com/businesses/renewable>
- R6 <http://www.tatapower.com/businesses/renewable>
- R7 <http://nptel.ac.in/courses/112105051>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7204	AGRICULTURAL EXTENSION	3	0	0	3

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

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

By the end of the course student will be able

CO1: To critically analyze different Agricultural Extension approaches.

- Course Outcome**
- CO2: Understand Agricultural Knowledge Information System
- CO3: New trends in agriculture extension: privatization extension.
- CO4: Monitoring and evaluation – concept and definition, monitoring, and evaluation of Extension programmes. Transfer of Technology- Concept and models
- CO5: To expose with various Rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis.

TEXT BOOKS

- T1 Annamalai, R., M. Manoharan, S.Somasundaram and K.N.Krishnakumar, 1987;Extension methods and their principles. Palaniappa printers, Tirunelveli.
- T2 Berlo,1970: Process of communication. Holt Rinehart Winston Inc. Newyork.

- T3 Dahama, O.P. and O.P. Bhatnagar, 1985; Education and communication for development, Oxford and IBH publishing Co., New Delhi.
- T4 Gallagher K. 1999. Farmers Field School (FFS) – A Group Extension Process based on Non-Formal Education Methods. Global EPM Facility, FAO.
- T5 Jalihal KA & Veerabhadrarai V. 2007. Fundamentals of Extension Education and Management in Extension. Concept, Publ. Khan.
- T6 Grover I, Kaushik S, Yadav L & Varma SK. 2002. Communication and Instructional Technology. Agrotech Publ. Academy.

REFERENCE BOOKS

- R1 Directorate of extension, 1968; Extension education in community development, Ministry of food and agriculture, Government of India, New Delhi
- R2 Ray G.L. 1971; Extension communication and management, Naya Prakash, Kolkata
- R3 Rogers E. 1985; Diffusion of innovation, Collier McMillan publishers, London.
- R4 **Dimensions of agriculture extension - TNAU**
- R5 **Extension communication and management- G. L. Ray**

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7001	GIS LABORATORY FOR AGRICULTURAL ENGINEERS	0	0	2	1

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

S.NO	Description	Instructional Hours
1	Measurement of relief displacement using parallax bar	
2	Stereoscopic vision test	
3	Satellite images interpretation – visual	
4	Introduction to QGIS	
5	Image enhancement practice	
6	Database Management Systems	
7	Spatial data input and editing - Digitising	
8	GIS applications in DEM and its analysis	
9	GIS application in watershed analysis	
10	GIS application in rainfall-runoff modelling	
11	GIS application in soil erosion modelling	
Total Instructional Hours		30

Course Outcome

CO1: Understand the process of data acquisition of satellite images and their characteristics

CO2: Understand the Image enhancement , Supervised and Unsupervised classification of image.

CO3: Understand the Database Management Systems of GIS application in agriculture.

CO4: Understand the DEM usage in watershed analysis, rainfall -runoff and erosion modelling

CO5: The students will have adequate knowledge in application of RS and GIS in various fields of agricultural engineering.

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

REFERENCES

- R1 Lillesand, T.M. and Kiefer, R.W. 2005. "Remote Sensing and Image Interpretation ", II edition. John Wiley & sons.
- R2 Heywood, I., Cornelius. S., Carver. S 2002. An Introduction to Geographical Information Systems. Addison Wesley Longman, New York.
- R3 Floyd F.Sabins. 2005. "Remote Sensing: Principles and Interpretation", III edition. Freeman and Company New York.
- R4 Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote Sensing Perspective". Prentice – Hall. New Jersey.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7002	RENEWABLE ENERGY LABORATORY	0	0	4	2

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

S.NO	Description	Instructional Hours
1	Characterization of biomass – proximate analysis	
2	Determination of caloric value of fuels – solids and gases	
3	Design of KVIC / Deenbandhu model biogas plant	
4	Determine composition of biogas	
5	Testing of engine performance.	
6	Study on briquetting and Stoichiometric calculations	
7	Analysis of wind data and prediction	
8	Testing of solar water heater	
9	Testing of natural convection solar dryer	
10	Study on Solar power and I-V Characteristics	
11	Testing of solar photovoltaic water pumping system	
Total Instructional Hours		30

Course Outcome

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

CO1: Identifying categories of renewable energy sources and their application.
CO2: Design of floating drum and fixed dome type Bio-gas plant
CO3: Analysis gas composition like CH₄, CO₂ and CO and H₂S through orsat apparatus
CO4: Understand the Stoichiometric calculations, weather station I-V Characteristics.
CO5: Testing of engines and solar water heater, dryer and Photovoltaic system and identifying performance of system.

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Hot air oven	1
2	Muffle furnace	1
3	Junkers gas calorimeter	1
4	Bomb calorimeter	1
5	Model of Biogas and Deenabandhu biogas plant	1
6	Biogas scrubbing unit	1
7	Gasifier - Lab Scale	1
8	Pyrolysis unit	1
9	Biogas/ Producer gas dual fuel Engine	1
10	Briquetting Machine - Lab Scale	1
11	Automatic weather station.	1
12	Solar water heater	1
13	Solar dryer-1 no.	1
14	Solar PV training kit-	1
15	Solar PV water pumping system	1

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

REFERENCES

- R1 Khandelwal, K.C. and Mahdi, S.S. "Biogas Technology". Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 1986.
- R2 Nijaguna, B. T. "Biogas Technology" New Age International Pvt. Ltd., New Delhi, 2006.
- R3 Rao, S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi, 2000.
- R4 Solanki, C.S. "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., New Delhi, 2011.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7003	ICT IN AGRICULTURAL ENGINEERING	0	0	4	2

Course Objective

- To gain practical knowledge on various technologies in information and communication for agricultural engineering applications.

S.NO	LIST OF EXPERIMENTS	Instructional Hours
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 functions (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	
11	Application of MATLAB in agricultural data optimization	
Total Instructional Hours		30

By the end of the course, the students will be able to

Course Outcome

CO1: Gain practical knowledge on various technologies in information and communication for agriculture.

CO2: Write various languages (*like*., Java, C, Javascript, swift and PHP) to activate model.

CO3: Understand the importance of mobile apps in controlling various agricultural system

CO4: Practicing various tools in image processing and crop simulation software.

CO5: The students will able to develop automation system with help of ICT tool as well as properly applying in agriculture.

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Timing devices and small pumps for simulations – required nos.	1
2	Solenoid valves and layout of drip or sprinkler system – required nos.	1
3	Time Domain Reflectometer (TDR)	1
4	Digital thermometer	1
5	Breadboards, relays etc.	1
6	MATLAB software	1
7	Open source Crop simulation models – any one for demonstration	1
8	Other facilities for cloud resources, agro advisory systems etc.	1

REFERENCES

- R1 Gelb, E. and Voet, H., 2009. ICT Adoption Trends in Agriculture: A summary of the EFITA ICT Adoption Questionnaires (1999-2009). Abrufbar unter: <http://departments.agri.huji.ac.il/economics/voet-gelb.pdf>. Letzter Zugriff, 20, p.2010.
- R2 Tolulope Kehinde. K.A., Agwu, D. and Edwin, M., 2015. Application of ICT to Agriculture as a Panacea to Unemployment in Nigeria
- R3 Taragola, N. and Gelb, E., 2005. Information and Communication Technology (ICT) adoption in horticulture: A comparison to the EFITA baseline. ICT in agriculture: Perspectives of technological innovation.

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7701	INDUSTRIAL TRAINING/TECHNICAL SEMINAR	0	0	0	2

- Course Objective**
- To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering.
 - To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.

PLACE OF TRAINING

The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

- Course Outcome**
- CO1: Understand the working culture in industries/NGO and human relationship.
CO2: Understand the variables involved in process sequence and optimization of process parameters.
CO3: To analyze the research problem and formulate methodology to find a solution.
CO4: Understanding the manufacturing processes and marketing strategies.
CO5: To get the exposure in testing and evaluation of tools, equipment and machinery and preparing a test report.


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SEMESTER VIII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8901	PROJECT WORK	0	0	20	10

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

- Course Outcome**
- On completion of the project work,
- CO1:** Students will be in a position to take up any challenging practical problem and find solution by formulating proper methodology.
- CO2:** Students will formulate a real world problem, identify the requirement and develop the design solutions
- CO3:** Students will utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
- CO4:** Students will be able to identify technical ideas, strategies and methodologies
- CO5:** Students will be in a position to test and validate through conformance of the developed prototype and analysis the cost effectiveness

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PROFESSIONAL ELECTIVE – III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7301	INDUSTRIAL WASTE WATER MANAGEMENT	3	0	0	3

- Course Objective**
- To enriches the student knowledge of determining bio kinetic constants for aerobic treatment process.
 - To carryout analysis on biological sludge developed during the biological treatment of wastewater
 - To understand design criteria and design the various advanced wastewater treatment processes.

Unit	Description	Instructional Hours
I	IMPORTANT OF WASTEWATER TREATMENT Objectives of wastewater treatment, characteristics, flow variations, types of reactors and reactors analysis. Wastewater Treatment Flow Diagrams and Hydraulic Profile.	9
II	PROCESS OF WASTEWATER TREATMENT Wastewater treatment – aerobic, anaerobic, suspended and attached growth systems. Kinetics of biological treatment systems –batch and continuous systems	9
III	DESIGN OF WASTE WATER TREATMENT REACTORS Theoretical principles and design considerations - screens, equalization basin, grit chamber, primary and secondary settling tanks. suspended growth system - attached growth system – trickling filter, bio-towers and rotating biological contactors.	9
IV	SLUDGE PROCESSING Sludge Processing – separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic. Nitrification and De-nitrification Processes, Phosphorous removal - Wastewater disinfection.	9
V	DEGRADATION OF POLLUTANTS Microbial Treatment - Degradation of high concentrated toxic pollutants- Rural wastewater systems – Septic tanks, two-pit latrines, Ecotoilet, soak pits.	9
Total Instructional Hours		45

- Course Outcome**
- By the end of the course student will be able
- CO1: Understand the basic characteristics of wastewater.
- CO2: To know the basic characteristics of wastewater and the kinetics of Biological system.
- CO3: Acquire knowledge of residual pollutants in the effluent of conventionally treated wastewater and their removal by various advanced processes

CO4: Apply the knowledge of nutrients removal using advanced wastewater treatment processes design

CO5: Understand the basic concepts degradation of pollutants

TEXT BOOKS

- T1 "Wastewater Engineering - Treatment and Reuse", Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- T2 "Wastewater Treatment Concepts and Design Approach", Karia G.L., and Christian R.A., (2001), Prentice Hall of India Pvt. Ltd., New Delhi.
- T3 Hammer M.J., and Hammer Jr. M.J., (2008), "Water and Wastewater Technology", Prentice Hall of India Pvt. Ltd., New Delhi.
- T4 Metcalf and Eddy Inc., (2003), "Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- T5 Metcalf & Eddy Inc, (2003), "Wastewater Engineering, Treatment and reuse" - 4th Edition, Tata McGraw Hill Publishers Co. Ltd, New Delhi

REFERENCE BOOKS

- R1 Fair G.M., Geyer J.G and Okun, "Water-wastewater Engineering".
- R2 "Wastewater Engineering – Treatment and Reuse", Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- R3 Adams and Eckenfelder Jr. W.W. (1974), "Environmental, Process Design Techniques for Industrial Waste Treatment". Nashville (USA), 1974.
- R4 CPHEEO Manual (2014), "Wastewater Collection, Treatment and Disposal", Ministry of Urban Development, Government of India, New Delhi
- R5 National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Pollution Control Handbook"
- R6 Syed R. Qasim, (1999), "Wastewater treatment plants: planning, design, and operation" - 2nd edition, CRC Press LLC


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7302	ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	3	0	0	3

Course Objective

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

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

Course Outcome

By the end of the course student will be able

CO1: Understand role of human metabolism in design of agricultural implements.
CO2: To assessment of energy expenditure through various measuring techniques.
CO3: Understand the types of anthropometric data and its application in tool design
CO4: Understand the physiological effects of vibration and noise in work station.
CO5: To improve the performance of the farm systems by enlightening the human - machine interaction with safety measures.

TEXT BOOKS:

- T1 Mark S.Senders,Ernest J.Mccormick (1975) human factors in Engineering Design.
- T2 McGraw Hill Book co., New York 2. Wesley E.Woodson (1981),Human factors design hand book,
- T3 Gite LP. 2009. Anthropometric and strength data of Indian Agricultural Workers for farm equipment design. AICRP on ESA. CIAE, Bhopal.
- T4 Astrand, P.O and Rodahl, K.1977. Text book of work physiology, McGraw Hill, New York
- T5 Dul J and Weerdmeester B.1993.Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.
- T6 Kroemer, K.H.E., Kroemer,H.J. and K.E.Kroemer-Elbert. 1997. Engineering Physiology: bases of human factors/ergonomics, VAN NOSTRAND REINHOLD, New York.

REFERENCE BOOKS:

- R1 Robert W.Bailey (1992).Human performance Engineering .PTR Prentice Hall. Englewood cliffs, New Jersey.07632.
- R2 Bridger, R.S,1995. Introduction to Ergonomics. McGraw Hill, New York
- R3 Rodal, K.1989.The Physiology of work, Taylor and Francis, London.
- R4 K.U.E. Kroemer and E. Grandjean. 2001. Fitting the Task to the Human: A textbook of Occupational Ergonomics. Taylor and Francis.
- R5 Mark S. Sanders and Ernest James McCormick,1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7303	ON FARM WATER MANAGEMENT	3	0	0	3

- Course Objective**
- To understand the fundamentals of minor irrigation, its types, operation and maintenance and people's participation
 - Command Area Development, On farm structures, policy, operation and maintenance.

Unit	Description	Instructional Hours
	DESIGN OF IRRIGATION CHANNELS	
I	Design of Erodible and Non-Erodible, Alluvial channels- Kennedy' s and Lacey' s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods	9
	COMMAND AREA	
II	Command area – Concept- Duty of water- relationship between duty and delta- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts- Water productivity – Water pricing	9
	CONJUNCTIVE USE OF SURFACE AND GROUNDWATER	
III	Availability of water - Rainfall, canal supply and groundwater – Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix.	9
	WATER BALANCE	
IV	Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency	9
	SPECIAL TOPICS	
V	National water policy - Institutional aspects - Socio-economic perspective- CADA Programmes in Tamil Nadu- Warabandhi - water distribution and Rotational Irrigation System – case studies.	9
Total Instructional Hours		45

- Course Outcome**
- By the end of the course student will be able
- CO1: To **design irrigation channels and understand the importance of** Water control and Diversion structure in agricultural area.
- CO2: Understand about Irrigation demand and water requirement for crop cultivation
- CO3: Understand the Physical characteristics of soil, depths of irrigation, field layout and water sources.
- CO4: Understand the Climatic factors like frost potential, drought potential, rainfall amounts and intensities.
- CO5: Understand the Economic and market prices, material availability, labor cost and availability.

TEXT BOOKS:

- T1 Michael. A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006.

- T2 Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.
- T3 Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
- T4 Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi
- T5 Keller, J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van Nostrand Reinhold New York

REFERENCE BOOKS:

- R1 Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.
- R2 Harrison, D. S. 1981. Irrigation efficiencies. Agricultural Engineering Fact Sheet No. AE-21. University of Florida/IFAS, Gainesville, Florida.
- R3 Jensen, M.E., ad. 1983. Design and operation of farm irrigation systems. ASAE Monograph No. 3. American Society of Agricultural Engineers, St. Joseph, Michigan.
- R4 Luthin, James N., ad. 1957. Drainage of agricultural lands. ASA Monograph No. 7. The American Society of Agronomy, Madison, Wisconsin.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7304	WATERSHED HYDROLOGY AND MANAGEMENT	3	0	0	3

Course Objective 5. To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

Unit	Description	Instructional Hours
	PRECIPITATION AND ABSTRACTIONS	
I	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.	9
	RUNOFF	
II	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	9
	FLOOD AND DROUGHT	
III	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)	9
	RESERVOIRS	
IV	Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve	9
	GROUNDWATER AND MANAGEMENT	
V	Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas	9
Total Instructional Hours		45

Course Outcome The students completing the course will have :

CO1:An understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments

CO2:Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge

CO3:Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs

CO4:Understand the concept and methods of ground water management


CO5: understand the importance of RWH in rural and urban areas for improving ground water level.

TEXT BOOKS:

- T1 Murty, V.V.N. and Jha, M.K. (2009). Land and Water Management Engineering. Fifth edition, Kalyani Publishers, Ludhiana.
- T2 Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
- T3 Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995
- T4 Subramanya, K. (2008). Engineering Hydrology, Third Edition, Tata McGraw Hill, 195-196.
- T5 Suresh R. (2007). Soil and Water Conservation Engineering. Fourth edition, Standard Publishers Distributors, New Delhi.

REFERENCE BOOKS:

- R1 David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
- R2 USSR(1978). Committee for the International hydrological Decade. World Water Balance and Water Resources of the Earth. English translation, Studies and Reports in Hydrology, Vol. 25, UNESCO, Paris.
- R3 NCIWRD (1999). Integrated Water Resources Development – A Plan for Action. Report of The National Commission for Integrated Water Resources Development. Govt. of India, Ministry of Water Resources, New Delhi.
- R4 Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
- R5 Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.


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PROFESSIONAL ELECTIVE - IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7305	APPLICATION OF DRONE AND ROBOTICS TECHNOLOGY IN AGRICULTURE	3	0	0	3

Course Objective To assimilation of theoretical and practical knowledge required to design, build, program and use of the drone and robotic under safety conditions and maximize its application in agriculture.

Unit	Description	Instructional Hours
I	INTRODUCTION TO DRONE TECHNOLOGY History of drone -Types of current generation of drones based on their method of propulsion Classifications of the UAS -installation and utilization - on-board controls and communications - Telemetry-tracking - launch and recovery systems - ground control stations.	9
II	DRONE ANATOMY AND ASSEMBLY Multi rotor introduction - Drone Anatomy: Motor – Propeller - ESC – Flight controller – Transmitter – Receiver Sensors – Assembly – Autonomous system - Emergency identification and handling.	9
III	DRONE PROGRAMMING AND OPERATION Drones configurations -The methods of programming drone-Install program on computer Running Programs –Multi rotor stabilization -Flight modes -Wi-Fi connection .Concept of operation for drone -Drone controls - drone operations management tool.	9
IV	APPLICATIONS OF ROBOTICS IN AGRICULTURE Agriculture -Seed Planting-Crop Spraying and Spot Spraying-Crop Mapping and Surveying-Irrigation Monitoring and Management-Real-Time Livestock Monitoring and health issues.	9
V	OPERATIONAL CONSIDERATIONS AND FUTURE SCOPE DGCA regulations –CAR - NPNT – fly zones - Digital sky platform - Federal Aircraft Regulations - Future Prospects and Challenges- Business opportunities and Case Studies.	9
Total Instructional Hours		45

Course Outcome After successful completion of the course, our students will be able to:
 CO 1: Understand drone concepts and terminology
 CO2: Understand the technology to transmit and receive data
 CO3: Understand the various methods of programming and Install program on computer for successfully operating in agricultural field.
 CO4: Understand the operational considerations and future scope of drone and robotic technologies in agriculture.
 CO5: Identify business opportunities with the use of drone and robotic technology in agriculture.

TEXT BOOKS:

- T1 Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
- T2 Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
- T3 **K. R. Krishna "Aerial Robotics in Agriculture"- 1st Edition-2021, eBook
ISBN9781003054863.**

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- R1 Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
- R2 Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
- R3 Gerard Sylvester, "E-Agriculture in action: Drones for Agriculture" Published by Food and Agriculture Organization of the United Nations And International Telecommunication Union Bangkok, 2018.
- R4 Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7306	DAIRY PROCESS TECHNOLOGY	3	0	0	3

Course Objective To describe the chemical-physico-thermal properties and their applications
To illustrate the technologies involved in processing of dairy products.

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

Course Outcome
CO1: Acquire the basic knowledge in dairy Technology
CO2: The ability to use the acquired knowledge during dairy processing
CO3: Students will learn about technologies to handle physical aspects of fluid-based process.

CO4: Understand the working principles of mordant equipment's which involves in dairy technology.

CO5: Understand the Sequence of operation during the packing process.

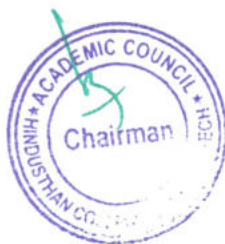
TEXT BOOKS:

- T1 Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.
- T2 Walstra. P., Jan T. M. Wouters., Tom J. Geurts "Dairy Science and Technology", CRC press, 2005.
- T3 Kurmann, J. A., Rasic, J. L. and Kroger, M. (1992). Encyclopedia of Fermented Fresh Milk Products: An International Inventory of Fermented Milk, Cream, Buttermilk, Whey and Related Products: CBS Publications, New Delhi.
- T4 Fox, P. F. and McSweeney, P. L. H. (1998). Dairy Chemistry and Biochemistry: Kluwer Academic, New York.
- T5 Kutty, C. I. and Khamer, S. (2004). Milk Production and Processing: Daya, Delhi.

REFERENCE BOOKS

- R1 Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.
- R2 Toledo, R.T., "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 1997.
- R3 Dairy Science and Technology Handbook, Volumes 1-3, John Wiley & Sons, 1993.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7307	STORAGE AND PACKAGING TECHNOLOGY	3	0	0	3

- Course Objective**
- To explain food material damage and control measure of losses in storage and estimation of losses
 - To explain different types of packaging materials and their forms used in food industries.
 - To describe package performance and various testing of packaging materials
 - To explain importance of storage of food materials .

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

- Course Outcome**
- The students will have a clear
- CO1: Understand about different methods of food material damage and storage losses and estimation.
- CO2: Understand the packaging strategies for various environment in food industries.
- CO3: Understand different types of packaging material and their properties and apply the knowledge in packaging various food materials.
- CO4: Understand the selection of packages for specific food & agricultural commodities and advancement in food packaging
- CO5: Understand the working principles of special packing equipment and its role emerging food industries.

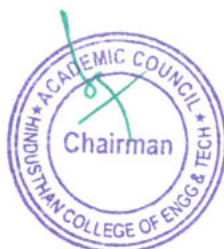
TEXT BOOKS:

- T1 Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.
- T2 Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
- T3 Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.
- T4 Robertson G.L." Food Packaging: Principles and Practice"
- T5 Mahadeviah M. and Gowramma R.V." Food Packaging Materials"

REFERENCE BOOKS:

- R1 Himangshu Barman. 2008. Post Harvest Food grain storage. Agrobios (India), Jodhpur.
- R2 Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.
- R3 Alexandru Grumezescu Alina Maria Holban"Food Packaging and Preservation"


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7308	PROCESS ENGINEERING OF FRUITS AND VEGETABLES	3	0	0	3

- Course Objective**
- To understand the basics of Post Harvest Technology of fruits and vegetables through their structure and composition
 - To study the different methods of processing and preservation of fruits and vegetables including drying and dehydration
 - To learn the latest methods of storage of fruits and vegetables.

Unit	Description	Instructional Hours
I	STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage.	9
II	CLEANING, GRADING AND ON-FARM PROCESSING 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.	9
III	PRESERVATION OF FRUITS AND VEGETABLES Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques.	9
IV	DRYING AND DEHYDRATION Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.	9
V	STORAGE Storage of fruits and vegetables – storage under ambient conditions, low temperature storage, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage – concept and methods –modified atmosphere packaging – gas composition, quality of storage – waxing of fruits – types of wax, equipment and advantages.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the Importance of post harvest technologies and preventions of post harvesting losses.
- CO2: Understand the basic of cleaning, grading and on-farm processing for increasing the self-life of food grains

- CO3: Understand the thermal and non-thermal techniques for preservation of fruits and vegetables
CO4: Understand the working principles of drying technologies and dehydration of fruits and vegetables
CO5: Understand the current storage technologies and its role in agriculture commodities

TEXT BOOKS:

- T1 Fellows. P. 2000. Food Processing Technology – Principles and Practice, second edition, CRC Press, Woodland Publishing Limited, Cambridge, England.
T2 Sudheer K. P. and V. Indra. 2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi.
T3 L.R.Verma and V.K.Joshi. 2000. Post Harvest Technology of Fruits and Vegetables – handling, Processing, Fermentation and waste management. Indus Publishing company, New Delhi.

REFERENCE BOOKS:

- R1 Heid, J.L. and M.A. Joslyn. 1983. Food processing operations. Vol. II. AVI Publishing Co. Inc. Westport, Connecticut.
R2 Potter, N.N. 1976. Food science. AVI Publishing Co. Inc. Westport, Connecticut, 2nd edition.
R3 Sivetz Michael and N.W. Desrosier. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport, Connecticut.
R4 Humberto vega and Gustavo v Barbosa. 1996. Dehydration of foods. Springer Science, Business Media, Chapman & Hall Publishers, U.K.


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PROFESSIONAL ELECTIVE – V

Program	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8301	AGRICULTURAL BUSINESS MANAGEMENT AND ENTERPREUSHIP	3	0	0	3

- Course Objective**
1. To introduce the importance of Agri-business management, its characteristics and principles
 2. To teach each various aspects of marketing, agribusiness management and enterprise development
 3. To impart knowledge on the functional areas of Agri-business like Marketing management, Product pricing methods and Market potential assessment.
 4. To apply the acquired knowledge and practical skills to run an agribusiness, develop a business plan, process commodities, analyze marketing, and collaborate with others
 5. To make use of the problem-solving skills integrated in the agribusiness value chain, from agricultural input supply, agricultural production, commodity processing, agribusiness marketing and food quality.

Unit	Description	Instructional Hours
	AGRIBUSINESS MANAGEMENT	
I	Concept - components of agribusiness - forms of agribusiness firms. Management - concept - functions of management - managerial roles and skill (Mintzbergs) required at various levels of management.	9
	MANAGEMENT FUNCTIONS	
II	Planning - steps and types of plans. Organizing - basics for Departmentation - Staffing - human resource planning process - Directing - techniques of direction. Coordination and control - types. Management approaches - Strength, Weakness, Opportunities and Threat (SWOT) Analysis.	9
	AGRICULTURAL MARKETING (FUNCTIONAL AREA – I)	
III	Operations management - planning and scheduling - supply chain management in agribusiness - Human resource management - job analysis, recruitment and selection process	9
	AGRICULTURAL MARKETING (FUNCTIONAL AREA – II)	
IV	Marketing Management - market segmentation, consumer buying behaviour and marketing mix - Financial management - concept and financial planning for agribusinesses	9
	ENTREPRENEURSHIP	
V	Entrepreneur - entrepreneurship - types, characteristics and process - Innovation, business incubation and financing entrepreneurs. Case study	9
	Total Instructional Hours	45

- Course Outcome**
- At the end of this course,
- CO1: The students will analyze agribusiness situations, formulate strategies, implement plans and manage strategic change.
 - CO2: The students will learn the concepts and process of planning and organizing Human and other resource in industries
 - CO3: Students will understand the marketing principles, role of marketing and various marketing channels in domestic and international market.

CO4: Students will be capable of problem-solving integrated in the agribusiness value chain to develop the business in the competitive marketing

CO5: Students will understand the systematic process to select and ability to discern distinct entrepreneurial traits

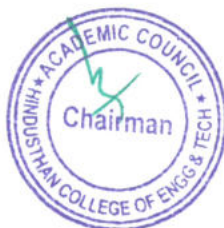
TEXT BOOKS:

- T1 Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2005.
- T2 Smita Diwase, "Indian Agriculture and Agribusiness Management", Krishi resource Management Network, Pune 2004.
- T3 Beierlein, J.G., Schneeberger, K.C. and Osburn, D.D., "Principles of agribusiness management". Waveland Press, 2013.
- T4 Sharangi, A. B., Acharya, S. K. and Somani, L. "Enterprise, Entrepreneurship & Agribusiness Management", 2015.
- T5 Micheal, E. Newman, "Agribusiness Management and Entrepreneurship", Vero Media Inc; Teachers Guide edition, 1994.

REFERENCE BOOKS:

- R1 Chandra Prasanna, "Projects: Preparation, Appraisal, Budgeting and Implementation", Tata McGraw Hill Publications, New Delhi, 2001.
- R2 Kotler, P., "Marketing Management. Analysis, Planning and Control", Prentice Hall Inc., New York, 2001.
- R3 Rao, V.S.P., and Narayana, P.S., "Principles and Practices of Management", Konark Publishing Private Limited, New Delhi, 2001.
- R4 Barnard, F.L., Foltz, J., Yeager, E.A. and Brewer, B., "Agribusiness management", Routledge, 2020
- R5 "Agri-business Management Handbook", Technoserve, Washington DC, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8302	AGRICULTURAL ECONOMICS AND FARM MANagements	3	0	0	3

Course Objective	
	1. To impart the fundamental knowledge and basic concepts of Economics and Farm Management
	2. To understand the types of resources and Investment analysis in agriculture sector
	3. To estimate the cost of cultivation and production of crops.
	4. To plan the financial aspects related to farm management in a cost effective manner.
	5. To understand Farm financial analysis, Investment and Budgeting for farms.

Unit	Description	Instructional Hours
	FARM MANAGEMENT Agricultural Economics – definition and scope – Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts – Farm appraisal techniques – Valuation .	9
	LAWS OF ECONOMICS Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - Cost concepts – types - Opportunity cost – comparison of costs – Factor relationship – concepts.	9
	COST CURVES Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs-Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves –Optimum input and output levels – Factor –factor relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops – Preparation of interview schedule and farm visit for data collection.	9
	MANAGEMENT OF RESOURCES Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.	9
	FARM MANAGEMENT AND FINANCIAL ANALYSIS Farm management- need and analysis – Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles – Farm planning – Elements of farm planning – Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting.	9
	Total Instructional Hours	45

Course Outcome	
	CO1: Acquire fundamental knowledge and basic concepts of Economics and Farm Management
	CO2: Students will be able to understand the types of resources and Investment analysis in agriculture sector
	CO3: Students will be able to estimate the cost of cultivation and production of crops.
	CO4: Students will be able to plan the financial aspects related to farm management in a cost effective manner.


CO5: Students will be able to handle Farm financial analysis, Investment and Budgeting for farms.

TEXT BOOKS:

- T1 Johl, S.S., and Kapur, T.R., "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
- T2 Subba Reddy, S., and Raghu Ram, P. ,, "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
- T3 Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.
- T4 Sankhayan, P.L. ,, "Introduction to Farm Management", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001
- T5 Bilgrami S.A.R. "An Introduction to Agricultural Economics". Himalaya Publishing House; 2nd Edition, 2017.

REFERENCE BOOKS:

- R1 Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
- R2 M. K. Dhaka. " Economics of Agricultural Production and Farm management". pointer publishers. 2017.
- R3 Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
- R4 C. B. Singh. And R. K. Singh. " A textbook of Agricultural Economics". Laxmi Publications, 2011.
- R5 Muniraj, R., "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8303	INTELLECTUAL PROPERTY RIGHTS	3	0	0	3

Course Objective
1. To provide an understanding of the law relating to Intellectual Property and Competition in India.
2. To give an idea about IPR, registration and its enforcement.
3. To understand the intricacies of grant of Patent, Patentability, Licensing and Revocation at National and International levels.
4. To realize the Rights and Duties of Patentees.
5. To equip students with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

Unit	Description	Instructional Hours
I	INTRODUCTION Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.	9
II	REGISTRATION OF IPRs Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad	10
III	AGREEMENTS AND LEGISLATIONS International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act. .	10
IV	DIGITAL PRODUCTS AND LAW Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies. .	9
V	ENFORCEMENT OF IPRs Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.	7
	Total Instructional Hours	45

Course Outcome
CO1: Students will able to understand the law relating to Intellectual Property and Competition in India.
CO2: Students will get an idea about IPR, registration and its enforcement.
CO3: Students can understand the intricacies of grant of Patent, Patentability, Licensing and Revocation at National and International levels.
CO4: Students realizes the Rights and Duties of Patentees.
CO5: Students will be equipped with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

TEXT BOOKS:

- T1 V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt Ltd, 2012 2. S. V. Satarar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002
- T2 Ganguli P., "Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill. Intellectual Property Rights: Key to New Wealth Generation. 2001", NRDC & Aesthetic Technologies, 2001.

- T3 Rothschild, M. and Scott, N. (Ed.), "Intellectual Property Rights in Animal Breeding and Genetics", CABI, 2003.
- T4 Saha, R. (Ed.), "Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies", Daya Publ. House, 2006.
- T5 Erbisch, F. H. and Maredia, K., "Intellectual Property Rights in Agricultural Biotechnology", CABI, 1998.

REFERENCE BOOKS:

- R1 Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
- R2 Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011
- R3 Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013
- R4 V. Technology Generation and IPR Issues. Academic Foundation.
- R5 Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8304	AGRICULTURAL WASTE MANAGEMENT	3	0	0	3

- Course Objective**
1. To study the environmental impacts of agricultural wastes.
 2. To understand the energy production potential from agro wastes.
 3. To understand various applications of agro wastes
 4. To study different agro waste management methods
 5. To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.	9
	COMPOSTING	
II	Definition- Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods	9
	BIOMASS BRIQUETTING	
III	Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes.	9
	BIOCHAR PRODUCTION	
IV	Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.	9
	BIOGAS AND BIO ETHANOL PRODUCTION	
V	Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value-per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol –pretreatment-fermentation-distillation.	9
	Total Instructional Hours	45

- Course Outcome**
- At the end of the course student will be able to understand,
- CO1:** Environmental impacts of agricultural wastes
CO2: Various applications of agro-wastes
CO3: Nutritive value and energy production potential of agro wastes
CO4: Various eco-friendly methods for agricultural waste management.
CO5: Apply these management techniques in day to day life for better waste management

TEXT BOOKS

- T1 Raymond C Loehr, "Agricultural Waste Management- problems, processes and approaches". First edition, Academic press, 1974.
- T2 Diaz,I.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380
- T3 Uta Krogmann, Ina Körne and Luis F. Diaz.2010. Solid waste technology and management (Vol 1 and2). Blackwel Pub Ltd., Wiley Online library.
- T4 Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.,” Biochar-production characterization and applications”. 2015. CRC press

T5 Thelma Bosso. 2016. Agricultural Waste Management. Callisto Reference.

REFERENCE BOOKS

- R1 P.D. Grover & S.K. Mishra, "Biomass Briquetting: Technology and Practices". Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996
- R2 Magdalena Muradin and Zenon Foltynowicz, "Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland". Sustainability, 2014, 6, 5065-5074.
- R3 Biochar production from agricultural wastes via low-temperature microwave carbonization
- R4 Qian Kang, Lise Appels, Tianwei Tan and Raf Dewil. "Bioethanol from Lignocellulosic Biomass: Current Findings Determine Research Priorities" The Scientific World Journal, 2014, Article ID 298153, 13 pages
- R5 Raymond Loehr. 1974. Agricultural Waste Management. 1st edition. Academic Press.


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PROFESSIONAL ELECTIVE – VI

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8305	SPECIAL FARM EQUIPMENT	3	0	0	3

- Course Objective**
1. To impart knowledge about machines / implements for intercultural operation
 2. To impart knowledge about machines / implements for plant protection
 3. To impart knowledge about machines / implements for harvesting
 4. To impart knowledge about machines / implements for threshing
 5. To study the specialized machineries used for agricultural applications

Unit	Description	Instructional Hours
	Mowers and Weeding Equipment	
I	Weeding and intercultural equipment. Junior hoe - guntaka - blade harrow - rotary weeders for upland and low land - selection, constructional features and adjustments - Spading machine – coir pith applicators - Mower mechanism – lawn mowers, Flail mowers.	8
	Sprayers and Dusters	
II	Sprayers – Sprayer operation – boom sprayer – precaution – coverage – factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) – Electrostatic sprayers – Areal spraying – Air assist sprayers – orchard sprayers – Dusters – types – mist blower cum duster – other plant protection devices, care and maintenance.	9
	Harvesters	
III	Construction and adjustments – registration and alignment. Windrowers, reapers, reaper binders and forage harvesters. Diggers for potato, groundnut and other tubers. Sugarcane harvesters -cotton pickers – corn harvesters – fruit crop harvesters – vegetable harvesters-Rice Combines.	10
	Threshers and Other Machineries	
IV	Threshers – construction and working of multi crop thresher. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter- flail mowers - lawn mowers – tree pruners	9
	Specialized Farm Equipment	
V	Pneumatic planters – air seeders – improved ploughs – reversible ploughs – suction traps – seed and fertilizer broadcasting devices, manure spreaders, sweep weeders – direct paddy seeders, direct paddy cum daincha seeder, coconut tree climbing devices, tractor operated hoist, tractor operated rhizome planter – Transplanters and Balers.	9
	Total Instructional Hours	45

- Course Outcome**
- After completion of the course,
- CO1:** The students will have knowledge on the usage and working principles of machineries used for intercultural operations.
- CO2:** The students will have knowledge on the plant protection equipments.

CO3: The students will have knowledge on the usage and working principles of various harvesters.

CO4: The students will have knowledge on different threshers and other cutting machineries.

CO5: The students will have a thorough knowledge on special farm equipment required for various agricultural operations.

TEXT BOOKS

- T1 Jagdishwar Sahay. 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.
- T2 Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.
- T3 Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributors, Delhi.
- T4 Jain S. C., and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi
- T5 Surendra Singh. 2020. Farm Machinery – Principles and Applications. ICAR publication. New Delhi

REFERENCE BOOKS:

- R1 Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi
- R2 Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi
- R3 Yadav, R., and Solanki, H. B. 2009. Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture. New India Publishing Agency, New Delhi.
- R4 Triveni Prasad Singh. 2016. Farm Machinery. Eastern Economy Edition.
- R5 R. K. Veera Selvam. 2010. Farm machinery and power. Vedams eBooks (P) Ltd, New Delhi, India.


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**Dean (Academics)
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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8306	MECHANICS OF TILLAGE AND TRACTION	3	0	0	3

- Course Objective**
1. To impart the fundamental knowledge of mechanics and dynamics in various tillage implements
 2. To study the relationship of soil parameters to the forces acting on tillage tools
 3. To understand and analyze the dimensional analysis of different variables related to soil-tyre system.
 4. To study the tyres, traction and its applications
 5. To acquaint and equip with the dynamic properties of soil and soil compaction

Unit	Description	Instructional Hours
	Introduction to mechanics of tillage tools	
I	History of tillage –Soil machine crop system –Mechanics of tillage tools- Analysis of soil machine dynamics in tillage. Physical properties of soils- Mechanical properties of soils – Assessment of the dynamic properties of soil.	9
	Design of tillage tools and principles of soil cutting	
II	Design of tillage tools - design factors-Shape-Macroshape-Mould board plow surface – principles of soil cutting – Design equation.	9
	Application of dimensional analysis in soil dynamics	
III	Dimensional Analysis – Development of prediction equations- Methods of dimensional analysis – Application of dimensional analysis and simulation to soil mechanics.	9
	Traction and Mechanics	
IV	Traction- Traction Mechanics-off road traction- traction model- traction improvement and traction prediction- Cone index and tire basics- tires for agricultural tractors- tire terminology and selection of tires – ballasting	9
	Soil compaction and plant growth	
V	soil compaction- mechanical and hydraulic properties of compacted soil-soil physical properties and plant growth-measure for optimizing crop growth by avoiding excessive soil compaction- GIS for soil variability study .	9
	Total Instructional Hours	45

- Course Outcome**
- After completion of the course,
- CO1:** Students will have thorough knowledge on the fundamental of mechanics and dynamics in various tillage implements
- CO2:** Students will acquire knowledge on the relationship of soil parameters to understand the forces acting on tillage tools
- CO3:** Students will understand and analyze the dimensional analysis of different variables related to soil-tyre system.
- CO4:** Students will understand traction and its applications in agricultural tractors
- CO5:** Students will know the dynamic properties of soil and soil compaction

TEXT BOOKS:

- T1 Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub. Co. NewYork
- T2 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
- T3 Gill & Vandenberg.1968. Soil Dynamics in Tillage and Traction. Supdt. of Documents, U.S. Govt. Printing Office, Washington, D.C
- T4 Sineokov GN. 1965. Design of Soil Tillage Machines. INSDOC, New Delhi.

T5 Daniel Hill. 1962. Fundamentals of Soil Physics. Academic Press.

REFERENCE BOOKS:

R1 Kepner, R. A., Roy Bainer and E. L. Barger. 1978. Principles of farm machinery. Third edition; AVI Publishing Company Inc: Westport, Connecticut.

R2 S. C. Jain, Farm Machinery- An Approach

R3 Ralph Alcock.1986. Tractor Implements System. AVI Publ.

R4 Terzaghi K & Peck Ralph B.1967. Soil Mechanics in Engineering Practices. John Wiley & Sons.

R5 Raymond N, Yong Ezzat A & Nicolas Skiadas 1984. Vehicle Traction Mechanics. Elsevier.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8307	MICRO IRRIGATION SYSTEMS	3	0	0	3

- Course Objective**
1. To expose the students to basic conceptual differences in the design of Pressure Irrigation systems viz., Drip, Sprinkler, Surge and Capillary modes
 2. To impart technical confidence in the minds of students in designing and layout preparation for drip irrigation with cost economics.
 3. To impart technical confidence in the minds of students in designing and layout preparation for sprinkler irrigation with cost economics.
 4. To impart technical confidence in the minds of students in designing and layout preparation for surge irrigation with cost economics.
 5. To impart technical confidence in the minds of students in designing and layout preparation for subsurface irrigation with cost economics.

Unit	Description	Instructional Hours
	CONCEPTS AND HYDRAULICS OF MICROIRRIGATION Pressure Irrigation Concepts – Underground/Overground irrigation conveyance - Drip Irrigation – Sprinkler Irrigation –Perfospray Irrigation - Blind Pipe Hydraulics – Head Loss due Friction – Multi-outlet (Irrigation)/Multi-inlet (Drainage) Pipe flow Hydraulics – General Formula - Darcy-Weisbach theoretical and empirical formulae – Hazen-Williams Formula – Reduction Factor – Christiansen’s Formula - Hydraulic Gradient - Slope gradient effects on friction losses - Surge Irrigation – Subsurface Capillary Diffusion – Pitcher Irrigation – Micro-sprinklers – Pop-up Sprinklers – Lawn and Landscape Irrigation layouts.	
I		9
	DESIGN AND LAYOUT OF DRIP IRRIGATION Basic Data and Information – Soil Compatibility – Crop Suitability – Row to Row and Plant to Plant Spacing – Per Hectare Square Layouts – Crop Population – Evapotranspiration variations with Crop and Climate – Wetting Circles around Plants – Daily Water Requirements – Pump Discharge requirements – Emitter types – Daily Irrigation Duration – Permissible Friction Loss variations – Dripper Pressure Vs Discharge – Multi-outlet Lateral and Sub-main Pressures – Mainline Pressures (Blind pipes) – Horse-Power and Material Requirements – Pipe size determinations Uniformity Coefficient– Catch-Can and Hydraulic Gradient techniques- Cost Economics – Operation and maintenance	
II		12
	DESIGN AND LAYOUT OF SPRINKLER IRRIGATION Basic Data and Information – Soil types and Infiltration rates –Bulk crop coverage – Water Requirement – Frequency of Irrigation - Materials required – Solid Systems – Portable systems – system components – sprinkler spacing along laterals - Lateral Spacing along sub-mains – Operational Pressure requirements – Horse Power of Pump – theoretical water distribution patterns – sprinkler spray circle overlapping - Perfospray sprinkling – High Pressure Spray Guns – determination of pipe sizes – calibration of sprinkler discharges with operating Pressures – catch-cans for Uniformity Coefficient evaluation – Operation and Maintenance aspects – cost economics.	
III		9
	DESIGN AND LAYOUT OF SURGE IRRIGATION Surge Flow Furrow Irrigation – Hydraulics – ON-OFF flow cycling – Surge Cycle Ratio - infiltration variations – water front advance predictions – optimization of furrow inflow rates with length and spacing – Water Distribution Efficiency – soil and crop compatibility – semi-automation with lever systems – total automation with sensor system – limitations – cost economics.	
IV		9
	DESIGN AND LAYOUT OF SUB-SURFACE IRRIGATION Sub-surface piping and wick networks – capillary diffusion mode – location of pipes and outlets – rootzone wetting patterns – Pitcher Pot Irrigation – Afforestation, Kitchen	
V		9

Gardening and Terrace cultivation prospects – surface mulching – automation with soil moisture deficit sensing – cost economics.

Total Instructional Hours 45

Course Outcome	CO1: The students gain confidence with the exposure to different water saving micro-irrigation systems alongside the field-oriented designs and layouts
	CO2: The students will be able to design cost effective drip irrigation layouts, benefitting the farmers for sustained productivity along with optimal water usage even under scarcity situations.
	CO3: The students will be able to design cost effective Sprinkler irrigation layouts, benefitting the farmers for sustained productivity
	CO4: The students will be able to design cost effective surge irrigation layouts, benefitting the farmers.
	CO5: The students will be able to design cost effective sub-surface irrigation layouts.

TEXT BOOKS:

- T1 Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
- T2 Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
- T3 Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.
- T4 Rydzewski 1987. Irrigation Development Planning. John Wiley & Sons.
- T5 Ivan E Henk. 1951. Irrigation Engineering. Vol. I. John Wiley & Sons.

REFERENCE BOOKS:

- R1 Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
- R2 Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998.
- R3 Finkel HJ. 1983. Handbook of Irrigation Technology. Vols. I-II. CRC Press
- R4 Karmeli D, Peri G & Todes M. 1985. Irrigation Systems: Design and Operation. Oxford Univ. Press
- R5 Pillsbury AF. 1972. Sprinkler Irrigation. FAO Agricultural Development Paper No. 88, FAO.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG8308	AUTOMATION IN IRRIGATION	3	0	0	3

- Course Objective**
1. To expose the students to the concept of Irrigation Automation
 2. To introduce the concepts of Automatic Systems and IoT applications
 3. To train the students to explore and use new technologies in Irrigation.
 4. To equip the students for preparing a design for automated irrigation system.
 5. To assess the parameters of irrigation using new technologies

Unit	Description	Instructional Hours
	INTRODUCTION TO AUTOMATION	
I	Automatic Irrigation – Traditional methods of Irrigation – Need for Automation – Comparison between Traditional and Automated Irrigation – Advantages – Disadvantages – Economic Impacts of Automation on Agricultural Firms – Future of Automation.	9
	SYSTEMS OF IRRIGATION AUTOMATION	
II	Irrigation Mode Automation Systems – Pneumatic System – Portable timer system – Timer/Sensor Hybrid/SCADA – Methods of automating Irrigation layout – Machine Learning in Tank Monitoring System.	9
	IoT IN IRRIGATION	
III	IoT based Automated Irrigation System – IoT based Smart Irrigation – Sensor based Automation – types – operation – Solar based Automatic Irrigation System – components – operation - Automation by sensing soil moisture – Automation using ANN based controller – operation.	9
	SURFACE AND MICRO-IRRIGATION AUTOMATION	
IV	Automation and control in Surface Irrigation Systems – Equipments – benefits – barriers – Automation Design in Bay, Basin and Furrow Irrigation – Automation in Micro Irrigation – Systems components of Automation – Design – Cost – Operation and maintenance.	9
	ASSESSMENT OF PARAMETERS IN IRRIGATION	
V	Crop water estimate using Satellite data – Automation of Lysimeter for PET Measurements and Energy based Remote Sensing model – Remote Monitoring design of Automatic Irrigation system – Cost and Benefits of Automation.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1:** The students will understand the technologies available for automation
CO2: The students will acquire knowledge on Automatic Systems and IoT applications for irrigation.
CO3: The students will be trained to explore and use new technologies in Irrigation.
CO4: The students will be equipped to redesign the conventional methods to automated system for more efficient working.
CO5: The students would assess the parameters of irrigation using new technologies

TEXT BOOKS:

- T1 H.R.Haise, E.G.Kruse. *et al.*, 1981. "Automation of Surface Irrigation: 15 years of USDA Research and Development at Fort Collins, Colorado"
- T2 Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems. American Society of Civil Engineers, 2014
- T3 Zhang, Q. and Pierce, F.J. eds., 2013. *Agricultural automation: Fundamentals and practices*. CRC Press.
- T4 Abbas, Md & Mohiddin, Md & Kumar, N. (2019). Automatic Plant Irrigation System. International Journal of Trend in Scientific Research and Development, Volume-3.

T5 Report by Dell Technologies. "Automated Irrigation Systems". 2017.
https://www.dellemc.com/content/dam/uwaem/production-design/assets/emea/campaigns/envisionthefuture/Final_report_DELL EMC Automated_irrigation%20System.pdf

REFERENCE BOOKS:

- R1 Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers,1987.
- R2 Hassan, Aslinda & Sheng, Siah & Md Shah, Wahidah & Bahaman, Nazrulazhar. (2018). An Automated Irrigation System Using Arduino Microcontroller.
- R3 Umair, S.M. and Usman, R., 2010. Automation of irrigation system using ANN based controller. *International Journal of Electrical & Computer Sciences IJECS-IJENS*, 10(02), pp.41-47.
- R4 Cardenas-Lailhacar, B., Dukes, M.D. and Miller, G.L., 2008. Sensor-based automation of irrigation on bermudagrass, during wet weather conditions. *Journal of Irrigation and Drainage Engineering*, 134(2), pp.120-128.
- R5 Naik, P., Kumbi, A., Katti, K. and Telkar, N., 2018. Automation of irrigation system using IoT. *International Journal of Engineering and Manufacturing Science*, 8(1), pp.77-88.


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OPEN ELECTIVE – II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AG7401	EMERGING TECHNOLOGIES IN FOOD PROCESS ENGINEERING	3	0	0	3

Course Objective

- To describe working principles of various innovative/invention techniques in food processing industries
- To illustrate advantage & disadvantage of innovative techniques to improve quality and yield of production.

Unit	Description	Instructional Hours
	THERMAL PROCESSING	
I	Thermal processing: Death rate kinetics, thermal process calculations, methods of sterilization and equipments involved, latest trends in thermal processing, novel dehydration techniques.	9
	HIGH PRESSURE PROCESSING	
II	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.	9
	PULSED ELECTRIC FIELD PROCESSING	
III	Principles, Mechanism, PEF treatment systems, Main processing parameters; PEF technology: Equipments, Applications; Mechanisms of microbial and enzyme inactivation. PEF processing of solid foods, liquid foods and beverages. Food safety aspects of pulsed electric fields.	9
	NON-THERMAL PROCESSING	
IV	Non-thermal processing: Osmotic dehydration, Athermal membrane processes for the concentration of liquid foods, High intensity pulsed light technology, Radio frequency heating, Ultrasound, Food irradiation, Microwave heating, ohmic heating, combined microwave vacuum drying, new hybrid drying technologies, NMR Technology.	9
	Innovations in Food refrigeration and minimal processing	
V	Vacuum cooling of foods, Ultrasonic assistance of food freezing, High pressure freezing, Controlling the freezing process with antifreeze proteins. Minimal fresh processing of vegetables, fruits and juices, Minimal processing of ready meals, Modified atmosphere packaging for minimally processed foods.	9
Total Instructional Hours		45

	CO1: Understand the status of food processing industry and future prospects in growth of industries
Course Outcome	CO2: Understand the latest trends in thermal processing and novelty in dehydration techniques.
	CO3: Understand the need of high pressure and pulsed electric field processing in food industries.
	CO4: Understand the role of non-thermal processing like hybrid drying technologies, NMR Technology in food industries
	CO5: To identifying suitable Innovations in food refrigeration and minimal processing for improving self-life of fruits and vegetables.

TEXT BOOKS:

- T1 Unit Operations in Food Processing - R. L. Earle
- T2 Da-Wen Sun ,”Emerging Technologies for Food Processing ”
- T3 Maria Laura Passos, Claudio P. Ribeiro,”Innovation in Food Engineering: New Techniques and Products”
- T4 Chakraverty, A. Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2000.

REFERENCE BOOKS:

- R1 Da-Wen Sun., 2005.,Emerging Technologies for Food Processing., Copyright © 2005 Elsevier Ltd. <https://doi.org/10.1016/B978-012676757-5/50000-1>
- R2 Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
- R3 Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.
- 3. Mohsenin, N.N. Physical Properties of Plant and Animal Materials Gordon and Breach Publishers, Ludhiana, 1970.

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CO'S, PO'S & PSO'S MAPPING

Academic Year : 2021-2022

Semester – I

Course Code & Name: 21HE1101/ TECHNICAL ENGLISH

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 21MA1102/ CALCULUS AND LINEAR ALGEBRA

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name: 21ME1101/BASICS OF CIVIL AND MECHANICAL ENGINEERING

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	1	-	-	-	-	-	1	3	3
CO2	3	1	1	-	-	1	-	-	-	-	-	1	3	2
CO3	3	1	1	-	-	1	-	-	-	-	-	1	2	2
CO4	3	1	1	-	-	1	-	-	-	-	-	1	3	2
CO5	3	1	1	-	-	1	-	-	-	-	-	1	3	2
Avg	3	1	1	-	-	1	-	-	-	-	-	1	3	2

Course Code & Name : 21PH1151/ APPLIED PHYSICS

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2	2

Course Code & Name : 21CY1151/ CHEMISTRY FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name : 21CS1151/PYTHON PROGRAMMING PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Semester –II (R 2019)

Course Code & Name : 21HE2101/ BUSINESS ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name : 21MA2101/ DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	2	2	2

Course Code & Name : 21AG2104/ PRINCIPLES OF FOOD SCIENCES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			1	2	1		1				2	2
CO2	1	2	1	1	1	1							2	1
CO3	1	1	3		1	2							2	3
CO4	1	2	1	1	2	1							1	2
CO5	1	1	1	1	1	2	1		1				1	2
Avg	1	1.6	1.5	1	1.2	1.6	1		1				1.6	2

Course Code & Name : 21PH2151/ MATERIAL SCIENCE

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name : 21CY2151/ ENVIRONMENTAL STUDIES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name : 21IT2151/ PROGRAMMING IN C

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3.0	-	2	-	-	-	-	-	-	2	2	2

Course Code & Name : 21ME2001/ ENGINEERING PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
CO2														
CO3														
CO4														
CO5														
Avg	3		3		3				1				1	2

Semester –III (R 2019)

Course Code & Name : 19MA3102/ FOURIER ANALYSIS AND TRANSFORMS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	3	2.6	-	-	-	-	-	-	2	2	1.2

Course Code & Name: 19AG3201 – SOIL SCIENCE AND ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		3			3	3	2	1		1	3	3	1
CO2	3	2						2		1	1	2	2	1
CO3	1		1	2	2	1			2			3	2	2
CO4	2	1			2		1	2	1			1	2	1
CO5	3	2	1	3		2	1	1	2	3	2	2	1	1
Avg	2	1	2	2	2	2	2	1	1	2	1	2	2	1

Course Code & Name: 19AG3202 – FLUID MECHANICS AND HYDRALICS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1			2					3	1
CO2	2	2	1	1	2					3		1	2	1
CO3	3	1	1	1	3	1	1	1		2		1	2	2
CO4	2	1			2		1	2	1			1	2	1
CO5	3	2	1	3		2	1	1	2	3	2	2	1	1
Avg	2	2	1	1	2	1	1	1		2		1	2	1

Course Code & Name: 19AG3203 - PRINCIPLES AND PRACTICES OF CROP PRODUCTION

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	1	-	-	-	1	-	-	-	2	2	3	1
CO2	1	1	2	-	2	-	-	-	1	1	2	2	2	2
CO3	1	2	2	1	1	-	-	-	1	1	2	2	2	2
CO4	1	1	1	-	1	-	-	-	1	1	2	2	1	3
CO5	1	3	1	-	1	-	-	-	1	1	2	2	1	3
Avg	1	1	1	1	1		1		11	1	2	2	2	2

Course Code & Name: 19AG3251 – UNIT OPERATIONS IN AGRICULTURAL PROCESSING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1		2		3	2		3	1
CO2	2	2	1	1			2		3			1	2	1
CO3	3	1	1	1	3		2		1		1	1	2	2
CO4	3	1	1	1		2		3		3		1	1	2
CO5	3	2	1	1		3		2	3	1		1	1	1
Avg	3	2	1	1	2	2	2	2	2	2	1	1	2	1

Course Code & Name: 19AG3001 - FIELD CROP PRODUCTION PRACTICAL

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	1	-	-	-	1	-	-	-	2	2	3	1
CO2	1	1	2	-	2	-	-	-	1	1	2	2	2	2
CO3	1	2	2	1	1	-	-	-	1	1	2	2	2	2
CO4	1	1	1	-	1	-	-	-	1	1	2	2	1	3
CO5	1	3	1	-	1	-	-	-	1	1	2	2	1	3
Avg	1	1	1	1	1		1		11	1	2	2	2	2

Course Code & Name: 19AG3002 - SOIL SCIENCE LABORATORY

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		3			3	3	2	1		1	3	1	1
CO2	3	2		2				2		1	1	2	1	1
CO3	1		1		2	1			2			3	1	2
CO4	2	1		3	2		1	2	1	3		1	1	2
CO5	3	2	1			2	1	1	2	1	2	2	1	3
Avg	3	2	2	2	2	2	1	1	1	1	1	2	1	1

SEMESTER-IV
Course Code & Name: 19AG4201 - FARM TRACTORS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		3			3	3	2	1		1	3	1	1
CO2	3	2		2				2		1	1	2	1	1
CO3	1		1		2	1			2			3	1	2
CO4	2	1		3	2		1	2	1	3		1	1	2
CO5	3	2	1			2	1	1	2	1	2	2	1	3
Avg	2	1	1	2	2	1	1	2	1	1	1	2	1	2

Course Code & Name: 19AG4202 – THERMODYNAMICS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2										3	2	3
CO2	3		2			2							3	2	3
CO3		1	2	2										3	
CO4	3		2									2		3	3
CO5	1	3	3	3								2		3	1
Avg	3	1	2	2		2						2	3	3	3

Course Code & Name: 19AG4203 - IRRIGATION AND DRAINAGE ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1										1	1	1
CO2	3	3	3	3			1		3		3	2	3	2
CO3	1	1											1	2
CO4	3	3	2	2			1		2			2	2	3
CO5	2	2	1									1	1	2
Avg	2	1	2	2			1		2		3	1	1	2

Course Code & Name : 19MA4152/ STATISTICS AND NUMERICAL METHODS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	2.8	3	2	2							2.2	2.2	2

Course Code & Name : 19AG4251 BIO-ENERGY RESOURCE TECHNOLOGY

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	3	1
CO2	3	3	3	1	2	1	2		2	1	1	2	3	2
CO3	3	3	3	1	2	1	2		2	1	1	2	3	2
CO4	1		1	2	2	1						2	3	2
CO5	1											2	3	3
Avg	2	2	2	1	2	1	2	0	2	1	1	2	3	2

Course Code & Name : 19AG4252 SURVEYING AND LEVELING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1	2	1	2	1	1				1	1	1
CO2	2	1	1	2	1	2	1	1				1	1	1
CO3	3	1	2	3	2	3	1	1				1	1	2
CO4	3	2	2	2	2	3	2	1				2	1	2
CO5	3	2	3	2	3	3	2	2				3	1	3
Avg	3	3	3	2	2	3	1	1	0	0	0	1	1	2

Course Code & Name : 19AG4001 IRRIGATION FIELD LABORATORY

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1										1	1	1
CO2	3	3	3	3			1		3		3	2	3	2
CO3	1	1											1	2
CO4	3	3	2	2			1		2			2	2	3
CO5	2	2	1									1	1	2
Avg	2	2	2	2.5	0	0	1	0	2.5	0	3	1.5	1.6	2

SEMESTER-V

Course Code & Name : 19AG5201 FARM MACHINERY AND EQUIPMENT

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	2	2	1	3	2			1	3	3	3
CO2	2	2	3	3		1	2					3	2	3
CO3	2	2	3	3		1	2					3	2	3
CO4	2	2	3	3		1	2					3	2	3
CO5	2	2	3	3	1	1	2					3	2	3
Avg	1.8	1.8	2.8	2.8	1.5	1	2.2	2	0	0	1	3	2.2	3

Course Code & Name : 19AG5202 REFRIGERATION AND COLD CHAIN MANAGEMENT

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	3	1
CO2	3	3	3	1	2	1	2		2	1	1	2	3	2
CO3	3	3	3	1	2	1	2		2	1	1	2	3	2
CO4	1		1	2	2	1						2	3	2
CO5	1											2	3	3
Avg	2	3	2	1	2	1	2	0	2	1	1	2	3	2

Course Code & Name: 19AG5203-THEROY OF MACHINES

PO&PSO →	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	3	1
CO2	3	3	3	3			2		2	1	1	2	3	2
CO3	3	3	3	3			2		2	1	1	2	3	2
CO4	1		2	2								2	3	2
CO5	1											2	3	3
Avg	2	3	3	3			2		2	1	1	2	3	2

Course Code & Name: 19AG5301 - SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	2	1
CO2	2	2	2	1	2	1	2	1	1	1	1	2	2	2
CO3	2	3	3	1	3	1	1		2	1	1	1	2	1
CO4	1	2	1	2	2	1		1				2	2	2
CO5	1											2	1	1
Avg	2	2	2	1	2	1	1	1	1	1	1	2	2	1

Course Code & Name: 19AG5302 - SUSTAINABLE AGRICULTURE AND FOOD SECURITY

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3			1						2	3	1
CO2	1	1	3	1	2	1	2		2	1	1	1	2	2
CO3	3	3	2	1	3	1	2	1	2	1	1	2	2	2
CO4	1		1	2	2	1	1		1		1	2	2	2
CO5	1											2	1	1
Avg	2	2	2	1	2	1	2	1	2	1	1	2	2	2

Course Code & Name: 19AG5303 - CDM AND CARBON TRADING TECHNOLOGY

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2	3	1		1					2	1	1
CO2	3	3	1	1	2	1	1		2	1	1	1	1	2
CO3	2	3	2	1	2	2	2	1	1	1	1	1	2	1
CO4	1	1	1	2	1	1			1	1	1	1	2	2
CO5	1			1								2	2	2
Avg	2	2	2	2	2	1	1	1	1	1	1	1	2	2

Course Code & Name: 19AG5304 - IOT IN AGRICULTURAL SYSTEMS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	2	3	1		1			2		2	1	1
CO2	3	3	1	1	2	1	1		1	1	1	2	1	2
CO3	2	2	2	1	2	2	2	1	1	2	1	3	2	1
CO4	1	1	1	2	1	1			1	2	1	2	2	2
CO5	1			1								2	2	2
Avg	2	1	2	2	2	1	1	1	1	2	1	2	2	2

Course Code & Name: 19AG5305 - ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	1	1	1			1		1	2	3	2
CO2	1	1	3	1	2	1	2	1	2	1	1	1	3	2
CO3	1	1	2	1	2	1	2	1	2	1	1	3	2	2
CO4	1		1	2	2	1	1	1	1	1	1	3	2	2
CO5	1											2	1	1
Avg	2	1	2	1	2	1	2	1	2	1	1	2	2	2

Course Code & Name : 19AG5251 GROUNDWATER AND WELL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3			2	2					3	2
CO2	3	3	2	2		2	2						3	2
CO3	2	1	2	2		2	3						2	3
CO4	3		2			2						2	2	3
CO5	2	3	3	2	3							2	2	3
Avg	3	2	2	2	3	2	2	2				2	2	3

Course Code & Name: 19AG5252 SOIL AND WATER CONSERVATION ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1				1	2	1	1		1	2	3	1
CO2	3	3	3	3	3	2	3	1	3	2	2	3	3	2
CO3	3	3	3	3	2	2	3	1	3	3	3	3	3	2
CO4	2	2	2	2	2	2	3	1	2	3	3	3	3	2
CO5	1	1				1	2	1	1	1	1	2	3	3
Avg	2	2	3	3	2	2	3	1	2	2	2	3	3	2

**Course Code & Name : 19AG5001 OPERATION AND MAINTENANCE OF FARM MACHINERY
LABORATORY**

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1										1	1	1
CO2	3	3	3	3			1		3		3	2	3	2
CO3	1	1											1	2
CO4	3	3	2	2			1		2			2	2	3
CO5	2	2	1									1	1	2
Avg	2	2	2	2	0	0	1	0	2	0	3	1	2	2

Course Code & Name: 19AG5002 CAD FOR AGRICULTURAL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3			2	2					3	2
CO2	3	3	2	2		2	2						3	2
CO3	2	1	2	2		2	3						2	3
CO4	3		2			2						2	2	3
CO5	2	3	3	2	3							2	2	3
Avg	3	2	2	2	3	2	2	2				2	2	3

SEMESTER-VI

Course Code & Name : 19AG6201 HYDROLOGY AND WATER RESOURCES ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3	1		2	2					3	2
CO2	3	3	2	2	3	2	2						3	2
CO3	2	1	2	2	2	2	3						2	3
CO4	3		2		1	2						2	2	3
CO5	2	3	3	2	3							2	2	3
Avg	3	2	2	2	2	2	2	2				2	2	3

Course Code & Name 19AG6202 - SOLAR AND WIND ENERGY ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	3		1	2	2				1	1	2
CO2	2	1	2	2		1	2					2	1	2
CO3	1	23	2	3		1	2	1				2	1	2
CO4	2	2	2	32		1	2					2	1	2
CO5	1	1	2	3		1	3	1			1	3	3	2
Avg	2	2	2	3		1	2	1			1	2	2	2

Course Code & Name 19AG6181 - PROFESSIONAL ETHICS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	3	1
CO2	3	3	3	1	2	1	2		2	1	1	2	3	2
CO3	3	3	3	1	2	1	2		2	1	1	2	3	2
CO4	1		1	2	2	1						2	3	2
CO5	1											2	3	3
Avg	2	3	2	1	2	1	2		2	1	1	2	3	2

Course Code & Name: 19AG6301 - CLIMATE CHANGE AND ADAPTATION

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2					1				2	2	1
CO2	3	3	3	1	2	1	2		2	1	1	2	3	2
CO3	3	3	3	1	2	1	2		2	1	1	2	2	2
CO4	1	1	1	2	2	1						2	2	2
CO5	1	2			1	1		1	1		1	2	2	3
Avg	2	2	2	1	2	1	2	1	2	1	1	2	2	2

Course Code & Name: 19AG6302 - HEAT AND MASS TRANSFERS FOR AGRICULTURAL ENGINEERS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2			1	2							2	2
CO2	1	3	1	1	1	1							2	1
CO3	1	1	3		1	2							2	3
CO4	1	2	1	1	2	1							1	2
CO5	1	1	1	1	1	2	1		1				1	2
Avg	1	2	2	1	1	2	1		1				2	2

Course Code & Name: 19AG6303 - DISASTER MANAGEMENT

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	3	1	2	1	2				2	1	1
CO2	1	2	1	1	2	1	1		2	1	1	1	1	2
CO3	2	3	1	1	3	3	2	1	1	1	1	2	2	3
CO4	2	2	1	2	1	1	3	1	1	1	1	3	2	2
CO5	1			1				1		1		2	2	2
Avg	2	2	1	2	2	2	2	1	1	1	1	2	2	2

Course Code & Name : 19AG6304 & HORTICULTURAL CROP PROCESSING

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	3	2	1	2	1	1	2	2	1	2	2	2
CO2	3	2	1	3	2	3	3	2	2	3	2	1	1	1
CO3	2	1	2	2	3	1	3			3	2	2	2	1
CO4	3	2		1	1	2		1	1	2	1	2	1	2
CO5	2	1		3	2	2	2	3	1			3	1	1
AVG	2	1	2	2	2	2	2	2	2	3	3	2	1	1

Course Code & Name : 19AG6305- ORGANIC FARMING TECHNOLOGIES

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	2	3	1	2	3		2	2	2	3	2	2
CO2	1	3	1	2	2	2	2		1	2	1	2	2	1
CO3	2	2	2	3	2	1	2	1	3	2	2	2	1	1
CO4	2	2	1	3	1	1	2	1	2	1	2	1	2	1
CO5	1	1	1	2	1	1		1	2	1	1	1	1	1
AVG	2	2	1	3	1	1	2	1	2	2	2	2	2	1

Course Code & Name : 19AG6401 – MODERN AGRICULTURAL PRACTICES

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	2	2	2	1	3	2				3	3	3
CO2	2	2	3	3		1	2		2			3	2	3
CO3	2	2	3	3		1	2		2			3	2	3
CO4	2	2	3	3		1	3					3	2	3
CO5	2	2	3	3		1	2					3	2	3
AVG	2	2	3	3	2	1	2	2	2			3	2	3

Course Code & Name 19AG6251 - FOOD AND DAIRY ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1v	2			1	2	1		1				2	2
CO2	1	2	1	1	1	1							22	1
CO3	1	1	3		1	2							2	3
CO4	1	2	1	1	2	1							1	2
CO5	1	1	1	1	1	2	1		1				1	2
Avg	1	2	2	1	1	2	1		1				2	2

Course Code & Name 19AG6252 - ICT IN AGRICULTURAL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	3									1	2	3
CO2	3	2	2	2	1	2	1		1	1	2	3	2	2
CO3	3	2	1	2	1	2	3		1	2	1	3	1	2
CO4	1		2	1	2	1						1	2	1
CO5	1											2	2	12
Avg	2	2	2	2	1	2	2		1	2	2	2	2	2

Course Code & Name 19AG6701 - INDUSTRIAL TRAINING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	1
CO2	3		2			2							3	2
CO3		1	2	2	2								3	2
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	3	2	2	3		2						2	3	3

SEMESTER-VII

Course Code & Name . 19AG7201 - GROUNDWATER AND WELL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3			2	2					3	2
CO2	3	3	2	2		2	2						3	2
CO3	2	1	2	2		2	3						2	3
CO4	3		2			2						2	2	3
CO5	2	3	3	2	3							2	2	3
Avg	2	2	2	2	3	2	2	2				2	2	3

Course Code & Name: 19AG7202 - REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	3	1
CO2	3	3	3	1	2	1	2		2	1	1	2	3	2
CO3	3	3	3	1	2	1	2		2	1	1	2	3	2
CO4	1		1	2	2	1						2	3	2
CO5	1											2	3	3
Avg	2	3	2	1	2	1	2		2	1	1	2	3	2

Course Code & Name: 19AG7203 - SOLAR AND WIND ENERGY ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	3		1	2	2				1	1	2
CO2	2	1	2	2		1	2					2	1	2
CO3	1	2	2	3		1	2	1				2	1	2
CO4	2	2	2	3		1	2					2	1	2
CO5	1	1	2	3		1	3	1			1	3	3	2
Avg	2	2	2	3		1	2	1			1	2	1	2

Course Code & Name 19AG7204 - AGRICULTURAL EXTENSION

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1	1	1						2	1	2
CO2	1	1	1	1	1							1	1	2
CO3	1	1		1	1							2		2
CO4	1	1	1	1	1							1		2
CO5	1	1		1								2		2
Avg	1	1	1	1	1	1						2	1	2

Course Code & Name : 16AG7301 - INDUSTRIAL WASTE WATER MANAGEMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	3		3	3		1		1			1	
CO2	2	3		2	1		2		2		3			
CO3	3	1	1		2	1						2	1	1
CO4	1	2		3	1		2	2		3				
CO5	1	2	2	1	2		1					1		1
AVG	1	2	2	2	2	2	2	1	2	2	3	3	1	1

Course Code & Name : 16AG7302 - ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	1		2			2	3		2	1	
CO2	2	3	2	2		3	1	2			1			
CO3	1	2		1	2	1				1		2		1
CO4	1	1	1					1	1	2	1		3	1
CO5	2	2	3	3	1		3					1		
AVG	2	2	1	1	2	2	2	2	1	2	1	2	1	1

Course Code & Name : 16AG7303 - ON FARM WATER MANAGEMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	3		3	3		1		1			1	
CO2	2	3		2	1		2		2		3			
CO3	3	1	1		2	1						2	1	1
CO4	1	2		3	1		2	2		3				
CO5	1	2	2	1	2		1					1		1
AVG	1	2	2	2	2	2	2	1	2	2	3	3	1	1

Course Code & Name : 16AG7304 - WATERSHED HYDROLOGY AND MANAGEMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	3		3	3		1		1			1	
CO2	2	3		2	1		2		2		3			
CO3	3	1	1		2	1						2	1	1
CO4	1	2		3	1		2	2		3				
CO5	1	2	2	1	2		1					1		1
AVG	1	2	2	2	2	2	2	1	2	2	3	3	1	1

Course Code & Name : 16AG7305 - APPLICATION OF DRONE TECHNOLOGY IN AGRICULTURE

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	3	2			3		1	2		1	2		1
CO2	1	2		3					3	2			2	
CO3	2	1			3	2	1		1			3		2
CO4	2	2	3				2	1			2			
CO5	1	3	1	2	1		3		2	1		2		1
AVG	1	2	2	2	2	2	2	1	2	1	1	2	2	1

Course Code & Name : 16AG7306 - DAIRY PROCESS TECHNOLOGY

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3			1		2			2	3		2	1	
CO2	2		2	3		3	1	2			1			
CO3	1	2		1	2	1				1		2		1
CO4		3	1					1	1	2	1		3	1
CO5		2	3		1		3					1		
AVG	2	2	2	1	1	2	2	1	1	2	1	2	2	1

Course Code & Name : 16AG7307 - STORAGE AND PACKAGING TECHNOLOGY

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	2		1		3	2	1		1	1	1	
CO2	2	1		3	2	1				2	3			2
CO3		3	2					3		1	1	2	2	
CO4	1	3	1	3		3				2				3
CO5		2			2		2		2		3		3	
AVG	3	2	1	3	2	2	2	2	1	2	1	1	2	2

Course Code & Name : 16AG7308 - PROCESS ENGINEERING OF FRUITS AND VEGETABLES

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	1	3		2	1	1	3	2		2		1
CO2	2	3	2	1	3	3	3		2	1			2	
CO3	1	2	1	2	1	1	1	2	1	2		3	1	2
CO4	2	1	1	3			1	2	2	1	2			
CO5	1	2	1		2	2		1		3	3		2	1
AVG	1	2	1	2	2	2	2	2	2	2	2	2	2	1

Course Code & Name: 16AG7001 - GIS LABORATORY FOR AGRICULTURAL ENGINEERS

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2									2	3	1
CO2	3	2	1	1	2	1	2		2	1	1	2	3	2
CO3	3	2	1	1	2	1	2		2	1	1	2	3	2
CO4	1		1	2	2	1						2	3	2
CO5	1											2	3	2
Avg	2	2	1	1	2	1	2		2	1	1	2	3	2

Course Code & Name 61AG7002 - RENEWABLE ENERGY LABORATORY

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	1									2	3	1
CO2	3	2	2	2	1	2	1		1	1	1	1	2	3
CO3	2	3	3	1	2	1	2		2	1	1	2	3	2
CO4	1		1	1	3	2						2	1	2
CO5	2											2	2	1
Avg	2	3	2	1	2	2	2		2	1	1	2	2	2

Course Code & Name: 16AG7003 - ICT IN AGRICULTURAL ENGINEERING

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2									2	2	1
CO2	2	2	2	1	2	1	2	1	1	1	1	2	2	2
CO3	2	3	3	1	3	1	1		2	1	1	1	2	1
CO4	1	2	1	2	2	1		1				2	2	2
CO5	1											2	1	1
Avg	2	2	2	1	2	1	1	1	1	1	1	2	2	1

Course Code & Name: 16AG7701 - INDUSTRIAL TRAINING / TECHNICAL SEMINAR

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	1
CO2	1	1	1		1	1		1	1	1	1	1	1	1
CO3	1	1	1		2	1			2	1	1	1	1	2
CO4	1	1	1		1	1		1				2	1	1
CO5	1											2	2	2
Avg	1	1	1			1		1	1	1	1	1	1	22

Semester – VIII

Course Code & Name : 16AG8301 - AGRICULTURAL BUSINESS MANAGEMENT AND ENTREPRENEURSHIP

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	1		2			2	3		2	1	
CO2	2	3	2	2		3	1	2			1			
CO3	1	2		1	2	1				1		2		1
CO4	1	1	1					1	1	2	1		3	1
CO5	2	2	3	3	1		3					1		
AVG	2	2	1	1	2	2	2	2	1	2	1	2	1	1

Course Code & Name : 16AG8302 - AGRICULTURAL ECONOMICS AND FARM MANAGERMENTS

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	2	3	1	2	3		2	2	2	3	2	2
CO2	1	3	1	2	2	2	2		1	2	1	2	2	1
CO3	2	2	2	3	2	1	2	1	3	2	2	2	1	1
CO4	2	2	1	3	1	1	2	1	2	1	2	1	2	1
CO5	1	1	1	2	1	1		1	2	1	1	1	1	1
AVG	2	2	1	3	1	1	2	1	2	2	2	2	2	1

Course Code & Name : 16AG8303 - INTELLECTUAL PROPERTY RIGHTS

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	2	1	3		2	1	1	3	2	1	2
CO2	2		2	1		1	2	1	2					1
CO3	1	3	2	1	2				1		1	3	2	
CO4	2	2					3			2	2	2		2
CO5	1	1		2		3				3		2	1	
AVG	2	2	2	2	2	2	3	2	1	2	2	3	1	2

Course Code & Name : 16AG8304 - AGRICULTURAL WASTE MANAGEMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	1	3		2	1	1	3	2		2		1
CO2	2	3	2	1	3	3	3		2	1			2	
CO3	1	2	1	2	1	1	1	2	1	2		3	1	2
CO4	2	1	1	3			1	2	2	1	2			
CO5	1	2	1		2	2		1		3	3		2	1
AVG	1	2	1	2	2	2	2	2	2	2	2	2	2	1

Course Code & Name : 16AG8305 - SPECIAL FARM EQUIPMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	1		2			2	3		2	1	
CO2	2	3	2	2		3	1	2			1			
CO3	1	2		1	2	1				1		2		1
CO4	1	1	1					1	1	2	1		3	1
CO5	2	2	3	3	1		3					1		
AVG	2	2	1	1	2	2	2	2	1	2	1	2	1	1

Course Code & Name : 16AG8306 - MECHANICS OF TILLAGE AND TRACTION

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	1	3		2	1	1	3	2		2		1
CO2	2	3	2	1	3	3	3		2	1			2	
CO3	1	2	1	2	1	1	1	2	1	2		3	1	2
CO4	2	1	1	3			1	2	2	1	2			
CO5	1	2	1		2	2		1		3	3		2	1
AVG	1	2	1	2	2	2	2	2	2	2	2	2	2	1

Course Code & Name : 16AG8307 - MICRO IRRIGATION SYSTEM

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	2	2	2	1	3	2				3	3	3
CO2	2	2	3	3		1	2		2			3	2	3
CO3	2	2	3	3		1	2		2			3	2	3
CO4	2	2	3	3		1	3					3	2	3
CO5	2	2	3	3		1	2					3	2	3
AVG	2	2	3	3	2	1	2	2	2			3	2	3

Course Code & Name : 16AG8308 - AUTOMATION IN IRRIGATION

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	2	3	1	2	3		2	2	2	3	2	2
CO2	1	3	1	2	2	2	2		1	2	1	2	2	1
CO3	2	2	2	3	2	1	2	1	3	2	2	2	1	1
CO4	2	2	1	3	1	1	2	1	2	1	2	1	2	1
CO5	1	1	1	2	1	1		1	2	1	1	1	1	1
AVG	2	2	1	3	1	1	2	1	2	2	2	2	2	1

Course Code & Name-16AG8901 - PROJECT WORK

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1										1	1
CO2	1	2	1		1	1		1	1	1	1	1	1	1
CO3	1	1	1		2	1			2	1	1	1	1	2
CO4	1		1		1	1		1				2	1	1
CO5	1											2	2	2
Avg	1	2	1		1	1		1	1	1	1	1	1	22

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E AGRICULTURE ENGINEERING (UG)

REGULATION-2019

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

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

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

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

		19AG7202 Remote Sensing and Geographical Information System	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		19AG7251 Precision Farming and Protected Cultivation	3	2	2	3	-	2	-	-	-	-	-	2	3	3
		19AG7001 Renewable Energy Laboratory	2	3	2	1	2	2	2	-	2	1	1	2	2	2
		19AG7002 GIS Laboratory for Agricultural Engineers	2	2	1	1	2	1	2	-	2	1	1	2	3	2
		19AG7901 Innovative Project	1	1	1	-	-	1	-	1	1	1	1	1	1	2
		19AG7301 Post-Harvest Technology	2	2	1	2	1	1	2	1	1	2	2	1	1	1
		19AG7302 Dairy Process Technology	2	2	2	1	1	2	2	1	1	2	1	2	2	1
		19AG7303 Storage and Packaging Technology	3	2	1	3	2	2	2	2	1	2	1	1	2	2
		19AG7304 Process Engineering of Fruits and Vegetables	1	2	1	2	2	2	2	2	2	2	2	2	2	1
		19AG7305 Fat and Oil Processing	1	2	2	2	2	2	2	1	2	1	1	2	2	1
		19AG7401 Urban Agriculture and organic farming	1	1	1	1	-	-	-	-	-	-	-	2	1	2
IV	VIII	19AG8901 Project work	1	2	1	-	-	1	-	1	1	1	1	1	1	2
		19AG8301 Agricultural Business Management and Entrepreneurship	2	2	1	1	2	2	2	2	1	2	1	2	1	1

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