HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai) (Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade) Valley Campus, Pollachi Highway, COIMBATORE 641 032

B. Tech. AGRICULTURAL ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

Curriculum & Syllabus

2022-2023

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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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 engmeenng problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineenng SCIences.

PO 3. Design/development o f 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 modem 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 engmeenng 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.

POIO. 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 l l 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.

POI2.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long leamin in the broadest context of tech

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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 EDUCATIONAL AND CHARITABLE TRUST
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Hindusthan College of Engineering and Technology
(An Autonomous Institution, Affiliated to Anna University, Chennai
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Valley Campus, Pollachi Highway, Coimbatore, Tamilnadu.

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.Tech. AGRICULTURAL ENGINEERING

REGULATION-2019 & 2022

REGULATION-2022

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

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
THEORY WITH LAB COMPONENT											
3.	22PH1151	Physics For Non-Circuit Engineering	BSC	2	0	2	3	4	50	50	100
4.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming And Practices	ESC	2	0	2	3	4	50	50	100
EEC COURSES											
6.	22HE1071	Universal Human Values	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
8.	22MC1091	Indian Constitution	MC	2	0	0	0	2	100	0	100
	22MC1092	தமிழரும்தொழில்நுட்பமும்									
TOTAL CREDITS				**17**	**5**	**6**	**19**	**29**	**470**	**330**	**800**

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SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	COURSE CATEGORY	L	T	P	C	TCP	CIA	ESE	TOTAL
THEORY											
1.	22MA2101	Differential Equations and Complex Variables	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4.	22CY2151	Chemistry for Engineers	BSC	2	0	2	3	4	50	50	100
5.	22AG2252	Principles and Practices Of Crop Production	PCC	2	0	2	3	4	50	50	100
6.	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking	AE	1	0	2	2	2	100	0	100
9.	22HE2072	Soft Skills -1	SE	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2091 / 22MC2092	தமிழர்மரபு / Heritage of Tamil	MC	2	0	0	0	2	100	0	100
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL CREDITS				**17**	**1**	**12**	**22**	**29**	**630**	**370**	**1000**

(For the students admitted during the academic year 2021-2022)

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2	21AG3201	Soil Science and Engineering	PC	3	0	0	3	25	75	100
3	21AG3202	Fluid Mechanics and Hydraulics	PC	3	1	0	4	25	75	100
4	21AG3203	Principles and practices of Crop Production	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	21AG3251	Unit Operations in Agricultural Processing	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21AG3001	Field Crop Production Practical	PC	0	0	3	1.5	50	50	100
7	21AG3002	Soil Science Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	21MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	2	0	0	0	100	0	100
			Total:	**20**	**2**	**8**	**20**	**550**	**450**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AG4201	Farm Tractors	PC	2	1	0	3	25	75	100
2	21AG4202	Thermodynamics	PC	3	0	0	3	25	75	100
3	21AG4203	Irrigation and Drainage Engineering	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	21MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
5	21AG4251	Bio-Energy Resource Technology	PC	2	0	2	3	50	50	100
6	21AG4252	Surveying and Leveling	PC	2	0	2	3	50	50	100
PRACTICAL										
7	21AG4001	Irrigation Field Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	21AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100	-	100
9	21HE4072	**Career Guidance Level – IV** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE4073	Ideation Skills	EEC	1	0	0	0	100	-	100
Total				**20**	**1**	**10**	**21**	**575**	**425**	**1000**

(For the students admitted during the academic year 2020-2021)

SEMESTER V

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

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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	25	75	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	25	75	100
			Total	**19**	**1**	**6**	**24**	**275**	**725**	**1000**

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 - I										
AGRICULTURE ENGINEERING										
S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19AG6401	Modern Agricultural Practices	OE	3	0	0	3	25	75	100

(For the students admitted during the academic year 2019-2020)

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG7201	Agricultural Extension	PC	3	0	0	3	25	75	100
2	19AG7202	Remote Sensing and Geographical Information System	PC	3	0	0	3	25	75	100
3	19AG73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
4	19XX74XX	Open Elective-II	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AG7251	Precision Farming and Protected Cultivation	PC	2	0	2	3	50	50	100
PRACTICALS										
6	19AG7001	Renewable Energy Laboratory	PC	0	0	3	1.5	50	50	100
7	19AG7002	GIS Laboratory for Agricultural Engineers	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8	19AG7901	Innovative Project	EEC	0	0	4	2	50	50	100
			Total	**14**	**0**	**12**	**20**	**300**	**500**	**800**

SEMESTER VIII

Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AG83XX	Professional Elective – IV	PE	3	0	0	3	25	75	100
2	19AG83XX	Professional Elective-V	PE	3	0	0	3	25	75	100
PRACTICAL										
7	19AG8901	Project Work	EEC	0	0	20	10	100	100	200
		Total		**6**	**0**	**20**	**16**	**150**	**250**	**400**

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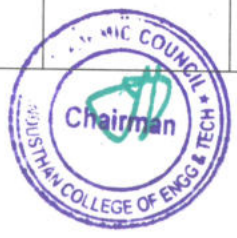
PROFESSIONAL ELECTIVE – III										
Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19AG7301	Post-Harvest Technology	PC	3	0	0	3	25	75	100
2	19AG7302	Dairy Process Technology	PC	3	0	0	3	25	75	100
3	19AG7303	Storage and Packaging Technology	PC	3	0	0	3	25	75	100
4	19AG7304	Process Engineering of Fruits and Vegetables	PC	3	0	0	3	25	75	100
5	19AG7305	Fat and Oil Processing	PC	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – IV										
Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19AG8301	Agricultural Business Management and Entrepreneurship	PC	3	0	0	3	25	75	100
2	19AG8302	On-Farm Water Management	PC	3	0	0	3	25	75	100
3	19AG8303	Intellectual Property Rights	PC	3	0	0	3	25	75	100
4	19AG8304	Agricultural Waste Management	PC	3	0	0	3	25	75	100
5	19AG8305	Energy Conservation in Agro based Industry	PC	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – V										
Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19AG8306	Special Farm Equipment's	PC	3	0	0	3	25	75	100
2	19AG8307	Mechanics of Tillage and Traction	PC	3	0	0	3	25	75	100
3	19AG8308	Watershed Hydrology and Management	PC	3	0	0	3	25	75	100
4	19AG8309	Micro Irrigation System	PC	3	0	0	3	25	75	100
5	19AG8310	Agriculture Economics and Farm Management	PC	3	0	0	3	25	75	100



LIST OF OPEN ELECTIVE - II

AGRICULTURE ENGINEERING										
Sl.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19AG7401	Urban Agriculture and organic farming	OE	3	0	0	3	25	75	100

CREDIT DISTRIBUTION – R 2019

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

CREDIT DISTRIBUTION – R 2022

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

Chairman, Board of Studies
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SYLLABUS

SEMESTER I

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22MA1101	MATRICES AND CALCULUS	3	1	0	4

Course Objective

1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors
2. To impart the knowledge of sequences and series.
3. Analyseanddiscussthemaximaandminimaofthefunctionsofseveralvariables.
4. Evaluate the multiple integrals and apply in solving problems.
5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
I	**Matrices** 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
II	**Single Variate Calculus** Rolle's Theorem–Lagrange's Mean Value Theorem-Maxima and Minima–Taylor's and Maclaurin's Series.	12
III	**Functions of Several Variables** Partial derivatives-Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.	12
IV	**Integral Calculus** Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	**Vector Calculus** Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
	Total Instructional Hours	60

Course Outcome

CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.
CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.
CO4: Evaluate multiple integral and its applications in finding area, volume.
CO5: Apply the concept of vector calculus in two- and three-dimensional spaces.

TEXT BOOKS

T1 R.L.Finney,"Calculus andAnalyticalGeometry",9th Edition Addison Wesley Publishing company,201.
T2 ErwinKreyszig, "Advanced Engineering Mathematics", John Wiley&Sons,2019
T3 K.P.Umaand S.Padma, "Engineering Mathematics I (Matrices and Calculus) ",PearsonLtd,2022.

REFERENCE BOOKS

R1 Jerrold E.Marsden, Anthony Tromba, "Vector Calculus", W.H.Freeman,2003
R2 Strauss M. J,G.L.BradleyandK.J.Smith,"Multivariablecalculus",PrenticeHall,2002.
R3 Veerarajan T, "Engineering Mathematics",McGrawHill Education (India)PvtLtd,NewDelhi,2016.

BoS Chairman
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22ME1201	ENGINEERING DRAWING	1	4	0	3

Course Objective

The learner should be able to

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections –Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	9
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	9
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	9
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	9
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	9
	Total Instructional Hours	45

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.

CO2: Draw the orthogonal projections of straight lines and planes.

CO3: Interpret the projections of simple solid objects in plan and elevation.

CO4: Draw the projections of section of solids and development of surfaces of solids.

CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOKS

T1 K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5thedition New Age International Publishers, New Delhi 2016.

T2 K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCE BOOKS

R1 BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited,New Delhi 2013.

R2 N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

BoS Chairman

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22PH1151	PHYSICS FOR NON- CIRCUIT EGINEERING	2	0	2	3

Course Objective

The student should be able to

1.Gain knowledge about laser, their applications and Conversant with principles of optical fiber, types and applications of optical fiber
2. Enhance the fundamental knowledge in properties of matter
3. Extend the knowledge about wave optics
4. Gain knowledge about magnetic materials.
5.Acquire fundamental knowledge of nano materials which is related to the engineering program

Unit	Description	Instructional Hours
I	**LASER AND FIBRE OPTICS** Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link. **Determination of Wavelength and particle size using Laser**	6 3
II	**PROPERTIES OF MATTER** Elasticity – Hooke's law –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. Twisting couple - torsion pendulum: theory and experiment. **Determination of Young's modulus by uniform bending method** **Determination of Rigidity modulus – Torsion pendulum**	6 3 3
III	**WAVE OPTICS** Interference of light – air wedge –Thickness of thin paper - Diffraction of light – Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. **Determination of wavelength of mercury spectrum – spectrometer grating. Determination of thickness of a thin wire – Air wedge method**	6 3 3
IV	**QUANTUM PHYSICS** Black body radiation –Compton effect: theory and experimental verification – wave particle duality –concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.	6
V	**THERMAL PHYSICS** Transfer of heat energy –thermal conduction, convection and radiation – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: solar water heaters.	6
	Total Instructional Hours	45

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the advanced technology of LASER and optical communication in the field of Engineering
CO2: Illustrate the fundamental properties of matter
CO3: Discuss the Oscillatory motions of particles
CO4: Understand the advanced technology of magnetic materials in the field of Engineering
CO5: Develop the technology of smart materials and Nano materials 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 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi2016
R2 Dr. G. Senthilkumar "Engineering Physics – I", VRB publishers Pvt Ltd., 2021

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22HE1151	ENGLISH FOR ENGINEERS	2	0	2	3

Course Objective

1. To improve the communicative proficiency of learners
2. To help learners use language effectively in professional writing
3. To advance the skill of maintaining the suitable tone of communication.
4. To introduce the professional life skills.
5. To impart official communication etiquette.

Unit	Description	Instructional Hours
I	**Language Proficiency:** Types of Sentences, Functional Units, Framing question. **Writing:** process description, Writing Checklist. **Vocabulary** – words on environment. **Practical Component: Listening-** Watching short videos and answer the questions, **Speaking-** Self introduction, formal& semi-formal	7+2
II	**Language Proficiency**; Tenses, Adjectives and adverbs. **Writing:** Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. **Vocabulary**– words on entertainment. **Practical Component: Listening-**Comprehensions based on TED talks **Speaking-** Narrating a short story or an even happened in their life	7+2
III	**Language Proficiency:** Prepositions, phrasal verbs. **Writing:** Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. **Vocabulary** – words on tools. **Practical Component: Listening-**Listentosongsandanswerthequestions**Speaking-** Justaminute	5+4
IV	**Language Proficiency:** Subject verb concord, Prefixes & suffixes. **Writing:** Preparing agenda &minutes, writing an event report. **Vocabulary**– words on engineering process. **Practical Component: Listening-** Comprehensions based on Talk of orators or interview shows **Speaking-**Presentation on a general topic with ppt.	5+4
V	**Language Proficiency:** Modal Auxiliaries, Active & passive voice, **Writing:** Project report (proposal & progress), sequencing of sentences **Vocabulary** –words on engineering material. **Practical Component: Listening-** Listening- Comprehensions based on Nat Geo/Discovery channel videos **Speaking-** Preparing posters and presenting a sateam.	6+3
	Total Instructional Hours	45

Course Outcome

CO1: To communicate in a professional forum
CO2: To speak or write a content in the proficient language
CO3: To maintain and use appropriate tone of the communication.
CO4: To read, write and presenting professional way.
CO5: To follow the etiquettes informal communication.

TEXT BOOKS

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

REFERENCE BOOKS

R1 Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
R2 Raymond Murphy, "EnglishGrammarinUse"-4thedition CambridgeUniversityPress,2004.
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. Tech	22IT1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objective

The learner should be able to

To read and write simple Python programs.
To develop Python programs with conditionals and loops and to define Python functions and call them.
To use Python data structures -lists, tuples, dictionaries.
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 strategies for developing algorithms (iteration, recursion).	5
	Illustrative problems: To find the Greatest Common Divisor (GCD)oftwo numbers, Fahrenheit to Celsius, Perform Matrix addition.	4
II	**DATA, STATEMENTS, CONTROL FLOW** Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass;	5
	Simple algorithms and programs: Area of the circle, check the given year is Leap year or not, Factorial of a Number.	4
III	**FUNCTIONS, STRINGS** Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module.	5
	Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs	4
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.	5
	Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.	4
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages	9
	Illustrative programs: Reading writing in a file, word count, Handling Exceptions	
	Total Instructional Hours	45

Course Outcome

At the end 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 CharlesDierbach, —Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.

R2 Timothy A. Budd, —Exploring Pythonl, Mc-Graw Hill Education (India) Private Ltd., 2015

R3 Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22HE1071	UNIVERSAL HUMAN VALUES	2	0	0	2

Course Objective

To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
TohighlightplausibleimplicationsofsuchaHolisticunderstandingintermsofethicalhumanconduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
II	**Harmony in the Human Being and Harmony in the Family** Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction. Values in Human-to-Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human-to-Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	**Harmony in the Nature / Existence** Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasive space Realizing Existence as Co-existence at All Levels the Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct a Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
	Total Instructional Hours	30

Course Outcome

CO1: To become more aware of holistic vision of life - themselves and their surroundings.
CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.
CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.
CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.
CO5: To develop competence and capabilities for maintaining Health and Hygiene.

TEXT BOOKS

T1 *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

T2 Teachers'Manualfor*AFoundationCourseinHumanValuesandProfessionalEthics*, RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2

REFERENCE BOOKS

R1 JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.

R2 Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22HE1072	ENTREPRENEURSHIP & INNOVATION	1	0	0	1

Course Objective

1. To acquiretheknowledgeandskillsneededtomanagethedevelopmentofinnovation
2. Torecognizeandevaluatepotentialopportunitiestomonetizetheseinnovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire their sources necessary to implement these plans.
5. To make students understand organizational performance and its importance.

Unit	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	**30**

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 effectivelyandefficientlythepotentialofnewbusinessopportunities.
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.
CO5: Develop business model for a new venture, including revenue. Margins, operations, Working capital, and investment

TEXT BOOKS

T1 AryaKumar "EntrepreneurshipCreatingandleadinganEntrepreneurialOrganization", Pearson, Second Edition (2012).
T2 EmrahYayici "Design Thinking Methodology", Artbiztech, First Edition (2016).

REFERENCE BOOKS

R1 Christopher Golis "Enterprise & Venture Capital", Allen &Unwin Publication, Fourth Edition (2007).
R2 ThomasLockWood&EdgerPapke "InnovationbyDesign", CareerPress.com, Second Edition (2017).
Jonathan Wilson "EssentialsofBusinessResearch", Sage Publication, First Edition (2010).

WEBRESOURCES

W1:https://blof.forgeforward.in/tagged/startup-lessons
W2:https://blof.forgeforward.in/tagged/entrepreurship
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

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech.	22MC1091	INDIAN CONSTITUTION	2	0	0	2

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
I	**BASICFEATURESANDFUNDAMENTALPRINCIPLES** Meaning of the constitution law and constitutionalism–Historical perspective of the constitution of India salient features and characteristics of the constitution of India.	6
II	**FUNDAMENTALRIGHTS** 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.	6
III	**PARLIAMENTARYFORMOFGOVERNMENT** The constitution power sand 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.	6
IV	**LOCALGOVERNANCE** Local self-government-Rural Local Government-Panchayath Raj, Elections of Panchayat-State Election Commission-Urban Local Government-Amendment Act, Urban Local Government Structures in India	6
V	**INDIANSOCIETY** Constitutional Remedies for citizens–Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	6
	Total Instructional Hours	30

Course Outcome

Upon completion of the course, students will be able to
CO1: Understand the functions of the Indian government.
CO2: Understand and abide the rules of the Indian constitution

TEXT BOOKS

T1 DurgaDasBasu, "Introduction to the Constitution of India ", Prentice Hallof India, New Delhi, 197.
T2 Agarwal R C., "Indian Political System", S.Chand and Company, NewDelhi,1997.
T3 Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi.
T4 Sharma K L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, NewDelhi,1997.

REFERENCE BOOKS

R1 Sharma, Brij Kishore, "Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
R2 GahaiUR., "Indian Political System ", New Academic Publishing House, Jalandhar.
R3 Sharma RN., "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

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SEMESTER II

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS	3	1	0	4

The learner should be able to

Course Objective

1. Describe some methods to solve different types of first order differential equations.
2. Understand the various approach to find general solution of the ordinary differential equations
3. Evaluate the various types of Partial differential equations and methods to find solution.
4. Introduction to analytic functions and its properties.
5. Understand Cauchy's theorem and its applications in evaluation of integral.

Unit	Description	Instructional Hours
	ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER	
I	Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
	LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER	
II	Second order linear differential equations with constant with RHS of the form e^{ax} , x^n , sinax, cosax- – Cauchy's linear equations– Method of variation of parameters.	12
	PARTIAL DIFFERENTIAL EQUATIONS	
III	Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form f(p,q)=0, Clairaut's equation – Lagrange's equation.	12
	COMPLEX DIFFERENTIATION	
IV	Functions of complex variables – Analytic functions – Cauchy's – Riemann 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 - Contour Integration with unit circle only.	12
	Total Instructional Hours	**60**

At the end of the course, the learner will be able to

Course Outcome

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Evaluate the solutions of higher order ordinary differential equations and its properties.
CO3: Compute the solution of first order partial differential equations.
CO4: Understand the concept of analytic functions and discuss its properties.
CO5: Evaluate various integrals by using Cauchy's residue theorem and classify singularities and derive Laurent series expansion

TEXT BOOKS:

T1 – Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2019.
T2 - William E. Boyce, Richard C. DiPrima, Douglas B. Meade, Elementary Differential Equations and Boundary Value Problems, Wiley, 2017.
T3 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1 - James Ward Brown, Ruel Vance Churchill, Complex Variables and Applications, McGraw-Hill Higher Education, 2004
R2 - Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones & Bartlett Learning, 2011
R3 - Ian N. Sneddon, Elements of Partial Differential Equations, Courier Corporation, 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22CY2101	ENVIRONMENTAL STUDIES	2	0	0	2

Course Objective

The learner should be able to

1. Grasp the importance and issues related to ecosystem and biodiversity and their protection.
2. Acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. Identify the various natural resources, exploitation and its conservation
4. Gain knowledge on the scientific, technological, economic and political solutions to environmental problems.
5. Become aware on the national and international concern for environment and its protection

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – 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.	9
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	9
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution.	9
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones.	9

	HUMAN POPULATION AND THE ENVIRONMENT	
V	Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – 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.	9
	Total Instructional Hours	**45**

At the end of the course, the learner will be able to

Course Outcome

CO1: Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.

CO2: Identify the causes of environmental pollution and hazards due to manmade activities.

CO3: Develop an understanding of different natural resources including renewable resources.

CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.

CO5: Describe about the importance of women and child education, existing technology to protect environment.

TEXT BOOKS:

T1 – S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020

T2 - Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

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.Tech	22PH2101	BASICS OF MATERIAL SCIENCE	2	0	0	2

Course Objective

The student should be able to

1.Gain knowledge about Crystal systems and crystal structures
2. Understand the knowledge about electrical properties of materials
3. Enhance the fundamental knowledge in semiconducting materials.
4. Gain knowledge about magnetic materials
5. Acquire fundamental knowledge new engineering materials which is related to the engineering program

Unit	Description	Instructional Hours
I	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices – Inter planar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
II	**ELECTRICAL PROPERTIES OF MATERIALS** Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression – Widemann - Franz law – Success and failures – Fermi- Dirac statistics – Density of energy states.	6
III	**SEMICONDUCTING MATERIALS** Introduction – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Intrinsic semiconductor — electrical conductivity – band gap determination. - Extrinsic semiconductor – n type and p type semiconductor –Light Emitting Diode.	6
IV	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magnetron – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
V	**NEW ENGINEERING MATERIALS** Metallic glasses: melt spinning process, Preparation and applications - shape memory alloys: phases, shape memory effect - Characteristics of SMA : Pseudoelastic effect, Super elasticity and Hystersis. Applications of SMA. Nanomaterials preparation (bottom up and top down approaches) – various techniques - pulsed laser deposition - Chemical vapor deposition	6
	Total Instructional Hours	30

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the Crystal systems and crystal structures in the field of Engineering

CO2: Illustrate the fundamental of electrical properties of materials

CO3: Discuss concept of acceptor or donor levels and the band gap of a semiconducting materials

CO4: Develop the technology of the magnetic materials and its applications in engineering field

CO5: Understand the advanced technology of new engineering materials in the field of Engineering

TEXT BOOKS:

T1 - Rajendran V, "Materials Science", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2022

REFERENCE BOOKS:

R1 – Charles Kittel "Introduction to Solid State Physics". Wiley., New Delhi 2017

R2 - Dr. M.Arumugam "Materials Science " Anuradha publications., 2019

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22CY2151	CHEMISTRY FOR ENGINEERS	2	0	2	3

Course Objective

The learner should be able to

1. Acquire knowledge on the concepts of chemistry involved in day today life.
2. Identify the water related problems and water treatment techniques.
3. Enhance the fundamental knowledge on electrochemistry and the mechanism of corrosion and its control.
4. Acquire knowledge on various thermodynamical laws and its importance in engineering applications.
5. Extend the knowledge on the concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	**CHEMISTRY IN EVERYDAY LIFE** Chemicals in food – Food colors – Artificial sweeteners – Food preservatives. Soaps and Detergents – Soaps – Types of Soap – Detergents – Types of detergents. Drugs – Classification of drugs - Therapeutic Action of Different Classes of Drugs. Chemicals in Cosmetics – Creams – Talcum powders- Deodorants – Perfumes. Plastics – Thermoplastics- Preparation, properties and uses of PVC, Teflon and Thermosetting plastics - Preparation, properties and uses of Polyester and Polyurethane.	6
II	**WATER TECHNOLOGY** Impurities in Water, Hardness of Water, Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- - Softening Methods (Zeolite & Ion-Exchange Methods)- Desalination of Brackish Water - Reverse Osmosis, Potable water and treatment. **Estimation of total, permanent and temporary hardness of water by EDTA Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method.**	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. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Estimation of Ferrous iron by Potentiometry.**	6
IV	**CHEMICAL THERMODYNAMICS** Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs Helmholtz equation- Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.	6
V	**SPECTROSCOPY** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) - applications – 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.	6
	Total Instructional Hours	**30**
	Total Lab Instructional Hours	**30**

Course Outcome

At the end of the course, the learner will be able to

CO1: List out the chemicals used in food, soaps and detergents, drugs, cosmetics and plastics

CO2: Differentiate hard and soft water and solve the related problems on water purification in domestic as well as in industries.

CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes ofcorrosion, its consequences to minimize corrosion to improve industrial design

CO4: Develop sound knowledge on second law of thermodynamics and second law based derivations and its importance in engineering applications in all disciplines.

CO5: List out the applications of spectroscopic techniques in various engineering fields.

TEXT BOOKS

T1 - P.C. Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

T2 - O.G. Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCE BOOKS

R1 – Shikha Agarwal "Engineering Chemistry - Fundamentals and Applications, Cambridge University Press, Delhi, 2019

R2 - S.S. Dara "A Text book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi (2018).

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AG2252	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	2	0	2	3

The student should be able

Course Objective

1. To introduce the students to principles of agricultural and horticultural crop production and to introduce the production practices of crops.
2. To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

Unit	Description	Instructional Hours
I	**AGRICULTURE AND CROP PRODUCTION** Introduction to agriculture - 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- green house cultivation practices. **Lab:1-** Practice of Field preparation for various crops and calculate seed rate (kg/ha)	9
II	**CROP SELECTION AND ESTABLISHMENT** Regional and seasonal selection of crops-Systems of crop production-Competition among crop plants-Spacing and arrangement of crop plants-Factors affecting the crop growth and production. **Lab: 2-** Seed selection and seed treatment procedures for various crops. **Lab: 3-** Practice of seed Sowing / Transplanting of agricultural and horticultural crop and tree plant.	9
III	**CROP MANAGEMENT** Crop water Management- Irrigation scheduling -Crop nutrition management-fertigation scheduling- Weed management-Pests management Practices in crop production. **Lab: 4-** Study and calculate Irrigation scheduling for agricultural crop.	9
IV	**PRODUCTION PRACTICES OF AGRICULTURAL CROPS** 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-special purpose crops like green manure and fodder. **Lab:5-** Biometric observation of agricultural and horticultural crop and tree plant.	9
V	**PRODUCTION PRACTICES OF HORTICULTURAL CROPS** Important groups of horticultural crops in Tamil Nadu-Cultivation practices of representatives of each group: fruits and vegetables. **Lab:6** TypesHarvesting machineries used for agricultural and horticultural crops. **Lab:7-** Calculate crop yield and yield loss of agricultural crop	9
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome At the end of the course, the learner will be able to

CO1: Understanding the physical, biological, and economic factors influencing the crop production.

CO2: Understand the principles of crop growth and development.

CO3: To know various cultivation practices for important groups of field crops in Tamil Nadu

CO4: Understand the horticultural crops growth and importance of greenhouse cultivation

CO5: Understand the scientific principles and technologies can be applied to in-crop situations to optimize returns within best management practices.

TEXT BOOKS:

T1: Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, KrishiAnusandhan Bhavan, Pusa, New Delhi, 2015.

T2: Reddy T. Sankara G.H. YellamandaReddi, 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.Tech	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION	2	0	2	3

The learner should be able

Course Objective

1. To improve essential business communication skills.
2. To enrich employability knowledge.
3. To acquire the crucial organizing ability in official forum.
4. To impart important business writings.
5. To make effective presentation with essential etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of sentences in English according to structure Writing: writing definitions, Describing product, work place and service (purpose, appearance, function) Vocabulary – words on nature **Practical Component: Listening- Watching and interpreting advertisements/short films Speaking- Extempore speech**	9
II	Language Proficiency: Direct and Indirect speech. Writing: Formal memos, Job application and resume preparation Vocabulary - words on offense and ethics**Practical Component: Listening- Comprehensions based on telephonic conversation Speaking- Vote of thanks& welcome address**	9
III	Language Proficiency: Homophones and Homonyms, Writing: Preparing a detail plan for an official visit, schedule and Itinerary, reading comprehension, Vocabulary– words on society **Practical Component: Listening- Listening- paraphrasing the listened content Speaking- Group Discussion with preparation**	9
IV	Language Proficiency: Idioms Writing: Report writing (marketing, investigating) Vocabulary-words involved in business **Practical Component: Listening- Watching technical discussions and preparing MoM Speaking- On the spot Group Discussion**	9
V	Language Proficiency: spotting errors Writing: making /interpreting chart, sequencing of sentences Vocabulary- words involved in finance **Practical Component: Listening- Comprehensions based on announcements Speaking- Presentation on a technical topic with ppt.**	9
	Total Instructional Hours	45

Course Outcome

At the end of the course, learners will be able

CO1: To the business procedure and promotion skills.

CO2: To make oral and written presentation in corporate forum.

CO3: To schedule official events and participate in official discussions without reluctance.

CO4: To take an effective role and manage in an organizational sector.

CO5:To prepare and demonstrate a professional presentation

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	Name of the Course	L	T	P	C
B.Tech	22ME2001	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.

Unit **Description of the Experiments**

GROUP A (CIVIL AND MECHANICAL)

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, planning 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 ENGINEERING)

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 Instructional Hours **45**

Course Outcome

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22HE2071	DESIGN THINKING	1	0	2	2

The student should be able to

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
I	**DESIGN ABILITY** 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	6
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	**DESIGN EXPERTISE** 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	6
V	**DESIGN THINKING TOOLS AND METHODS** Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
	Total Instructional Hours	**30**

After completion of the course the learner will be able to

Course Outcome

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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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22HE2072	SOFT SKILLS - I	1	0	0	1

Course Objective

The student should be able to

1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
2. To enhance the students ability to deal with numerical and quantitative skills.
3. To identify the core skills associated with critical thinking.
4. To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	**Lessons on excellence** Skill introspection, Skill acquisition, consistent practice	2
II	**Logical Reasoning** Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	**Quantitative Aptitude** 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	11
IV	**Recruitment Essentials** Resume Building - Impression Management	4
V	**Verbal Ability** Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4
	Total Instructional Hours	**30**

Course Outcome

After completion of the course the learner will be able to

CO1: Students will analyze interpersonal communication skills. public speaking skills.
CO2: Students will exemplify tautology, contradiction and contingency by logical thinking.
CO3: Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4:Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity
CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar

REFERENCE BOOKS:

R1 - Quantitative Aptitude – Dr. R S Agarwal

R2 -Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley

R3 -Verbal and Non – Verbal Reasoning – Dr. R S Agarwal

R4- Objective General English – S.P.Bakshi

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Programme	Course Code	Name of the Course	L	T	P	C	C
B.Tech	22MC2091/ 22MC2092	தமிழர்மரபு/ HERITAGE OF TAMIL	2	0	0	2	(

தமிழர் மரபு

அலகு I மொழி மற்றும் இலக்கியம்: 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல், அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subbiramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies.)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10 Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

11 Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

12 Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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SEMESTER III

Programme	Course Code	Name of the Course	L	T	P	C
BE	21MA3102	FOURIER ANALYSIS AND TRANSFOR	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
	FOURIER SERIES	
I	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
	BOUNDARY VALUE PROBLEMS	
II	Classification of PDE - Solutions of one-dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
	TWO DIMENSIONAL HEAT EQUATIONS	
III	Steady state solution of two-dimensional equation of heat conduction in infinite plate and semi circular plate.	12
	FOURIER TRANSFORMS	
IV	Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity(Statement only).	12
	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	
V	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
BE	21AG3201	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
I	**INTRODUCTION AND SOIL PHYSICS** Soil - definition - major components –Soil forming minerals and processes- soil profile -Physical properties - texture –density-porosity-consistence-colour- -specific gravity - capillary and non-capillary -plasticity. Soil air - soil temperature - soil water - classification of soil water- Movement soil water. Soil colloids – organic and inorganic matter-Ion exchange- pH – Plant nutrient availability	9
II	**SOIL CLASSIFICATION AND SURVEY** Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping- mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.	9
III	**PHASE RELATIONSHIP AND SOIL COMPACTION** Phase relations- Gradation analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.	9
IV	**ENGINEERING PROPERTIESOF SOIL** Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability- Darcy's law-field and lab methods - Assessment of seepage - Compressibility	9
V	**BEARING CAPACITY AND SLOPE STABILITY** Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations-Terzaghi"s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method- slope protection measures.	9
	Total Instructional Hours	**45**

COURSE OUTCOMES

After completion of the course the learner will be able to

CO1:Fundamental knowledge of soil physical parameters.

CO2:The procedures involved in soil survey, soil classification.

CO3:The phase relationship and soil compaction.

CO4:Concepts of bearing capacity and slope stability

CO5: Understanding the important of BIS standards

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG3202	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
I	**PROPERTIES OF FLUIDS** 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
II	**FLUID FLOW ANALYSIS** 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
III	**FLOW MEASUREMENT** 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
IV	**OPEN CHANNEL FLOW** 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

V	**DIMENSIONAL ANALYSIS AND PUMPS**	**12**

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.

Total Instructional Hours **60**

COURSE OUTCOMES

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

CO1: Comprehend the properties of fluids

CO2: Understand the various types of fluid flow

CO3: Calculate the discharge and compute energy losses in pipe flow

CO4: Classify open channel flows and also design the most economical sections for open channel flows

CO5: Select appropriate model to provide solution to a real time problem related to hydraulics and also assess the performance of pumps

TEXT BOOKS:

T1 SsStreeter 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.	21AG3203	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
I	**AGRICULTURE AND CROP PRODUCTION** 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
II	**CROP SELECTION AND ESTABLISHMENT** 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
III	**CROP MANAGEMENT** 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
IV	**PRODUCTION PRACTICES OFAGRICULTURAL CROPS** 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
V	**PRODUCTION PRACTICES OF HORTICULTURAL CROPS** 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.	21AG3251	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
I	**EVAPORATION AND CONCENTRATION** Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation-performance of evaporators and boiling point elevation – capacity – economy and heat balance-types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator	9
II	**MECHANICAL SEPARATION** Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press-sedimentation – gravitational sedimentation of particles in a fluid – Stoke"s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.	9
III	**SIZE REDUCTION** Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger"s, Bond"s and Kick"s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.	9
IV	**CONTACTEQUILIBRIUM SEPARATION** Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium equilibrium concentration relationships – operating conditions-calculation of separation in contact equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment-properties of tower packing – types – construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – equipment	9
V	**CRYSTALLISATION AND DISTILLATION** Crystallization-Equilibrium –Rate of crystal growth stage-Equilibrium crystallization-Crystallizers-Equipment-Classification- Construction and operation – Crystallizers-Tank-Agitated batch-Swenson-Walker and Vacuum crystallizers-Distillation-Binary mixtures-Flash and differential distillation-Steam distillation –Theory-Continuous distillation with rectification –Vacuum distillation - Batch distillation-Operation and process-Advantages and limitation-Distillation equipments- Construction and operation-Factors influencing the operation.	9
	Total Instructional Hours	**45**

COURSE OUTCOMES

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

CO1:Fundamentals of various unit operations of Agricultural Processing.

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

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

CO4: Size reduction equipment and calculating the power requirements

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

TEXT BOOKS:

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

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

T3 Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th Edition, Prentice Hall, 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.	21AG3001	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**

COURSE OUTCOMES

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.

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 Acquaah, 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.	21AG3002	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
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.	21MC3191	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
I	**BASIC FEATURES AND FUNDAMENTAL PRINCIPLES** Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
II	**FUNDAMENTAL RIGHTS** 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
III	**PARLIAMENTARY FORM OF GOVERNMENT** 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
IV	**LOCAL GOVERNANCE** Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article21 – scope of the right to life and personal liberty under article 21.	4
V	**INDIAN SOCIETY** 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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Programme	Course Code	Name of the Course	L	T	P	C
BE	21HE3072	CAREER GUIDANCE – LEVEL III Personality, Aptitude and Career Guidance	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]
- 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 **9 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 **12 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

Module:3 Verbal Ability **7 hours** **SLO:** 8

Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreemen
- t• 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: **30 hours**

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21HE3073	LEADERSHIP MANAGEMENT SKILLS	2	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.	21AG4201	FARM TRACTORS	2	1	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
I	**TRACTORS** Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers.	9
II	**ENGINE SYSTEMS** Valves-inlet and outlet valves – valve timing diagram. Air cleaner- exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor-electrical system.	9
III	**TRANSMISSIONSYSTEMS** 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
IV	**HYDRAULIC SYSTEMS** 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 - operatorsseat.	9
V	**POWER TILLER, BULL-DOZER AND TRACTOR TESTING** 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 powertillers.	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 equipments 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 equipments.

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. "Automative 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.	21AG4202	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 A gricultural 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. Cenegal and Michael A.Boles, "Thermodynamics: An Engineering Approach", Fourth Edition, Tata McGraw-hill, 2004.

T2 Michael J.Moran, Howard N.Shapiro, "Fundamentals of Engineering Thermodynamics", Fourth Editon, John wiley &Sons, 2000.

REFERENCE BOOKS:

R1 R.K.Rajput, "A Text book of Engineering Thermodynamics", Third Edition, Laxmi publication (P) Ltd., 2007.

R2 Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.

R3 Domkundwar.S., C.P.Kothandaraman "A Course in Thermal Engineering", Fifth Edition, Dhanpat Rai & Co (p) Ltd, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AG4203	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
I	**WATER RESOURCES AND IRRIGATION REQUIREMENT** Water Resources- River basins-Development and Utilization in India and Tamil Nadu- Irrigation – duty and delta - Rooting characteristics - Moisture use of crop, Evapotranspiration - ET plot – Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.	9
II	**METHODS OF IRRIGATION** 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
III	**DIVERSION AND IMPOUNDING STRUCTURES** 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
IV	**CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT** 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
V	**DRAINAGE OF AGRICULTURAL LAND** Agricultural drainage, Nature and extent of Drainage Problems; Definition and calculation of drainage design criteria under rainfed and irrigated conditions; Steady and transient state drainage equations; Design, alignment, construction and maintenance of surface and subsurface drainage systems; Design, construction and maintenance of mole drains; Guideline for the selection of envelope materials for subsurface drain.	9
	Total Instructional Hours	**45**

Course Outcome	The students completing the course will have 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	21MA4152	STATISTICS AND NUMERICAL METHODS	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.
- 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 OUTCOMES	At the end of the study the student will have knowledge on 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.	21AG4251	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 biogas plants- Construction details- operation and maintenance	9
Lab	**1. Study on floating drum type biogas plants.** **2. Study on fixed dome type biogas plants.** **3. Design of biogas plants**	
II	**BIO ENERGY** Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.	9
Lab	**4. Determination of proximate analysis of biomass material.**	
III	**BIO REACTORS AND FERMENTORS** Bio reactors/ fermenters – Batch type – continuous stirred tank reactors- Biological wastewater treatment- Activated sludge process- Downstream Processing-Recovery and purification of products.	9
IV	**ALCOHOL PRODUCTION** Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis – Antibiotics enzymes- principles of thermochemical conversion – combustion - pyrolysis- Gasification – types of gasifiers.	9
Lab	**5. Study on pyrolysis plant.** **6. Study on biomass gasifier.**	
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
Lab	**7. Determination of Calorific value of fuel using bomb Calorimeter**	
	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

TEXTBOOKS:

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.	21AG4252	SURVEYING AND LEVELLING	2	0	2	3

Course Objective

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

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

COURSE OUTCOMES

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

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

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.	21AG4001	IRRIGATION FIELD LABORATORY	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	1
9	Weight balance	1
10	Catch cans, measuring jars – required numbers	---

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,

R3 Laboratory Manual, Centre for Water Resources, Anna University,Chennai.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21AC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE/ VALUE EDUCATION	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 Jitatmananda, "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, Inernational Chinmaya Foundation, Velliyanad,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.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	21HE4072	**Career Guidance – Level IV** 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]
- 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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE4073	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
I	**IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY** Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
II	**IDEATION: TOOLS FOR IDEATION** 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
III	**IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY** Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
IV	**PROTOTYPING AND PRODUCT IDEATION** 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 Visualitzation of Ideas", 2008.
R2 - Kathryn McElroy , "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.

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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

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 able to understand the working principle of every equipments used from sowing to harvesting.

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

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

TEXT BOOKS

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

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	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 psychometric processes on psychometric chart and their analysis, by-pass factor, Thermal comfort; Cooling and heating load Calculations-sensible heat factor, latent heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, and apparatus dew point.	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 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 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 - Kutzback 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 – Involutes and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio – Interference and undercutting – Non–standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears – Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials – Automobile gear box.	9
	FRICTION AND FRICTION DRIVES	
IV	Surface contacts –Friction in screw threads -Friction clutches -Belt and rope drives, Friction aspects in Brakes.	9
	GOVERNORS	
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 Mc Graw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	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

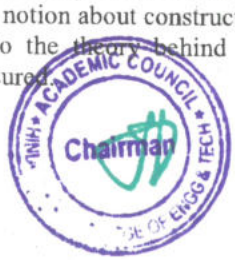
CO1: Students' knowledge base gets enriched with the technical aspects of groundwater, its availability, assessment and utilization

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 Distributers Pvt. Ltd, New Delhi

REFERENCES

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

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

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	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/B.TECH	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./B.Tech.	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
I	**DESIGN ABILITY** 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
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
IV	**DESIGN EXPERTISE** 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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SEMESTER VI

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
I	**PRECIPITATION AND ABSTRACTIONS** 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
II	**RUNOFF** 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
III	**FLOOD AND DROUGHT** 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
IV	**RESERVOIRS** Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.	9
V	**GROUNDWATER AND MANAGEMENT** 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 visualizes 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
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 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
I	**BASIC PROPERTIES OF FOOD MATERIALS** 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
II	**PROCESSING AND PRESERVATION OF FOODS** Thermal processing of foods - cooking, blanching, sterilization, pasteurization, drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers -rehydration of dehydrated foods - osmotic dehydration. Fat and oil processing, extraction, methods and equipment, refining of oils, hydrogenation, Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.	9
III	**REACTION KINETICS AND QUALITY CONTROL** Introduction Basic reactor, kinetics general Considerations, order of reaction, first-order rate processes, food spoilage- kinetics of microbial destruction, temperature dependence of reaction kinetics- Arrhenius model, thermal death time (TDT), Q10 model, decimal reduction time (D), Z and F values,– Quality control of processed food - Factors affecting quality.	9
IV	**ROPERTIES AND PROCESSING OF MILK** Physical, chemical, thermal and rheological properties of milk, , preservation and testing of milk - Processing –Staining -Filtering and Clarification - cream separation – Pasteurization – Homogenization -sterilization, LTLT, UHT processing and aseptic packaging – emulsification – Fortification, milk type.	9
V	**DAIRY PRODUCTS** 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	9
	Total Instructional Hours	**45**

Lab:

Unit 1:

1. Determination of size, true density, bulk density and porosity of food samples
2. Determination of consistency, viscosity and specific gravity of food samples
3. Determination of moisture content of food samples by oven-dry method

Unit 2:

4. Determination of drying characteristics of fruits and vegetables
5. Determination of oil content of given oil seeds using Soxhlet apparatus

Unit 3:

6. Problems on thermal death time (TDT) and decimal reduction time (D value) for food samples
7. Determination of food additives present in food sample

Unit 4 & 5:

8. Determination of fat, SNF and total solids content (TSC) in milk
9. Determination of acidity of milk
10. Determination of specific gravity of milk

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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 values 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

REFERENCES

R1 Agu, M. N. (2013). Application of ICT in agricultural sector: Women's perspective. International Journal of Soft Computing and Engineering, 2(6), 58-60.

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 Todays 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., & Khusdeep, 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 aquire the knowledge on system concepts

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

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

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

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

TEXT BOOKS

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

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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

Course Objective

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 water and trade - Sustainable food Security Action Plan – Regulations of Terrace Gardening product Market	9
	Total Instructional Hours	45

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

sustainable agriculture

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

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

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

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

TEXT BOOKS

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

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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Program	Course Code	Name of the Course	L	T	P	C
B.E.	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 (UNFCC)-ozone layer depletion -land degradation-air and water pollution-sea-level rise-loss of biodiversity-climatic change problem GHG emissions by different countries-developing country responsibilities - India's Greenhouse gas emissions - The conference of parties.	9
	KYOTO PROTOCOL AND CDM PROJECTS	
II	Kyoto protocol and clean development mechanism-CDM and cooperative mechanism-CDM overview administration -participation-CDM institutions-procedures CDM project cycle-project design and formulation - eligibility-additionally. Approval of (DNA) Designated National Authority. Validation and registration-monitoring-validation and certification through the source of Certified Emission Reduction (CER).	9
	TYPES AND FEATURES OF CDM	
III	Types of CDM-topology -project activity -small scale CDM project categories-access station and cater station projects. PDO- project design document -General description of project activity-baseline methodology-monitoring methodology-auditing period-technical aspects.	9
	MONITORING OF CDM	
IV	Monitoring and verification-verification process principles of verification-report preparation-pitfalls. Joint implementation (JI)-institutions and procedures-guidelines-JI or small scale projects-JI Land Use, Land Use Change and Forestry (LULUCF) projects.	9
	SUSTAINABLE ENERGY DEVELOPMENT	
V	Low carbon technologies-low carbon building-alternative approaches-energy efficiency projects- sustainable energy policy concepts-mitigating energy related GHG emissions through renewable energy- carbon trading.	9
	Total Instructional Hours	45

Course Outcome

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

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

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

CDM projects.

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

CO5: Compare the alternate techniques for lowering carbon emission.

TEXT BOOKS

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

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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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

Course Outcome

During this course, students will be trained:

CO1: To know the Basic of Electric Circuits

CO2: To understand the importance of Precision Farming.

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

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

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

TEXT BOOKS

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

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

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

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

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

REFERENCE BOOKS

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

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

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

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

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

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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

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

Unit	Description	Instructional Hours
	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
I	**EARTH'S CLIMATE SYSTEM** 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
II	**ATMOSPHERE AND ITS COMPONENTS** 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
III	**IMPACTS OF CLIMATE CHANGE** 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
IV	**OBSERVED CHANGES AND ITS CAUSES** 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
V	**CLIMATE CHANGE MITIGATION MEASURES** 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 OUTCOMES

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

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 MSV 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 - parallel, counter and cross flow- Types, tube in tube, shell and tube heat exchanger, plate heat exchange - heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU	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	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 conversion 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 AgeInternational private limited, New Delhi, 2010

T2 Yunus A. Cengel, Heat and Mass Transfer: a Practical Approach, Tata McGraw Hillpublishing Company private limited, New Delhi, 2007

REFERENCE BOOKS

R1 J. P. Holman, Heat Transfer, Tata McGraw Hill publishing Company private limited, NewDelhi, 2009

R2 C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, NewAge 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
I	**SITUATIONAL DISASTERS** 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 ofcaste, 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
II	**DISASTER RISK REDUCTION (DRR)** 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 Processess and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.	9
III	**VULNERABILITIES, IMPACTS AND DEVELOPMENTS** 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
IV	**DISASTER RISK MANAGEMENT** 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
V	**CATEGORICAL CASE STUDIES** 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.

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, IIAS 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	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

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 avai Laboratory le 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

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. -Modern Farming System and types – advantages –disadvantage - High Yielding Varieties (HYV) in India – Mushroom cultivation	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 - Groundnut Digger Shaker/Harvester-Coconut Tree Climber-Banana Harvester (Chopper)-Tea Plucking Machine-Turmeric Harvester/ Digger-Tapioca Harvester Sugarcane Harvester	9
V	**CURRENT TECHNOLOGY IN AGRICULTURE** Robotics and Drone usage in Agriculture -GIS and RS for Crop Mapping and Surveying -Application - Agriculture Innovation- Real- time Kinematic (RTK)-Mini chromosome Technology- Farm Management Software- Laser Scarecrows-Farm Automation- Research gap 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 Distributers Pvt. Ltd, New Delhi

REFERENCE BOOKS

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

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

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

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

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

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SEMESTER VII

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

Course Objective

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

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

Course Outcome

By the end of the course student will be able

CO1: To critically analyze different Agricultural Extension approaches.

CO2: Understand Agricultural Knowledge Information System

CO3: New trends in agriculture extension: privatization extension.

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

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

TEXT BOOKS

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

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

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

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

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

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

REFERENCE BOOKS

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

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

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

R4 Dimensions of agriculture extension - TNAU

R5 Extension communication and management- G. L. Ray

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7202	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, Hyderbad, 2001

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

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

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

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

REFERENCE BOOKS:

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

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

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

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

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

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

Course Objective

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

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7001	RENEWABLE ENERGY LABORATORY	0	0	3	1.5

Course Objective

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

S.NO	Description	Instructional Hours
1	Characterization of biomass – proximate analysis	
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 doom type Bio-gass plant
CO3: Analysis gas composition like CH_4, CO2 and CO and H_2S through orsat apparatus
CO4: Understand the Stoichiometric calculations, weather station I-V Characteristics.
CO5: Testing of engines and solar water heater, dryer and Photovoltaic system and identifying performance of system.

S.NO	LIST OF EQUIPMENTS REQUIRED	REQUIRED QUANTITY
1	Hot air oven	1
2	Muffle furnace	1
3	Junkers gas calorimeter	1
4	Bomb calorimeter	1
5	Model of Biogas and Deenabandhu biogas plant	1
6	Biogas scrubbing unit	1
7	Gasifier - Lab Scale	1
8	Pyrolysis unit	1
9	Biogas/ Producer gas dual fuel Engine	1
10	Briquetting Machine - Lab Scale	1
11	Automatic weather station.	1
12	Solar water heater	1
13	Solar dryer-1 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 Photovotaics – Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., New Delhi, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG7002	GIS LABORATORY FOR AGRICULTURAL ENGINEERS	0	0	3	1.5

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

S.NO	Description	Instructional Hours
1	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 - Digitizing	
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.	19AG7901	INNOVATION PROJECT	0	0	4	2

Course Objective

- 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.
- 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.
- The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department.
- The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

Course Outcome

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

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

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

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

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

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Professional Elective – III

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

Course Objective

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

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

Course Outcome

By the end of the course student will be able

CO1: At the end of the study the student will have knowledge on material handling and Processing equipment's.

CO2: Different Post Harvest operations and processing methods of harvested crops.

CO3: Fundamentals of various unit operations of Agricultural Processing

CO4: Understand the principles and theory of drying

CO5: To learn layout of modern industries

TEXT BOOKS

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

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

REFERENCE BOOKS

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

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

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

Course Objective

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

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

Course Outcome

By the end of the course student will be able

CO1: Acquire the basic knowledge in dairy Technology.

CO2: The ability to use the acquired knowledge during dairy processing.

CO3: Students will learn about technologies to handle physical aspects of fluid-based process

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

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

TEXT BOOKS:

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

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

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

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

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

Course Outcome

By the end of the course student will be able

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.	19AG7304	PROCESS ENGINEERING OF FRUITS AND VEGETABLES	3	0	0	3

Course Objective

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

Unit	Description	Instructional Hours
I	**STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE** Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage.	9
II	**CLEANING, GRADING AND ON-FARM PROCESSING** Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipment's – construction and working – pre-cooling – importance, methods, pretreatments and advantages.	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

The students completing the course will have :

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

Course Objective

- To study the Composition, Analysis and Processing of oils and fats.
- To study technologies in oilseed processing and lipid deterioration
- To study Chemical modification and Hydrogenation in oil processing

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

Course Outcome

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

CO 1: The student will be familiarized with the composition, analysis and processing of oil seeds

CO2: Understand the Chemical composition and nutritional value of oil seed

CO3: Understand the Physical and chemical modification of oil seed at end the process.

CO4: Understand the Role of lipids in food flavor.

CO5: Effective utilization of New technologies in oilseed processing.

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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Open Elective – II

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

Course Objective

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

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

Course Outcome

CO1: Effectively manage roof gardening as a small agri-business enterprise.
CO2: Will have gained all round knowledge of roof gardening and organic farming as an agri-business enterprise rather than as a community profession

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

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SEMESTER VIII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8901	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 - IV

Program	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8301	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
I	**AGRIBUSINESS MANAGEMENT** 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
II	**MANAGEMENT FUNCTIONS** 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
III	**AGRICULTURAL MARKETING (FUNCTIONAL AREA – I)** Operations management - planning and scheduling - supply chain management in agribusiness - Human resource management - job analysis, recruitment and selection process	9
IV	**AGRICULTURAL MARKETING (FUNCTIONAL AREA – II)** Marketing Management - market segmentation, consumer buying behaviour and marketing mix - Financial management - concept and financial planning for agribusinesses	9
V	**ENTREPRENEURSHIP** 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 r to develop the business in the competitive marketing

CO5: Students will understand the systematic process to elect 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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Program	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8302	ON FARM WATER MANAGEMENT	3	0	0	3

Course Objective

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

Unit	Description	Instructional Hours
I	**DESIGN OF IRRIGATION CHANNELS** 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
II	**COMMAND AREA** 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
III	**CONJUNCTIVE USE OF SURFACE AND GROUNDWATER** 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
IV	**WATER BALANCE** 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
V	**SPECIAL TOPICS** 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

At the end of this course,

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, NewDelhi.

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 No strand Rein hold 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.	19AG8303	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. Satakar, "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.	19AG8304	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
I	**INTRODUCTION** 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
II	**COMPOSTING** 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
III	**BIOMASS BRIQUETTING** 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
IV	**BIOCHAR PRODUCTION** 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
V	**BIOGAS AND BIO ETHANOL PRODUCTION** 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,l.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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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8305	ENERGY CONSERVATION IN AGRO BASED INDUSTRY	3	0	0	3

Course Objective

1. To acquaint and equip the students in energy auditing in industries and house hold sectors for increasing energy efficiency.

Unit	Description	Instructional Hours
I	**BASICS OF ENERGY** Classification of energy- primary and secondary energy, commercial and non commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators- Global fuel reserve -Impact of energy usage on climate-Energy Conservation and EC Act 2001.	9
II	**ENERGY EFFICIENCY IN ELECTRICAL UTILITIES** Pumps - Energy efficiency in agriculture pumps - Tips for energy saving in pumps. Compressed air systems - Energy saving opportunities in compressors. Energy Conservation in HVAC (Heating Ventilation and Air Conditioning) and Refrigeration System. Lighting and Direct Generator systems. Energy saving opportunities for other systems such as Computer, Fan, Heater, Blower, Washing Machine, Colour Television, Cooking and Transport.	9
III	**ENERGY EFFICIENCY IN THERMAL UTILITIES** Thermal Basics - Types of fuels -Thermal energy - Energy content in fuels - Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE). Energy Conservation in boilers and furnaces -Introduction and types of boilers - Energy performance assessment of boilers - Concept of stoichiometric air and excess air for combustion - Energy conservation in boilers and furnaces - Do's and Don'ts for efficient use of boilers and furnaces. Cooling Towers - Basic concept of cooling towers-Tips for energy savings in cooling towers. Efficient Steam Utilization.	9
IV	**ENERGY CONSERVATION BUILDING CODE (ECBC)** ECBC and its salient features. Tips for energy savings in buildings - New Buildings - Existing Buildings.	9
V	**ENERGY AUDIT** Types and methodology -Energy audit instruments - Energy auditing reporting format.	9
	Total Instructional Hours	45

Course Outcome

At the end of the course student will be able to understand,

CO1: The students will acquire the knowledge on fundamentals of economic operation of an electrical system and understand the basic principles of energy auditing, types and objectives, instruments used

CO2: Understand the Energy Conservation in HVAC

CO3: To learn Energy conservation in boilers and furnaces

CO4: Understand the importance energy conservation building code (ECBC).

CO5: Preparation of Energy auditing reports

TEXT BOOKS

T1 Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1, 2, 3 & 4. Bureau Energy Efficiency, New Delhi. 2005.

T2 Murphy, W.R. and McKay, G. Energy Management. Butterworth & Co., Publishers Ltd., London. 1982.

T3 Craig B. Smith. Energy Management Principles, Applications, benefits & savings. Pergamon Press Inc. 1981.

T4 Murgai, M.P. and Ram Chandra. Progress in Energy Auditing and Conservation - Boiler Operations, Wiley Eastern Ltd. 1990

REFERENCE BOOKS

R1 Victor B.Ottaviano,Energy Management. An OTIS Publication. Ottaviano Technical Service Inc. 150. Broad Hollow Road, Melville, New York. 11747

R2 Richard Porter and Tim Roberts, 1985. Energy saving by Waste recycling. Elsevier applied science publishers.

R3 Energy Management - Bi-monthly journal published by National Productivity Council, New Delhi.

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Professional Elective – V

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8306	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,

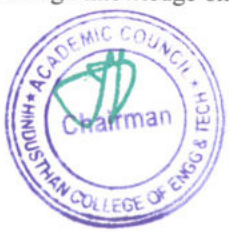
CO1: The students will have knowledge on the usage and working principles of machineries used for intercultural operations.

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 Distributers, 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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Chairman - BoS
AGRI - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19AG8307	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
I	**Introduction to mechanics of tillage tools** 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
II	**Design of tillage tools and principles of soil cutting** Design of tillage tools - design factors-Shape-Macroshape-Mould board plow surface – principles of soil cutting – Design equation.	9
III	**Application of dimensional analysis in soil dynamics** Dimensional Analysis – Development of prediction equations- Methods of dimensional analysis – Application of dimensional analysis and simulation to soil mechanics.	9
IV	**Traction and Mechanics** 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
V	**Soil compaction and plant growth** 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 knew 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.	19AG8308	WATERSHED HYDROLOGY AND MANAGEMENT	3	0	0	3

Course Objective

1. To provide fundamental understanding of the hydrologic cycle, the interactions among the hydrosphere, atmosphere and land-use management (forest, agriculture and urban) effects on the amount, timing and quality of water resourcesTo study the relationship of soil parameters to the forces acting on tillage tools
2. To understand and analyze the dimensional analysis of different variables related to soil-tyre system.
3. To study the tyres, traction and its applications
4. To acquaint and equip with the dynamic properties of soil and soil compaction

Unit	Description	Instructional Hours
I	**Introduction to mechanics of tillage tools** 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
II	**Design of tillage tools and principles of soil cutting** Design of tillage tools - design factors-Shape-Macroshape-Mould board plow surface – principles of soil cutting – Design equation.	9
III	**Application of dimensional analysis in soil dynamics** Dimensional Analysis – Development of prediction equations- Methods of dimensional analysis – Application of dimensional analysis and simulation to soil mechanics.	9
IV	**Traction and Mechanics** 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
V	**Soil compaction and plant growth** 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 knew 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.	19AG8309	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
I	**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.	9
II	**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 – Evapo-transpiration 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	12
III	**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.	9
IV	**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.	9
V	**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 Gardening and Terrace cultivation prospects – surface mulching – automation with soil moisture deficit sensing – cost economics.	9
	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.	19AG8310	AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	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
I	**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
II	**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
III	**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
IV	**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
V	**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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CO ' S, PO' S & P SO ' S MAPP ING

Academic Year : 2022-2023

Semester – I

Course Code & Name: 22MA1101/ MATRICES AND CALCULUS

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

Course Code & Name: 22ME1201/ ENGINEERING DRAWING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	3	2
CO2	3	3	2	2	1	1	1	-	1	-	2	2	3	1
CO3	3	3	2	2	2	1	1	-	1	-	1	2	2	2
CO4	3	2	3	1	3	1	1	-	1	-	1	2	2	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	2	1
Avg	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4

Course Code & Name: 22PH1151/ PHYSICS FOR NON CIRCUIT ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	3	2
CO2	3	3	2	2	1	1	1	-	1	-	2	2	3	1
CO3	3	3	2	2	2	1	1	-	1	-	1	2	2	2
CO4	3	2	3	1	3	1	1	-	1	-	1	2	2	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	2	1
Avg	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4

Course Code & Name : 22HE1151 / ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	1	2	2	2	3	1	1	1	2
CO2	2	1	-	-	1	1	1	2	2	3	-	2	-	2
CO3	2	1	-	-	1	1	2	3	3	3	-	1	1	2
CO4	2	1	-	-	-	1	2	2	2	3	1	1	-	-
CO5	2	-	-	-	-	1	1	2	3	3	-	1	1	2
Avg	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2

Course Code & Name : 22IT1151/PYTHON PROGRMMING AND 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 : 22MA2101/ 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	2.4	2.4	-	-	-	-	-	-	2	2	2

Course Code & Name : 22CY2101/ 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 : 22PH2101/ BASICS OF 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 : 22CY2151/ CHEMISTRY FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO3	2	2	2	2	1	1	1	-	1	-	1	2	-	-
CO4	2	2	3	1	2	1	1	-	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-
Avg	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	0	1

Course Code & Name : 22AG2252/ PRINCIPLES AND PRACTICES OF CROP PRODUCTION

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 : 22HE2151/ EFFECTIVE TECHNICAL COMMUNICATION

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 : 22ME2001/ 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 : 21MA3102/ 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: 21AG3201 – 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: 21AG3202 – 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	1.5	2	2	1	2	1

Course Code & Name: 21AG3203 - 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	-	1	1	2	2	2	2

Course Code & Name: 21AG3251 – 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: 21AG3001 - 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	-	1	1	2	2	2	2

Course Code & Name: 21AG3002 - 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: 21AG4201 - 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: 21AG4202 – 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	PS0 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: 21AG4203 - 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 : 21MA4152/ STATSTICS 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 : 21AG4251 - 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 : 21AG4252 - 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 : 21AG4001 - 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	-	-	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	-	-	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	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	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	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	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	-	-	-	-	-	2	3	3

SEMESTER-VII

Course Code & Name 19AG7201 - 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: 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 : 19AG7301 -POST HARVEST TECHNOLOGY

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

Course Code & Name : 19AG7302-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 : 19AG7303 - 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 : 19AG7304- 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 : 19AG7305 - FAT AND OIL PROCESSING

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 : 19AG7251 - PRECISION FARMING AND PROTECTED CULTIVATION

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

Course Code & Name 19AG7001 - 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: 19AG7002 - 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: 19AG7901 - INNOVATIVE PROJECT

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	1.2	1	-	1.2	1	0	1	1	1	1	1	1	2

Semester – VIII

Course Code & Name : 19AG8301 - 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 : 19AG8302- 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 : 19AG8303- 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 : 19AG8304 - 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 : 19AG8305 - ENERGY CONSERVATION IN AGRO BASED INDUSTRY

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 : 19AG8306 - SPECIAL FARM EQUIPMENT'S

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 : 19AG8307 - MECHANICS OF TILLAGE AND TRACTION

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 : 19AG8308 - 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 : 19AG8309 - MODERN AGRI CULTURAL PRACTICES

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 : 19AG8310 - AGRICULTURE ECONOMICS AND FARM MANAGEMENT

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-19AG8901 - 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	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-2022

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

		22CY2151 & Chemistry For Biological Sciences	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**
		22AG2252 & Principles and Practices of Crop Production	**1**	**1.6**	**1.5**	**1**	**1.2**	**1.6**	**1**	**-**	**1**	**-**	**-**	**-**	**1.6**	**2**
		22HE2151 & Effective Technical Communication	**1.6**	**1.6**	**1**	**1**	**1.2**	**2**	**1.8**	**1.8**	**2.2**	**3**	**1**	**2.8**	**1**	**1**
		22ME2001 & Engineering Practices	**3**	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**2**

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E AGRICULTURE ENGINEERING (UG)

REGULATION-2019

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

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

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

		of Farm Machinery Laboratory														
		19AG5002 & CAD for Agricultural Engineering	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**				**2**	**2**	**2**
III	**VI**	**19AG6201 Hydrology and Water Resources Engineering**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**3**
		19AG6202 Solar and Wind Energy Engineering	**2**	**2**	**2**	**3**	**-**	**1**	**2**	**1**	**-**	**-**	**1**	**2**	**2**	**2**
		19AG6181 Professional Ethics	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**-**	**2**	**1**	**1**	**2**	**3**	**2**
		19AG6301 Climate change and adaptation	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
		19AG6302 Heat and Mass Transfers for Agricultural Engineers	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**
		19AG6251 Food and Dairy Engineering	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**
		19AG6252 ICT in Agricultural Engineering	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**-**	**1**	**2**	**2**	**2**	**2**	**2**
		19AG6701 Industrial Training	**3**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
		19AG6303 Disaster Management	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
		19AG6304 Horticultural Crop Processing	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**
		19AG6305 Organic Farming Technologies	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**
		19AG6401 Modern Agricultural Practices	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**3**
IV	**VII**	**19AG7201 Agricultural Extension**	**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**	**1**	**2**	**2**	**3**	**3**	**1**	**1**
		19AG8303 Intellectual Property Rights	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**3**	**1**	**2**
		19AG8304 Agricultural Waste Management	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**
		19AG8305 Energy Conservation in Agro based Industry	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**1**
		19AG8306 Special Farm Equipment's	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
		19AG8307 Mechanics of Tillage and Traction	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**3**	**1**	**2**
		19AG8308 Watershed Hydrology and Management	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**1**
		19AG8309 Micro Irrigation System	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**3**
		19AG8310 Agriculture Economics and Farm Management	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**