### B.E.AGRICULTURE ENGINEERING REGULATION 2019 I – VIII SEMESTER CURRICULUM

#### SEMESTER I

Sl.No	Course Code	Course Title	L	Т	Р	C	CIA	ESE	TOT AL	Ca teg ory
THEO	RY	· · · ·								
1	19HE1101	Technical English	3	0	0	3	25	75	100	HS
2	19MA1102	Calculus and Linear Algebra	3	1	0	4	25	75	100	BS
3	19ME1101	Basics of Civil and Mechanical Engineering	3	0	0	3	25	75	100	ES
THEO	RY WITH LA	AB COMPONENT								
4	19PH1151	Applied Physics	2	0	2	3	50	50	100	BS
5	19CY1151	Engineering Chemistry	2	0	2	3	50	50	100	BS
6	19CS1151	Problem solving and python programming	2	0	2	3	50	50	100	ES
VALU	E ADDED CO	DURSE								
7	19HE1071	Language competency enhancement course - I	1	0	0	1	0	100	100	HS
8	19MC1191	Induction Programme	0	0	0	0				*MC
		Total	16	1	6	20			700	 I
*MC-	Mandatory C	ourse		1		1	1	1	11	
<u> </u>	SEMESTER I	I								

Sl.No	Course Code	Course Title	L	Т	Р	С	CIA	ESE	TOT AL	Ca teg
THEO	ORY									ory
1	19HE2101	Business English for Engineers	3	0	0	3	25	75	100	HS
2	19MA2101	Differential Equations and Complex Variables	3	1	0	4	25	75	100	BS
3	19AG2201	Principles of Food Science	3	0	0	3	25	75	100	PC

# CHAIRMAN / BOARD OF STUDIES

THEO	ORY WITH LA	AB COMPONENT									
4	19PH2151	Physics of Materials		2	0	2	3	50	50	100	BS
5	19CY2151	Environmental Sciences		2	0	2	3	50	50	100	BS
6	19IT2151	Programming in C		2	0	2	3	50	50	100	ES
LABO	RATORY CO	DURSES									
7	19ME2001	Engineering Practices		0	0	4	2	50	50	100	ES
VALU	E ADDED CO	DURSE									
8	19HE2071	Language Competency		1	0	0	1	0	100	100	HS
		Enhancement Course-II									
			Total	16	1	10	22			800	

# SEMESTER III

Sl.No	Course	Course Title	L	Т	Р	C	CIA	ESE	ТОТ	Ca
	Code								AL	teg
										ory
THEO	RY									
1	19MA3102	Fourier Analysis and	3	1	0	4	25	75	100	BS
		Transforms								
2	19AG3201	Soil Science and Engineering	3	0	0	3	25	75	100	PC
3	19AG3202	Fluid Mechanics and Hydraulics	3	1	0	4	25	75	100	PC
4	19AG3203	Principles and practices of Crop	3	0	0	3	25	75	100	PC
		Production								
THEO	RY WITH LA	AB COMPONENT								
5	19AG3251	Unit Operations in Agricultural	2	0	2	3	50	50	100	PC
		Processing								
LABO	RATORY CO	DURSES								
6	19AG3001	Field Crop Production Practical	0	0	3	1.5	50	50	100	PC
7	19AG3002	Soil Science Laboratory	0	0	3	1.5	50	50	100	PC
VALU	E ADDED CO	DURSE			·				· · · · ·	
8	19MC3191	Indian Constitution	2	0	0	0				*MC
		Total	16	2	8	20			700	
*MC-	Mandatory C	ourse		1		1	1	1	ıł	

# **CHAIRMAN / BOARD OF STUDIES**

#### SEMESTER IV

Sl.No	Course Code	Course Title	L	Т	Р	C	CIA	ESE	TOT AL	Ca teg ory
THEO	RY					1	1			
1	19AG4201	Farm Tractors	2	1	0	3	25	75	100	PC
2	<mark>19ME4232</mark>	Thermodynamics	3	0	0	3	25	75	100	ES
3	19AG4203	Irrigation and Drainage Engineering	3	0	0	3	25	75	100	PC
THEO	RY WITH LA	AB COMPONENT								
4	19MA4152	Statistics and Numerical Methods	3	0	2	4	50	50	100	BS
5	19AG4251	Bio-Energy Resource Technology	2	0	2	3	50	50	100	PC
6	19CE4252	Surveying and Leveling	2	0	2	3	50	50	100	ES
LABO	RATORY CO	DURSES							I	
7	19AG4001	Irrigation Field Laboratory	0	0	4	2	50	50	100	PC
8	19MC4191	Essence of Indian Traditional Knowledge	2	0	0	0				MC
		Total	17	0	10	21			700	
*MC-	Mandatory C	ourse				1	1	1	11	

# SEMESTER V

Sl.No	Course Code	Course Title	L	Т	Р	C	CIA	ESE	TOT AL	Ca teg
										ory
THEO	RY									
1	19AG5201	Farm Machinery and Equipment	3	0	0	3	25	75	100	PC
2	19AG5202	Refrigeration and Cold Chain Management	3	1	0	4	25	75	100	PC
3	19ME5203	Theory of Machines	3	0	0	3	25	75	100	ES
4	19AG53XX	Professional Elective-I	3	0	0	3	25	75	100	PE
THEO	RY WITH LA	AB COMPONENT								
5	19AG5251	Groundwater and Well Engineering	2	0	2	3	50	50	100	PC
6	19AG5252	Soil and Water Conservation Engineering	2	0	2	3	50	50	100	PC

CHAIRMAN / BOARD OF STUDIES

LABO	RATORY CO	DURSES								
7	19AG5001	Operation and Maintenance of	0	0	3	1.5	50	50	100	PC
		Farm Machinery Laboratory								
8	19AG5002	CAD for Agricultural	0	0	3	1.5	50	50	100	PC
		Engineering								
		Total	16	1	10	22			800	

# SEMESTER VI

Sl.No	Course Code	Course Title	L	Т	P	С	CIA	ESE	TOT AL	Ca teg ory
THEO	RY									
1	19AG6201	Hydrology and Water Resources Engineering	3	0	0	3	25	75	100	PC
2	19AG6202	Solar and Wind Energy Engineering	3	1	0	4	25	75	100	PC
3	19AG6181	Professional Ethics	3	0	0	3	25	75	100	HS
4	19AG63XX	Professional Elective-II	3	0	0	3	25	75	100	PE
5	19XX64XX	Open Elective-I	3	0	0	3	25	75	100	OE
THEO	RY WITH LA	AB COMPONENT				•	•	•		
6	19AG6251	Food and Dairy Engineering	2	0	2	3	50	50	100	PC
LABO	RATORY CO	DURSES				•	•	•		
7	19AG6252	ICT in Agricultural Engineering	0	0	4	2	50	50	100	PC
8	19AG6701	Industrial Training	0	0	0	1				EE C
		Total	17	1	6	22			700	

	SEMESTER '	VII								
Sl.No	Course	Course Title	L	Т	Р	С	CIA	ESE	ТОТ	Ca
	Code								AL	teg
										ory
THEO	RY									
1	19AG7201	Agricultural Extension	3	0	0	3	25	75	100	PC
2	19AG7202	Remote Sensing and Geographical Information System	3	0	0	0	25	75	100	PC
3	19AG73XX	Professional Elective-III	3	0	0	3	25	75	100	PC
4	19XX74XX	Open Elective-II	3	0	0	3	25	75	100	OE
CHAI	RMAN / BOA	RD OF STUDIES			PRINC	IPAL/	DEAN A	ACADE	MIC	

THEO	ORY WITH LA	AB COMPONENT								
5	19AG7251	Precision Farming and Protected Cultivation	2	0	2	3	50	50	100	PC
LABO	RATORY CO	DURSES								
6	19AG7001	Renewable Energy Laboratory	0	0	3	1.5	50	50	100	PC
7	19AG7002	GIS Laboratory for Agricultural Engineers	0	0	3	1.5	50	50	100	PC
PROJ	ECT WORK									
8	19AG7901	Innovative Project	0	0	4	2	50	50	100	EE C
		Total	14	0	12	20			800	

#### SEMESTER VIII

Sl.No	Course	Course Title	L	Т	Р	С	CIA	ESE		Ca teg
	Couc								AL	ory
THEO	RY									
1	19AG83XX	Professional Elective-IV	3	0	0	3	25	75	100	PE
2	19AG83XX	Professional Elective-V	3	0	0	3	25	75	100	PE
PROJ	ECT WORK									
3	19AG8901	Project work	0	0	24	12		100	100	EE
										С
		Total	6	0	24	18			800	

#### **CAREER GUIDANCE/VALUE ADDED COURSES – UG PROGRAMMES**

S.No	Course	Course Name	Semester	L	Т	Р	С
	Code						
1	19HE1072	Career Guidance Level – I	Ι	2	0	0	1
		Personality, Aptitude and Career Development					
2	19HE2072	Career Guidance Level – II	II	2	0	0	1
		Personality, Aptitude and Career Development					
3	19HE3071	Career Guidance Level – III	III	2	0	0	1
		Personality, Aptitude and Career Development					
4	19HE4071	<b>Career Guidance Level</b> – IV	IV	2	0	0	1
		Personality, Aptitude and Career Development					

# CHAIRMAN / BOARD OF STUDIES

#### **CREDITWISE SPILT-UP**

Category	SEM	Total							
	Ι	II	III	IV	V	VI	VII	VIII	credit
Humanities	4	4				3			11
Basic	10	10	4	4					28
science									
Engineering	6	5	6	3					19
Science									
Professional		3	10	14	19	12	12		71
core									
Professional					3	3	3	6	15
Elective									
Open						3	3		6
Elective									
Project work						1	2	12	15
Total	20	22	20	21	22	22	20	18	165

#### HUMANITES

S.No.	SEM	COURSE CODE	COURSE TITLE	CREDIT
1.	Ι	19HE1101	Technical English	3
2.	Ι	19HE1071	Language competency enhancement course - I	1
3.	II	19HE2101	Business English for Engineers	3
4.	II	19HE2071	Language Competency Enhancement Course-II	1
5.	VI	19AG6181	Professional Ethics	3
			TOTAL	11

#### **BASIC SCIENCE**

S.No.	SEM	COURSE CODE	COURSE TITLE	CREDIT
1.	Ι	19MA1102	Calculus and Linear Algebra	4
2.	Ι	19PH1151	Applied Physics	3
3.	Ι	19CY1151	Engineering Chemistry	3
4.	II	19MA2101	Differential Equations and Complex Variables	4
5.	II	19PH2151	Physics of Materials	3
6.	II	19CY2151	Environmental Sciences	3
7.	III	19MA3102	Fourier Analysis and Transforms	4
8.	IV	19MA4152	Statistics and Numerical Methods	4
			TOTAL	28

#### ENGINEERING SCIENCE

S.No.	SEM	COURSE CODE	COURSE TITLE	CREDIT
1.	Ι	19ME1101	Basics of Civil and Mechanical Engineering	3
2.	Ι	19GE1101	Engineering graphics	2
3.	II	19GE2101	C Programming	3
4.	II	19GE2103	Engineering practices Lab	2

CHAIRMAN / BOARD OF STUDIES

5.	IV	19CE4252	Surveying and Leveling	3
6.	V	19ME5203	Theory of Machines	3
7.	IV	19ME4202	Thermodynamics	3
			TOTAL	19

S.No.	SEM	COURSE CODE	COURSE TITLE	CREDIT
1.	II	19AG2201	Principles of Food Science	3
2.	III	19AG3201	Soil Science and Engineering	3
3.	III	19AG3202	Fluid Mechanics and Hydraulics	4
4.	III	19AG3203	Principles and Practices of Crop Production	3
5.	III	19AG3251	Unit operations in Agricultural Processing	3
6.	III	19AG3001	Field Crop Production Practical	1.5
7.	III	19AG3002	Soil Science Lab	1.5
8.	IV	19AG4201	Farm Tractors	3
9.	IV	19ME4202	Thermodynamics	3
10	IV	19AG4203	Irrigation and Drainage Engineering	3
11	IV	19AG4251	Bio energy Resource Technology	3
12	IV	19AG4001	Irrigation Field Laboratory	2
13	V	19AG5201	Farm Machinery and Equipment	3
14	V	19AG5202	Refrigeration and Cold chain management	4
15	V	19AG5251	Groundwater and Well Engineering	3
16	V	19AG5252	Soil and Water Conservation Engineering	3
17	V	19AG5001	Design of Farm Implements and Machinery	1.5
18	V	19AG5002	CAD for Agricultural Engineering	1.5
	VI	19AG6201	Hydrology and Water Resources Engineering	3
19	VI	19AG6202	Solar and Wind Energy Engineering	4
20	VI	19AG6251	Food and Dairy Engineering	3
21	VII	19AG7201	Agricultural Economics and Farm management	3
22	VII	19AG7202	Remote Sensing and Geographical Information System	3
23	VI	19AG7252	Precision Farming and Protected Cultivation	3
24	VII	19AG7001	Renewable Energy Lab	1.5
25	VII	19AG7002	GIS Laboratory for Agricultural Engineers	1.5
			TOTAL	71

# PROFESSIONAL CORE

# **PROJECT WORK**

S.No.	SEM	COURSE CODE	COURSE TITLE	CREDIT
1.	VI	19AG6701	Industrial Training	1
2.	VII	19AG7105	Project Phase I	2
3.	VIII	19AG8102	Project Phase II	12
			TOTAL	15

CHAIRMAN / BOARD OF STUDIES

L

	LIST OF PROFESSIONAL ELECTIVES				
COURSE CODE	URSE COURSE TITLE				
SEMESTER	SEMESTER V				
PROFESSIO	NAL ELECTIVE – I				
19AG5301	Systems Analysis and Soft Computing in Agricultural Engineering				
19AG5302	Sustainable Agriculture and Food Security				
19AG5303	CDM and Carbon Trading Technology				
19AG5304	IOT in Agricultural Systems				
19AG5305	Ergonomics and Safety in Agricultural Engineering				

	SEMESTER VI				
PROFESSIONAL I	PROFESSIONAL ELECTIVE – II				
19AG6301	Climate change and adaptation				
19AG6302	Heat and Mass Transfers for Agricultural Engineers				
19AG6303	Disaster Management				
19AG6304	Horticultural Crop Processing				
19AG6305	Organic Farming Technologies				

SEMESTER VII					
PROFESSIONAL ELECTIVE – III					
19AG7301	Post Harvest Technology				
19AG7302	Dairy Process Technology				
19AG7303	Storage and Packaging Technology				
19AG7304	Process Engineering of Fruits and Vegetables				
19AG7305	Fat and Oil Processing				

#### CHAIRMAN / BOARD OF STUDIES

# SEMESTER VIII

PROFESSIONAL ELECTIVE – IV					
19AG8301	Agricultural Business Management and Entrepreneurship				
19AG8302	On-Farm Water Management				
19AG8303	Intellectual Property Rights				
19AG8304	Agricultural Waste Management				
19AG8305	Energy Conservation in Agro based Industry				

# SEMESTER VIII

PROFESSIO	NAL ELECTIVE – V
19AG8306	Special Farm Equipment's
19AG8307	Mechanics of Tillage and Traction
19AG8308	Watershed Hydrology and Management
19AG8309	Micro Irrigation System
19AG8310	Agriculture Economics and Farm Management

#### LIST OF OPEN ELECTIVES

# SEMESTER VI – Open Elective I

# COURSE CODE COURSE TITLE

19AG6401 Research Methodology

# SEMESTER VII Open Elective II

19AG7401 Nanotechnology in Agricultural

**CHAIRMAN / BOARD OF STUDIES** 

Programme	<b>Course Code</b>	Name of the Course	L	Т	P	С
B.E/B.Tech	19HE1101	TECHNICAL ENGLISH	3	0	0	3
(COMMON '	TO ALL BRANCH	ES)				

	• It facilitates students to communicate effectively with coherence.
	• The student will get trained in descriptive communication.
Course	• The trainee will be introduced to professional communication.
Objective	• It enhances knowledge and provides the information on corporate environment.
	• The learner will equip with problem solving skills.

Unit	Description	Instructional Hours			
Ι	Listening and Speaking – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) Reading – Reading an article from newspaper, Reading comprehension Writing Chart analysis, process description, Writing instructions Grammar and Vocabulary- Tenses, Regular and irregular verb, technical vocabulary				
Π	<b>Listening and Speaking-</b> listening to product description, equipment & work place (purpose, appearance, function) <b>Reading-</b> Reading technical articles <b>Writing-</b> Letter phrases, writing personal letters, <b>Grammar and Vocabulary-</b> articles, Cause & effect, Prepositions.				
III	II Listening and Speaking listening to announcements Reading- Reading about technical inventions, research and development Writing- Letter inviting a candidate for interview, Job application and resume preparation Grammar and Vocabulary- Homophones and Homonyms.				
IV	IV Listening and Speaking Practice telephone skills and telephone etiquette (listening and responding, asking questions). Reading- Reading short texts and memos Writing-invitation letters, accepting an invitation and declining an invitation Grammar and Vocabulary- Modal verbs, Articles, Collocation, Conditionals, Subject verb agreement.				
V	V Listening and Speaking- listening to technical group discussions and participating in GDs Reading- reading biographical writing - Writing- Proposal writing, Writing definitions, Grammar and Vocabulary- Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs, Idioms.				
	Total Instructional Hours	45			
CourseCO1- Trained to maintain coherence and communicate effectively. CO2- Practiced to create and interpret descriptive communication. CO3- Introduced to gain information of the professional world. CO4- acquired various types of communication and etiquette. 					

# **TEXT BOOKS**

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

#### 2014

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

# **REFERENCE BOOKS**

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

R2- Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, 2005.

R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

# CHAIRMAN / BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E./B.Tech	19MA1102	CALCULUS AND LINEAR ALGEBRA COMMON TO AERO, AUTO, MECH, MECHT, FOOD, AGRI & CIVIL)	3	1	0	4

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

Unit	Description		
Ι	<b>DIFFERENTIAL CALCULUS</b> Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12	
Π	<b>MULTIVARIATE CALCULUS (DIFFERENTIATION)</b> Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12	
III	<b>DOUBLE INTEGRATION</b> Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12	
IV	<b>TRIPLE INTEGRATION</b> Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12	

V	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
	Total Instructional Hours	60
		I

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

#### **TEXT BOOKS**

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

#### **REFERENCE BOOKS :**

# **R1-** Thomas & Finney "Calculus and Analytic Geometry", Sixth Edition, Narosa Publishing House, New Delhi.

R2 - Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8<sup>th</sup> Edition, Laxmi Pub. Pvt. Ltd. 2011.

R3 - Grewal B.S, "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publications, Delhi, 2012.

#### **CHAIRMAN / BOARD OF STUDIES**

#### PRINCIPAL/DEAN ACADEMIC

Programme	<b>Course Code</b>	Name of the Course	L	Т	P	С
B.E/B.Tech	19ME1153	BASICS OF CIVIL AND MECHANICAL ENGINEERING	3	0	0	3

#### **OBJECTIVES**

- To learn about the working principles of IC engines and detailed explanation of components of power plant units.
- > To study Refrigeration and Air Conditioning system.
- > To impart basic knowledge on Civil and Mechanical Engineering.
- > To study materials used for the construction of civil structures.
- > To gain knowledge on the fundamentals of construction of structure.

#### A – MECHANICAL ENGINEERING

#### **UNIT I IC ENGINES**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

#### **UNIT II POWER PLANT ENGINEERING**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits –Power Transmission in conveyor systems- Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

#### 09

#### UNIT III REFRIGERATION AND AIR CONDITIONING SYSTEM

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.  $\mathbf{B} - \mathbf{CIVIL} \ \mathbf{ENGINEERING}$ 

#### UNIT IV SURVEYING AND CIVIL ENGINEERING MATERIALS

**Surveying**: Objects – types – classification – principles – measurements of distances

**Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections-Woods-Plastics.

#### UNIT V BUILDING COMPONENTS AND STRUCTURES

**Foundations:** Types, Bearing capacity – Requirement of good foundations.

**Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.

#### **TOTAL: 45 PERIODS**

#### **OUTCOMES:**

Upon completion of the course, the students will be able to

- > Demonstrate working principles of petrol and diesel engine.
- > Identify the components used in power plant cycle.
- Explain the components of Refrigeration and Air conditioning cycle.
- Explain the usage of construction material and proper selection of construction materials.
- Understand the building structures.

#### **TEXT BOOKS:**

- 1. Venugopal K. and Prabhu Raja V., —Basic Mechanical Engineeringl, Anuradha Publishers, Kumbakonam, 2010.
- 2. Shanmugam G and Palanichamy M S, —Basic Civil and Mechanical Engineering<sup>II</sup>, Tata McGraw Hill Publishing Co., New Delhi, 2000.

#### **REFERENCES:**

- 1. Ramamrutham S., Basic Civil Engineeringl, Dhanpat Rai Publishing Co. (P) Ltd.2004.
- 2. Seetharaman S., Basic Civil Engineering, Anuradha Agencies, 2005.
- 3. Shantha Kumar S R J., Basic Mechanical Engineeringl, Hi-tech Publications, Mayiladuthurai, 2000.

#### CHAIRMAN / BOARD OF STUDIES

#### PRINCIPAL/DEAN ACADEMIC

Programme	<b>Course Code</b>	Name of the Course	L	Т	P	С
BE/B.Tech	19PH1151	APPLIED PHYSICS	2	0	2	3

09

09

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

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

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

#### **TEXT BOOKS**

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8<sup>th</sup> edition, DhanpatRai Publications (P) Ltd., New Delhi, 2015.

#### **REFERENCE BOOKS**

**R1** - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

**R2** - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi

#### 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016

# CHAIRMAN / BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
BE/B.Tech	19CY1151	ENGINEERING CHEMISTRY	2	0	2	3

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

Unit	Description	Instructional Hours
Ι	WATER TECHNOLOGY Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process -	6
	desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. Estimation of total, permanent and temporary hardness of water by EDTA	3
II	POLYMER & COMPOSITES	6

	preparation, Polymerization – types Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	
III	<b>ELECTROCHEMISTRY AND CORROSION</b> Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – protective coatings – painte – constituents and functions	6
	Conductometric titration of strong acid vs strong base (HClvsNaOH). Conductometric titration (Mixture of strong acid and base). Conductometric precipitation titration using BaCl <sub>2</sub> and Na <sub>2</sub> SO <sub>4</sub>	3 3 3
IV	<b>ENERGY SOURCES AND STORAGE DEVICES</b> Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H <sub>2</sub> -O <sub>2</sub> fuel cell applications.	6
V	ANALYTICAL TECHNIQUES Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.	6
	Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).	3
	Total Instructional Hours	45

<b>Course</b> <b>Outcome</b> After the completion of the course, the learner will be able to CO1: Differentiate hard and soft water and to solve the related purification and its significance in industries and daily life CO2: Acquire the basic knowledge of polymers, composites an CO3: Develop knowledge on the basic principles of electroche causes of corrosion, its consequences to minimize corrosion to	problems on water d FRP and their significance. mistry and understand the improve industrial design.
--	---

# TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi (2018). **REFERENCES** 

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).

R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand& Co. Ltd., New Delhi (2017).

#### CAIRMAN / BOARD OF STUDIES

Programme	Course code	Name of the course	L	Т	Р	С
BE	19CS1151	PROBLEM SOLVING AND PYTHON PROGRAMMING	2	0	2	3

	• To know the basics of algorithmic problem solving
	• To read and write simple Python programs
COURSE OBJECTIVES	• 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
Ι	ALGORITHMIC PROBLEM SOLVING Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
П	DATA, EXPRESSIONS, STATEMENTS Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.	7+2(P)
III	<b>CONTROL FLOW, FUNCTIONS</b> Conditionals: Boolean values and operators, conditional (if), alternative (if- else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.	5+4(P)

	LISTS,	TUPLES, DICTIONARIES			
<ul> <li>Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.</li> </ul>					
v	FILES,	MODULES, PACKAGES			
	Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages. Illustrative programs: word count, copying file contents.				
	TOTAL INSTRUCTIONAL HOURS				
		CO1 - Develop algorithmic solutions to simple computational problem	s		
		CO2 - Read, write, execute by hand simple Python programs			
COURSE OUTCOMES		CO3 - Structure simple Python programs for solving problems and Decompose a Python program into functions			
		CO4 - Represent compound data using Python lists, tuples, dictionaries	5		
		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 andupdated 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
REFE	RENCE BOOKS:
R1:	Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-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 inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

# CHAIRMAN/BOARD OF STUDIES

# PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E/B.Tech	19HE2101	BUSINESS ENGLISH	3	0	0	3

(COMMON TO ALL BRANCHES)

Course Objective	✓ The learner gets started with business communication.
	✓ It trains the students to react to different professional situations.
	✓ The student will get familiarize to managerial skills
	✓ It empowers business writing skills.
	✓ The trainee will learn to interpret and expertise different content.

Unit	Description	Instructional Hours
Ι	Listening and Speaking – listening and discussing about programme and conference arrangement <b>Reading</b> –reading auto biographies of successful personalities <b>Writing</b> Formal & informal email writing, Recommendations <b>Grammar and Vocabulary-</b> Editing a passage(punctuation and spelling), Adjectives & adverbs	9
II	Listening and Speaking- listening to TED talks Reading- Making and interpretation of posters Writing- Business letters: letters giving good and bad news, Thank you letter, Grateful & pleased Grammar and Vocabulary- Active & passive voice, Spotting errors (Teses, , Preposition, Articles)	9
Ш	Listening and Speaking-travel arrangements and experience Reading- travel reviews Writing- Business letters (Placing an order, making clarification & complaint letters). Grammar and Vocabulary- Direct and Indirect speech,	9
IV	Listening and Speaking- Role play - Reading- Sequencing of sentence Writing- Business report writing (marketing, investigating) Grammar and Vocabulary- Connectors, Gerund & infinitive	9
V	<b>Listening and Speaking-</b> Listen to Interviews & mock interview <b>Reading-</b> Reading short stories, reading profile of a company - Writing- Descriptive writing (describing one's own experience) <b>Grammar and Vocabulary-</b> Business vocabulary.	9
	Total Instructional Hours	45

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

#### **TEXT BOOKS**

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2014.

T2- Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009 **REFERENCE BOOKS** 

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

2009.

#### **CHAIRMAN / BOARD OF STUDIES**

Programme/se	em Course Code	Name of the Course	L	Т	P	С	
B.E/II	19MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES (AERO, AUTO, MCT, MECH, CIVIL, FT & AGRI)	3	1	0	4	
	1. Describe some	methods to solve different types of first order different	tial eq	uation	s.		
G	2. Solve ordinary differential equations of certain types using Wronskian technique.						
Course	3. Use the effecti	3. Use the effective mathematical tools for the solutions of partial differential equations.					
Objectives	4. Describe the construction of analytic functions and conformal mapping.						

5. Illustrate Cauchy's integral theorem and calculus of residues

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

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

#### **TEXT BOOKS:**

T1- Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd., Chennai, 2017.

T2- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016 **REFERENCE BOOKS :** 

R1-Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8<sup>th</sup> Edition, Laxmi Pub. Pvt. Ltd. 2011.

R2- Grewal B.S, "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7<sup>th</sup> Edition, Cengage learning,2012.
R4-Erwin kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley and Sons, 2006. R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6<sup>th</sup> edition, 2003.

#### **CHAIRMAN / BOARD OF STUDIES**

#### **PRINCIPAL/DEAN ACADEMIC**

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E/B.Tech	19AG2104	PRINCIPLES OF FOOD SCIENCE	3	0	0	3

	1.	To give Introduction on Food Science	
Course	2.	To understand various cooking methods.	
Objectives	3.	To learn about Cooking qualities	
	4.	To Study about food additives and quality tests	
Unit - Untraduction to Food Science 9			9

#### **Unit - I Introduction to Food Science**

Definition of food. Nutrients - macro and micro constituents. Functions of foods. Food groups. Food Science - Definition - objectives and applications.

#### Unit - II Methods of cooking and sensory evaluation of foods

Methods of cooking - moist heat, dry heat and combination methods. Nutrient losses during cooking and processing. Sensory evaluation of foods - methods and applications.

#### Unit - III Cooking qualities of foods

Nutritive value, Factors affecting during cooking of foods- Cereals, pulses, nuts and oilseeds, vegetables, milk, meat, fish, egg and poultry. Spices and condiments – types – use in cookery

#### **Unit -IV Properties of foods**

Gelatinization, denaturation, colloids, emulsion, foam, sol, gel, fermentation, crystallization, enzymatic and non - enzymatic browning of foods. Antinutritional factors in foods.

#### Unit - V Food additives

Classification and role - preservatives, antioxidants, chelating agents, flour improvers, artificial sweeteners, flavours, colours, nutrient enhancement, stabilizers, emulsifier firming agent, leavening and releasing agent. Food fortification - enrichment - need - application in foods.

Cooking quality tests - cereals, pulses, vegetables, meat, poultry and fish - Gelatinization of starch -Denaturation of protein, stages of sugar cookery - formation of emulsion - enzymatic and non enzymatic browning. Leavening agents - clarifying agents - foam and its stability. Food enrichment.

#### **Total Instructional Hours**

45

- **TEXT BOOKS** 1. Potter, N. 2005. Food Science, CBS Publishers and Distributors, Delhi.
  - 2. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.

#### 9

9

9

#### **REFERENCE BOOKS**

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

#### CHAIRMAN / BOARD OF STUDIES

Programme	<b>Course Code</b>	Name of the Course	L	Т	P	С
BE/B.Tech	19PH2151	PHYSICS OF MATERIALS	2	0	2	3

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

Unit	Description	Instructional Hours
I	<b>SEMICONDUCTING MATERIALS</b> Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical	6
	properties of semiconductor – Light through optical fiber(Qualitative). Determination of band gap of a semiconductor Determination of acceptance angle and numerical aperature in an optical fiber	3 3
П	<b>MAGNETIC MATERIALS</b> Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications	6
	B - H curve by Magnetic hysteresis experiment	3
III	JPERCONDUCTING MATERIALS Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors –High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6

IV	<b>CRYSTAL PHYSICS</b> Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ULTRASONICS Dreduction Magnetectricitius generator Disposedestric concreter	6
	Determination of velocity using acoustic grating – Cavitations – Viscous force –	
V	co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing	
v	Determination of velocity of sound and compressibility of liquid – Ultrasonic	3
	wave	3
	termination of Coefficient of viscosity of a liquid –Poiseuille's method	
	Total Instructional Hours	45

	After completion of the course the learner will be able to
	CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor
Course	CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
Outcome	CO3: Discuss the behavior of super conducting materials
	CO4: Illustrate the types and importance of crystal systems
	CO5: Evaluate the production of ultrasonics and its applications in NDT

# **TEXT BOOKS:**

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

#### **REFERENCE BOOKS:**

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

**R2** - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

# CHAIRMAN / BOARD OF STUDIES

Programme	<b>Course Code</b>	Name of the Course	L	Т	P	С
BE/B.Tech	19CY2151	ENVIRONMENTAL SCIENCES	2	0	2	3

	1. To study about the natural resources, exploitation and its conservation
	2. To gain knowledge on the importance of environmental education, ecosystem and
	biodiversity.
G	3. To acquire knowledge about environmental pollution – sources, effects and control
Course	measures of environmental pollution.
Objective	4. To find and implement scientific, technological, economic and political solutions to
	environmental problems.
	5. To be aware of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
Ι	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 – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources, use of alternate energy sources – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and Desertification- role of an individual in conservation of natural resources.	б
п	<b>ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY</b> Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem - energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: Insitu and ex-situ conservation of biodiversity.	6
ш	<b>ENVIRONMENTAL POLLUTION</b> Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Marine pollution - Nuclear hazards – role of an individual in prevention of pollution.	б
IV	<b>SOCIAL ISSUES AND THE ENVIRONMENT</b> From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal solid waste. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management.	6
V	HUMAN POPULATION AND THE ENVIRONMENT Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS- remote sensing-role of information technology in environment and human health – Case studies.	6
	Total Instructional Hours	45

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

#### **TEXT BOOKS:**

T1- Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age International Publishers, New Delhi, 2014.

T2 – S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2018

#### **REFERENCES:**

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.

#### CHAIRMAN / BOARD OF STUDIES

		Name of the Course				
B.E	19CY1151	CHEMISTRY LAB – II	2	0	2	3

	1. Acquire practical skills in the quantitative analysis of water quality parameters.
Course	2. Acquire practical skills in the instrumental methods for quantitative
Objective	estimation of metal ion content.
	3. Gain knowledge in determination of rate of corrosion.

Expt. No.	Description of the Experiments (Any five experiments)	Practical Hours
1.	Determination of Dissolved Oxygen in water by Winkler's method.	
2.	Estimation of alkalinity of water sample by indicator method.	
3.	Determination of chloride content of water sample by argentometric method	
4.	Estimation of Copper by EDTA	
5.	Determination of sodium by flame photometry	

6.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).	
7.	Estimation of chromium in water sample using spectrophotometer.(Diphenyl carbazide method).	
	Total Practical Hours	30

# CHAIRMAN / BOARD OF STUDIES

Programme	Course code	Name of the course	L	Т	Р	C
B.E/B.Tech	19IT2151	PROGRAMMING IN C	2	0	2	3

	• To develop C Programs using Basic programming constructs
COUDEE	• To develop C programs using Arrays and Strings
OBJECTIVES	• To develop applications in C using Functions, Pointers and Structures
	• To do Input / Output and File handling in C
	• To develop C Programs using Basic programming constructs

UNIT	DESCRIPTION	INSTRUCTIO NAL HOURS
I	<ul> <li>Basics of C Programming</li> <li>Structure of C program - C programming: Data Types –Keywords – Variables</li> <li>Operators: Precedence and Associativity - Expressions – Input / Output statements Decision making statements - Looping statements – Pre-processor directives - Compilation process</li> <li>Programs using decision - making and Looping Constructs.</li> </ul>	5+4(P)
п	<ul> <li>Arrays And Strings</li> <li>Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations and String functions</li> <li>Programs Using Arrays and string functions.</li> </ul>	5+4(P)
Ш	<b>Functions And Pointers</b> Introduction to functions: Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers — Pointer to pointers – pointer to strings	5+4(P)

	Programs Using Functions and Pointers	
	Structures and Unions	
IV	Structure - Nested structures – Pointer to Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Typedef-Unions – Union of Structures	7+2(P)
	Programs Using Structures and Unions.	
V	File Processing	
	Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file – Command line arguments	7+2(P)
	Programs Using File concepts	
	TOTAL INSTRUCTIONAL HOURS	45

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

#### **TEXT BOOKS**

1. E. Balagurusamy – "Programming in ANSI C", Tata McGraw Hill, 7th Edition,201. ISBN 13: 9789339219666

2. ReemaThareja, — "Programming in C", Oxford University Press, Second Edition, 2016. ISBN 9780199456147

#### REFERENCES

- 1. Ashok.N.Kamthane,RajKamal ," Computer Programming and IT", Pearson Education (India),2012, ISBN -9788131799604
- 2. Paul Deitel and Harvey Deitel, —"C How to Program", Eighth edition,2012, Pearson PublicationISBN–9780132990448
- **3.** Kernighan, B.W and Ritchie, D.M, —The C Programming language, Second Edition, Pearson Education, 2012

ISBN 13: 9789332549449

4. Yashavant P. Kane tkar. " Let Us C", BPB Publications, 15<sup>th</sup> Edition , July 201, ISBN-13:978-8183331630

#### CHAIRMAN/BOARD OF STUDIES

Programme	Name of the Course	L	Т	Р	С
BE/B.Tech	19ME2001 & 19EE2001 ENGINEERING PRACTICES	0	0	4	2

# **OBJECTIVE:**

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

# **GROUP A (CIVIL & MECHANICAL)**

S.No	Description of the Experiments	
CIVII	CIVIL AND MECHANICAL ENGINEERING PRACTICES	
1	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.	
2	Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction	
3	Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction	
4	Preparation of arc welding of Butt joints, Lap joints and Tee joints.	
5	Practice on sheet metal Models- Trays and funnels	
6	Hands-on-exercise in wood work, joints by sawing, 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)**

S.No	Description of the Experiments
ELEC	TRICAL ENGINEERING PRACTICES
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5	Measurement of energy using single phase energy meter.
6	Soldering practice using general purpose PCB.
7	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function
1	Generator.
8	Study of Energy Efficient Equipment's and Measuring Instruments.
	Total Practical Hours 45

	After the completion of the course, the learner will be able to
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.
	• Determine the level of DO in a water sample.
	• Identify and estimate the different types of alkalinity in water sample.
	• Estimate the amount of copper in a water sample.

• Determine the metal ion content using instrumental methods.

# CHAIRMAN / BOARD OF STUDIES

Programme	<b>Course Code</b>	Name of the Course	L	Τ	Р	С
BE/B.TECH/III	19MA3102	FOURIER ANALYSIS AND TRANSFORMS (EEE, ECE, E&I, AGRI, BIO MEDICAL & FOOD TECHNOLOGY)	3	1	0	4

Course	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.
Objective	3. Apply the effective tools for the solutions of two dimensional heat equations.
objective	4. Apply Fourier transform techniques in various situations.
	5. Analyze Z transform techniques for discrete time systems.

Unit	Description	Instructional Hours
Ι	<b>FOURIER SERIES</b> 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
П	<b>BOUNDARY VALUE PROBLEMS</b> Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	<b>TWO DIMENSIONAL HEAT EQUATIONS</b> Steady state solution of two dimensional equation of heat conduction in infinite plate and semi circular plate.	12
IV	<b>FOURIER TRANSFORMS</b> Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity(Statement only).	12
V	<b>Z - TRANSFORMS AND DIFFERENCE EQUATIONS</b> 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

	CO1: Understand the principles of Fourier series which helps them to solve physical problems of
	engineering.
Course Outcome	CO2: Employ Fourier series in solving the boundary value problems.
Course Outcome	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:**

- 1. T1 Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd.,
- 2. Second reprint, New Delhi, 2012.
- 3. T2 Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi

#### 4. Publications Pvt Ltd, 2007

#### **REFERENCE BOOKS :**

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

#### **CHAIRMAN / BOARD OF STUDIES**

#### **PRINCIPAL/DEAN ACADEMIC**

#### SOIL SCIENCE AND ENGINEERING

### L T P C 3 0 0 3

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

#### UNIT I

**B.E. 19AG3201** 

#### 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

#### UNIT 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.

#### UNIT 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.

# UNIT IV

#### ENGINEERING PROPERTIES OF 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.

#### UNIT V

9

# 9

9

#### 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.

#### **TOTAL: 45 PERIODS**

#### **COURSE OUTCOMES:**

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

- Fundamental knowledge of soil physical parameters.
- The procedures involved in soil survey, soil classification.
- The phase relationship and soil compaction.
- Concepts of bearing capacity and slope stability.

#### **TEXTBOOKS:**

1. Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10<sup>th</sup> Edition, New York, 2008.

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

#### **REFERENCES:**

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

#### CHAIRMAN / BOARD OF STUDIES

#### PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	16AG3202	FLUID MECHANICS AND HYDRAULICS	3	1	0	4

Course Objective1. 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	bes of pumps
--	--------------

Unit	Description	Instructional Hours	
Ι	PROPERTIES OF FLUIDS	12	

	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.	
	<b>FLUID FLOW ANALYSIS</b> Types of fluid flow – velocity and acceleration of a fluid particle - Rotational –	
II	stream tube path line – streak line – flow net – velocity potential – stream function. Principles of conservation of mass – energy – momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion.	12
	FLOW MEASUREMENT	
ш	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	<b>OPEN CHANNEL FLOW</b> Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.	12
	DIMENSIONAL ANALYSIS AND PUMPS	
v	Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh's method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers – Reynolds, Froude, Euler, Mach and Weber - Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristic curves - submersible pumps – Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump- Hydraulic ram.	12
	Total Instructional Hours	60

Course Outcome	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 – Streeter V.L., Wylie E. B. and Bedford K. W., "Fluid Mechanics", Tata McGraw Hill Publishing Co. Ltd., 2017.
T2 - Modi P. N. and Seth S M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2013

T3 - Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

#### **REFERENCE BOOKS:**

R1 - Garde, R. J., "Fluid Mechanics through problems", New Age International Publishers (P) Ltd., New Delhi, 2002.

R2 - Kumar .K.L, "Engineering Fluid Mechanics", Eurasia Publishing House, 2002.

R3 - Jagdish Lal, "Hydraulic Machines". Metropolitan Book House, New Delhi, 2000.

#### CHAIRMAN / BOARD OF STUDIES

#### PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG3204	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	3	0	0	3

#### **COURSE OBJECTIVES:**

- 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 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

#### UNIT 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.

#### UNIT 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

9

#### UNIT 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, and special purpose crops such as those grown for green manure and fodder.

# UNIT 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.

#### **TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Students completing this course would have acquired knowledge on crop selection, crop production crop management.
- The students will have the required knowledge in the area of production of agricultural and horticultural crops.

#### **TEXTBOOKS:**

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

#### **REFERENCES:**

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

#### CHAIRMAN / BOARD OF STUDIES

#### PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	193251	UNIT OPERATIONS IN AGRICULTURAL PROCESSING	2	0	2	3

#### **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 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 UNIT 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 gascyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.

#### **UNIT 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.

#### UNIT IV

#### **CONTACTEOUILIBRIUM 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 – equipments

#### UNIT 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.

#### **TOTAL : 45 PERIODS**

#### **COURSE OUTCOMES:**

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

- •Fundamentals of various unit operations of Agricultural Processing.
- •Material handling equipments

#### **TEXTBOOKS:**

- 1. Earle, R.L., "Unit operations in Food Processing", Pergamon Press, Oxford, U.K, 1985.
- 2. McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill

9

9

#### 9
Inc., Kosaido Printing Ltd., Tokyo, 1990.

**3**. Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th Edition, Prentice Hall, 2003.

#### **REFERENCES:**

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

### **CHAIRMAN / BOARD OF STUDIES**

#### PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG3001	Field Crop Production Practical	0	0	4	2

**Course Objectives** 

- 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.

#### **List of Practicals**

**Practical 1** 4 Hours Identification of different crops, seeds, manures and fertilizers **Practical 2** 4 Hours Practicing cultivation of rice / maize / pulse crops to raise in new Agri. field area from seed to harvest **Practical 3** 4 Hours Identification of farm tools and implements, primary and secondary tillage **Practical 4** 4 Hours Practicing different methods of sowing and planting **Practical 5** 4 Hours Irrigation, fertilizer application and weed management practices **Practical 6** Biometric Observation **4 Hours** Practical 7 Working out Problems on seed rate, Fertilizer dose, Yield estion **Practical 8** 4 Hours Assessing maturity indices for harvesting of agricultural crops **Practical 9** 4 Hours Workout the cost of cultivation of major field crops. Practical 10 4 Hours Harvesting and post – harvest technology in field crops.

# Practical 11 4 Hours

Visit to multi crop station

#### Practical 12 4 Hours

Visit to private fields

#### **Total: 48 Hours**

#### **Course outcomes**

- 1. 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.
- 2. Utilize the knowledge on rainfed and dry land agriculture and precision farming.
- 3. 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.
- 4. Possess the knowledge on harvesting methods, pre cooling, packaging and storage of horticultural crops.

#### References

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

# CHAIRMAN / BOARD OF STUDIES

# PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG3002	SOIL SCIENCE LABORATORY	0	0	3	1.5

#### **COURSE OBJECTIVES:**

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

## **TOTAL : 30 PERIODS**

#### **COURSE OUTCOME:**

Students know the techniques to determine various physical and chemical properties of soil that are applicable for agriculture and irrigation by conducting appropriate tests.

#### **REFERENCES:**

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

#### **CHAIRMAN / BOARD OF STUDIES**

#### **PRINCIPAL/DEAN ACADEMIC**

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

#### **COURSE OBJECTIVE:**

To introduce the students to the different systems and working principles of tractor, power tiller, makes of tractors and power tillers.

#### **UNIT I TRACTORS**

Classification of tractors - Tractor engines - construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft - firing order combustion chambers. 9

#### **UNIT II ENGINE SYSTEMS**

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

#### **UNIT III TRANSMISSION SYSTEMS**

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

#### UNIT IV HYDRAULIC SYSTEMS

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

#### UNIT V POWER TILLER, BULLDOZER AND TRACTOR TESTING

Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors, power tillers and bulldozers. Bulldozer- salient features - turning mechanism, track mechanism, components - operations performed by bulldozers. Types of tests- test procedure - need for testing & evaluation of farm tractor -Test code for performance testing of tractors and power tillers. **TOTAL: 45 PERIODS** 

#### **COURSE OUTCOMES**

# 9

9

1. The students will be able to understand the various equipments and mechanizations used in the farm.

2. The students will have the knowledge on earth moving machinaries, tractor classification and tillage implements.

#### **TEXTBOOK:**

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

#### **REFERENCES:**

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

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

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

4. 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.

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

### CHAIRMAN / BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19ME4202	THERMODYNAMICS	3	0	0	3

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

Unit	Description	Instructional Hours
I	BASIC CONCEPTS OF THERMODYNAMICS	
	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
II	FIRST AND SECOND LAW OF THERMODYNAMICS	9

	First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility -Applications.	
	HEAT ENGINES	
ш	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	Upon completion of this course, the students can get a good knowledge and
Outcome	wisdom on different gas power cycles and use of them in IC and R&AC
	applications.

ТЕХ	KT 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.					
REF	REFERENCE BOOKS:					

R1	R.K.Rajput, "A Text book of Engineering Thermodynamics", Third Edition, Laxmi publication (P) Ltd., 2007.					
R2	2 Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.					
<ul> <li>R3 Domkundwar.S., C.P.Kothandaraman "A Course in Thermal Engineering", Fifth Editi Dhanpat Rai &amp; Co (p) Ltd, 2000.</li> </ul>						
CHA	AIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG4203	IRRIGATION AND DRAINAGE ENGINEERING	3	0	0	3

#### **COURSE OBJECTIVES:**

- 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 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

#### UNIT 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

#### UNIT 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.

#### UNIT 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. **UNIT V AGRICULTURAL DRAINAGE** 

Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy"s law infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

9

9

9

9

## **TOTAL: 45 PERIODS**

#### **COURSE OUTCOMES:**

The students will have knowledge and skills on Planning, design, operation and management of reservoir system.

The student will gain knowledge on different methods of irrigation including canal irrigation. □ **TEXTBOOKS:** 

- 1. Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
- 2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
- 3. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.
- 4. Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International

Institute of Land Reclamation and Improvement, Netherlands, 1994.

#### **REFERENCES:**

1. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.

- 2. Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998.
- 3. Bhattacharya, A.K., and Michael, A.M., "Land Drainage Principles, Methods and

Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.

4. Irrigation water Management, Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organisation, Rome 1996

5. Kessler, J., "Drainage Principles and Applications", Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands, 1979.

#### CHAIRMAN / BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	P	С
B.E	19MA4110	<b>STATISTICS &amp; NUMERICAL METHODS</b> (AGRI, BIO MEDICAL & FOOD TECHNOLOGY )	3	0	2	4

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

Unit	Description	Instructional Hours
Ι	<b>CORRELATION AND REGRESSION</b> Correlation – Karl Pearson's correlation coefficient – Spearman's Rank Correlation – Regression lines(problems based on Raw data only).	9
Π	<b>HYPOTHESIS TESTING</b> 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

	Total Instructional Theory Hours	45
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
IV	<b>INTERPOLATION</b> Interpolation: Newton's forward and backward difference formulae Lagrangian interpolation for unequal intervals – Divided differences- Newton's divided difference formula.	9

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				

	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
Course Outcome	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 ", 6<sup>th</sup> Edition , Khanna publishers, New Delhi 2004.

R3 - S.K.Gupta, Numerical Methods for Engineers", New Age Internationalm Pvt.Ltd Publishers, 2015.

#### CHAIRMAN / BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG4251	BIO - ENERGY RESOURCE TECHNOLOGY	3	0	0	3
COURSE	<b>OBJECTIVES:</b>					

To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.

Alcohol and ethanol production and Energy and Environment

# **UNIT 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.

# **UNIT II BIO ENERGY**

Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics -Biocatalysis -Kinetics of product formation.

# UNIT III BIO REACTORS AND FERMENTORS

Bio reactors/ fermentors - Batch type - continuous stirred tank reactors- Biological waste water treatment- Activated sludge process- Down stream processing-Recovery and purification of products.

# UNIT IV ALCOHOL PRODUCTION

Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis -Antibioticsenzymes-

principles of thermochemical conversion – combustion - pyrolysis- Gasification – types of gasifiers.

# UNIT 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.

# **COURSE OUTCOME:**

The students will be able to understand the concepts of bio energy sources and its applications.

# **TEXTBOOKS:**

1. Rai G.D, Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

2. Bouley James .E & David Follis - Biochemical Engineering Fundamentals Mc Graw-Hill publishing company, Tokyo.1986

# **REFERENCE:**

Chawla O.P., Advances in Biogas Technology ICAR publication New Delhi 1986 1.

# **CHAIRMAN / BOARD OF STUDIES** ACADEMIC

#### Т С Programme **Course Code** Name of the Course L Р 19CE4252 2 0 2 3 B.E. SURVEYING AND LEVELLING

# 9

# **TOTAL: 45 PERIODS**

**PRINCIPAL/DEAN** 

9

9

9

Course	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.
Objective	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
	<b>FUNDAMENTALS AND CHAIN SURVEYING</b>	
Ι	and chaining – Methods of ranging - well conditioned triangles - computation of cross sectional areas (Simpon's rule and Trapezoidal rule)	9
	Computation of area of the plot using Chain traversing	
	COMPASS AND PLANE TABLE SURVEYING	
Π	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
	LEVELLING	
III	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
	CONTOURING	
IV	Contouring - Methods – Characteristics and uses of contours - Plotting – Methods of interpolating contours – Earthwork calculations - Capacity of reservoirs - Mass haul diagrams. Grid Contouring.	9
	THEODOLITE AND MODERN SURVEYING	
V	Theodolite – components of theodolite - Temporary and permanent adjustments - Heights and distances by single plane and double method. <b>Computation of area by Theodolite Traverse</b> <b>Introduction to Total Station- Global Positioning System (GPS)</b>	9
	Total Instructional Hours	45

	Upon successful completion of the course, students shall have ability to
	CO1: Carryout preliminary surveying to prepare a layout of a given area.
Course	CO2: Apply compass surveying and plane table surveying.
Outcome	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.

#### CHAIRMAN / BOARD OF STUDIES

# PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG4001	IRRIGATION FIELD LABORATORY	0	0	4	2

### **OBJECTIVE**

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

LIST OF EXPERIMENTS	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	l) 4
10. To conduct experiment on disc filter for micro irrigation systems	4
	TOTAL: 48 hours

# LIST OF EQUIPMENTS REQUIRED

1. Meteorological lab with Cup counter anemometer, Sunshine recorder, Open pan vaporimeteF"r, Stevenson's screen - Dry bulb, wet bulb thermometers, recording and nonrecording type rain gauge etc. – each 1 no.

- 2. Double ring infiltrometer -1 no.
- 3. Digital infiltrometer 1 no.
- 4. Parshall flume, cut throat flume 1 no. each
- 5. V notch, Rectangular notch and trapezoidal notch -1 no. each
- 6. Drip irrigation system with all accessories
- 7. Sprinkler irrigation system with all accessories
- 8. Required number of stop watches
- 9. Weighing balance 1 no.
- 10. Catch cans, measuring jars required numbers

# **OUTCOME:**

On the completion of the course the student will have the knowledge on various meteorological instruments and understanding the concept of different irrigational systems in the laboratory tests.

# **REFERENCES:**

Michael, A.M., "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.
 Asawa, G.L., "Irrigation Engineering", New Age International Private Limited, New Delhi, 1996.

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

# CHAIRMAN / BOARD OF STUDIES

#### **V SEMESTER**

Sl.No	Course Code	Course Title	L	Т	P	С	CIA	ESE	TOT	Ca
									AL	teg
										ory
THEO	RY									
1	19AG5201	Farm Machinery and Equipment	3	0	0	3	25	75	100	PC
2	19AG5202	Refrigeration and Cold Chain Management	3	1	0	4	25	75	100	PC
3	19ME5203	Theory of Machines	3	0	0	3	25	75	100	ES
4	19AG53XX	Professional Elective-I	0	3	0	3	25	75	100	PE
THEO	RY WITH LABO	DRATORY COMPONENT								
5	19AG5251	Groundwater and Well Engineering	2	0	2	3	50	50	100	PC
6	19AG5252	Soil and Water Conservation Engineering	2	0	2	3	50	50	100	PC
LABO	RATORY ORAT	CORY COURSES								
7	19AG5001	Operation and maintenance of farm machinery Laboratory	0	0	3	1.5	50	50	100	PC
8	19AG5002	CAD for Agricultural Engineering	0	0	3	1.5	50	50	100	PC
		Total	16	1	10	22			800	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5201	FARM MACHINERY AND EQUIPMENT	3	0	0	3

Course Objective	• To introduce the students to the working principles of farm Machinery tillage implements. (Primary and Secondary)
	• 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	
п	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				rs	45							
<b>Course Outcome</b>	•	The	students	will	be	able	to	perceive	the	role	and	significance	of

mechanization in sustaining agricultural production
• The students will get acquainted the contextual usage of various equipment used in the farm for different field operations.

TEX	TEXT BOOKS				
T1	Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors				
T2	Michael and Ohja. Principles of Agricultural Engineering. Jain brothers				
REF	REFERENCE BOOKS				
R1	R1 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.				
R2	R2 Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.				
R3	R3 Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990				

# CHAIRMAN/BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5202	REFRIGERATION AND COLD CHAIN MANAGEMENT	3	0	0	3

Course Objective	<ul> <li>To understand the principles of unit operations involved in different Refrigeration and cold storage systems and its components.</li> <li>To impart basic knowledge on design and maintenance aspects related to cold storage systems.</li> </ul>
---------------------	--

Unit	Description	Instructional Hours
	<b>REFRIGERATION PRINCIPLES</b>	
Ι	Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - simple vapour compression cycle – T-S diagram – P-H chart - application of refrigeration.	9
II	VAPOUR COMPRESSION REFRIGERATION AND	9

	COMPONENTS	
	Vapour compression system - refrigeration components – compressor and condenser – types, construction and working - expansion device and evaporators – types, construction and working.	
	REFRIGERANTS AND VAPOUR ABSORPTION CYCLE	
ш	Refrigerants – properties – classification – comparison and advantages – chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants - vapour absorption cycle – theoretical - deviation in practice - Electrolux refrigerator – construction and principles.	9
	SHELF – LIFE OF FOOD PRODUCTS	
IV	Defining overall Shelf-life, remaining shelf life in the context of Chilled & Frozen foods; - Deterioration modes of food items; Models of quality deteriroration-Kinetic model; shelf-life model; $Q_{10}/q_{10}$ model; TTT model for the remaining shelf – life; General procedure for shelf – life testing – the 11 steps procedure. Storage of frozen foods; - Basic design requirements of storage to uphold the shelf –life – size , insulation, entry –exit position, palletization, proper disk-space for air-circulation, automatic door – closing, proper lighting, temperature monitoring and recording facility; stacking systems, emergency exits, material handling devices like fork-lifts, pallet trucks, etc floor heaters, vapour barriers, etc.	9
	COLD CHAIN MANAGEMENT	
V	The premises of cold chain - Need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Temperature limits;-in various countries-Europe, US, Australia etc; Chilling and freezing;- Chilling injury, cook-chilling systems; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators(TTI); Time –temperature –correlation-the kinetic approach, effective temperature; Transportation regulations; Role of packaging in cold chain– MAS, MAP, CAS, CAP etc; Thaw indicators.	9
	Total Instructional Hours	45
L		

<b>Course Outcome</b>	• Upon completion of this course, the students will be able to demonstrate the
	<ul> <li>operations in different Refrigeration &amp; cold storage systems</li> <li>They will also able to design Refrigeration &amp; Cold storage systems.</li> </ul>

\_

TEX	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.				
Т3	Kennedy, Christopher J. "Managing Frozen Foods". CRC / Woodhead Publishing, 2000.				
REF	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	R4 Stringer, Mike and C. Dennis. "Chilled Foods: A Comprehensive Guide". 2nd Edition, CRC / Woodhea Publishing, 2002.	

# CHAIRMAN/BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19ME5203	THEORY OF MACHINES	3	0	0	3

Course Objective	<ul> <li>To understand the purpose of kinematics, Kinematic joint and mechanism and to study the relative motion of parts in a machine without taking into consideration the forces involved.</li> <li>To understand the theories and applications of cams and Flywheels.</li> <li>To understand applications of different types of gears and gear profiles and its efficiency and gear trains.</li> </ul>
	• 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
III	GEARS AND GEAR TRAINS	
	Law of toothed gearing – Involutes and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio –	9

	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.		
	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	

<ul> <li>Course Outcome</li> <li>Classify mechanisms and inversions and determine mobility of a mechanism.</li> <li>Construct cam profiles for various followers and turning moment diagr flywheel.</li> <li>Evaluate the sensitivity of governor.</li> </ul>	am for
---	--------

-

TEXT BOOKS			
T1	Ratan.S.S, "Theory of Machines", Tata McGraw Hill Publishing company Ltd., 2 <sup>nd</sup> Edition, 2005.		
T2	Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 3rd Edition, 1984.		
REF	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	K4 Khurmi R.S., "Theory of Machines" Khanna Publishers, Delhi, 2006.		
СНА	IRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

Programme	Course Code	Name of the Course		Т	Р	С
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 ٠ engineering problems, planning and management.
- Soft computing techniques for modeling different problems in the field agricultural engineering.

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	
п	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	
ш	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

<b>Course Outcome</b>	Upon completion of the course, the student will have the knowledge on system concepts
	and will be able to apply the optimization techniques like LP, DP, FL and GA for problems
	in agriculture.

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.				
Т3	Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.				
REF	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.				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5302	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	3	0	0	3

Course Objective	<ul> <li>To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.</li> <li>Importance of science, food security and ecological balance.</li> </ul>
---------------------	---

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 – Monocropping – Multiple Cropping – Mixed Cropping - land degradation – causes and effects – delineation of Agricultural Lands – Lands for non-agricultural purposes – Forests and Wild Life areas – Coastal buffers – Usable Waste Lands – Industrial Zones – Sand dunes and Deserts – Urban space for Greenery and	9

	crop production – Terrace Cultivation prospects – Heat Island effects.	
	SUSTAINABLE WATER RESOURCES	
п	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 – Rainfall Runoff water harvesting – Lakes and Ponds – System and non-system Tanks – Farm Ponds, Check Dams and Percolation Ponds – Water Quality Indexing	9
	SUSTAINABLE RURAL AND URBAN FARMING	
ш	Agro-ecosystems - Impact of climate change on Agriculture, Effect on crop yield, effect on 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 – principles and practices – 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 – Rainwater Harvesting – Biomechanical Filters – Water Quality Indexing for domestic and agricultural usage – Wastewater treatment and recycling procedures.	9
	Total Instructional Hours	45

Course Outcome	• Upon completion of this course, the students will gain knowledge on the need for sustainable agriculture
	• They will be able to comprehend the need for food security on global level and the Nutritional Security.
	• The students will be able to demonstrate how ecological balance is required for sustainability of agriculture.

TEX	TEXT BOOKS							
T1	M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.				2010.			
T2	B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.							
REF	ERENCE I	BOOKS						
R1	Swarna S	.Vepa etal., Atlas o	f the sustainability of food security.	MSSRF, Chenna	i, 2004.			
R2	Sithampa Scitech Pu	ranathan, J., Renga iblications, Chenna	samy, A., Arunachalam, N. Ecosyst i, 1999.	em principles and	sustair	able a	gricult	ure,
R3	R3 Tanji, K. K., and Yaron, B. Management of water use in agriculture, Springer Verlag, Berlin, Germany, 1994.				,			
СНА	IRMAN/B	OARD OF STUDI	IES	PRINCIPA	L/DEA	N AC	ADEM	пс
Р	rogram	Course Code	Name of the Cour	rse	L	Т	Р	С
B.E. 19AG5303 CDM AND CARBON T TECHNOLOG		RADING Y	3	0	0	3		

- Course Objective • To
  - To know the basics, importance of clean development mechanism (CDM)
  - To know the concept of carbon trading

Unit	Description	Instructional Hours
	GREEN HOUSE GASES AND ENVIRONMENTAL CHANGE	
Ι	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	
П	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	
ш	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	• Examine the effects of greenhouse gas emission and explain the responsibilities of countries in GHG emission.
	• Outline the KYOTO PROTOCOL and develop clean development mechanism (CDM) projects.
	• Explain the features of CDM and employ monitoring and auditing techniques on CDM projects.
	• Develop guidelines for small scale and Land Use, Land Use Change and Forestry (LULUCF) CDM projects.
	• Compare the alternate techniques for lowering carbon emission.

T BOOKS
MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book- Vol.1, UNEP publication, 2005
Myungkyoon Lee, Information and Guide Book - the UNEP project CD4CDM-UNEP publication, June 2004.
ERENCE BOOKS
Manual for project developers and policy makers-UNFCCC Publication, 2007
Aukland L, Bass S, Hug S, Landell Mals N, Tipper R, Laying the Foundations for clean Development, Preparing the Land use sector London, 2002
Carbon sequestration in dryland soils, World Soil Resources report No.102, Food and Agriculture Organization, Rome, 2004.

#### CHAIRMAN/BOARD OF STUDIES

Program	Course Code	Name of the Course	L	Т	Р	C
B.E.	19AG5304	IT IN AGRICULTURAL SYSTEMS	3	0	0	3

Course	• To impart the knowledge of electronic devices for the purpose automation in agricultural practice.
Objective	• To develop AI to control agricultural system and its management.

Unit	Description	Instructional Hours
	BASIC ELECTRONICS CIRCUITS	
Ι	Passive devices -semi conductor devices - transistors - diode circuits - amplifier circuits- oscillator circuits- thyristor circuits-Integrated circuits and operational amplifier - logic gates - flip flop – counters digital to analog - analog to digital converters microprocessor introduction	9
	PRECISION FARMING	
Π	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	
ш	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,	9

Rural development and information society - Internet application tools and web technology.	
Total Instructional Hours	45

Course Outcome	During this course, students will be trained :
	<ul> <li>To know the Basic of Electric Circuits and importance Precision Farming.</li> <li>Understand about e-governance and agricultural systems management.</li> </ul>

TEX	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.					
REF	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.					
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5305	ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	3	0	0	3

Course	<ul> <li>The objectives of the study of ergonomics are to optimize the integration of man and machine so as to improve the work rate and accuracy.</li> <li>Machinemy Equipment and control devices in such a manner in order to</li> </ul>
Objective	• Machinery, Equipment and control devices in such a manner in order to minimize physical and mental strain on the individuals/workers there by improving the efficiency.

Unit	Description	Instructional Hours
	ERGONOMICS AND ITS APPLICATION	
Ι	Ergonomics –Introduction –important –Human metabolism- energy liberation in human body- energy content of nutrient – energy release –energy for storage and energy work- application of ergonomics in	9

	farm machinery design.	
II	SKELETAL STRUCTURE OF HUMANBase of human motor activities –the skeletal structure- skeletal musclesystem- muscle metabolism- physiological stress- efficiency of work –age and individual deference in physical function.	8
ш	<b>ENERGY EXPENDITURE</b> Physiological and operational criteria of physical activity- energy expenditure of activities –keeping energy expenditure within in bounds.	8
IV	MOVEMENT OF BODY MEMBERS Movement of body members and strength and endurance of movements – speed and accuracy of movements –time and distance of movements.	8
V	ANTHROPOMETRY Anthropometry –types of anthropometrical data- terminology – anthropometric measurement techniques- percentile- application of anthropometric data- anatomical reference position-standard reference terminology-anthropometric consideration in tool/ equipment design- displays and controls location of controls in tractor.	12
	Total Instructional Hours	45

<b>Course Outcome</b>	During this course, students have an ability to design a system, component, or process to
	meet accepted human factors and workplace ergonomics standards within realistic constraints
	such as economic, environmental and safety, manufacturability and sustainability.

TEXT BOOKS					
T1	Mark S.Senders, Ernest J.Mccormick (1975) human factors in Engineering Design.				
T2	McGraw Hill Book co., New York 2. Wesley E.Woodson	n (1981),Human factors design hand book,			
REF	REFERENCE BOOKS				
R1	Robert W.Bailey (1992).Human performance Engineering .PTR Prentice Hall, Englewood cliffs, New Jersey.07632.				
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
-----------	-------------	--------------------	---	---	---	---

B.E.	19AG5251	GROUNDWATER AND WELL ENGINEERING	2	0	2	3
Course Objective	<ul> <li>To hydr</li> <li>To u</li> </ul>	understand the theories and applications of groundw raulics understand about groundwater exploration and recharge understand the Groundwater quality criteria.	vater d	ynami	cs and	l well

Unit	Description	Instructional Hours
т	GROUNDWATER DYNAMICS Ground water development and potential in India – Groundwater theory - Types of Aquifers: Unconfined (Water Table) Aquifer – Phreatic Surface - Confined	9
	(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.	
	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	
ш	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
	CONSTRUCTION AND MAINTENANCE 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 – 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.	9
	GROUNDWATER QUALITY	
v	Solute Transport and Contamination sources - Geochemical Survey – Water sampling - Groundwater quality criteria – Agricultural, Industrial and Domestic requirements – EC, pH, CEC, SAR, TDS,TSS - Water Quality Indexing - Ground water pollution and legislation – Water Quality enhancements – FAO and WHO guidelines.	9

	Total Instructional Hours45
Course Outcome	• Students' knowledge base gets enriched with the technical aspects of groundwater,

	its availability, assessment and utilization
•	Better exposure to the theory behind well design, construction and water quality
	management is ensured.

TEX	TEXT BOOKS				
T1	Karanth, K.R. Groundwater Assessment, Development and Mana	agement. Tata Mc-Graw Hill, 2008.			
T2	Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2	2000.			
REF	ERENCE BOOKS				
R1	R1 Rastogi, A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008				
R2	2 David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007				
R3	R3 Fletcher.G.Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5252	SOIL AND WATER CONSERVATION ENGINEERING	2	0	2	3

Course	• To impart a thorough knowledge and understanding of the basic causes of soil erosion and the relevant mitigation strategies.
Objective	• To enable the students to design appropriate watershed based soil conservation structures and rainwater harvesting systems.

Unit	Description	Instructional Hours
	MECHANICS OF WATER AND WIND EROSION	
I	Soil Erosion – Causes and Conservation status in India - Mechanics of water erosion – Raindrop Splash erosion - Kinetic Energy of Raindrops - usage of Automatic Rain Gauge Chart - Sheet erosion, Rill erosion, Gully erosion and Ravines - Stream bank erosion – Classification of Gully - Mechanics of Wind Erosion - sand dunes and desertification – Special forms of Erosion – Landslides – Mass movements – Pedestal Erosion –	9

	Pinnacle Erosion – Soil Piping .	
	ESTIMATION OF SOIL LOSS	
п	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	
ш	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.	9
	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 – Wind Erosion Sand Dunes and Desertification.	9
	Total Instructional Hours	45

Course Outcome	• The students will be able to gain fundamental knowledge on the concepts of erosion and sedimentation.
	• They get enriched with knowledge on Hydrologic, Hydraulic and Structural designs of soil and water conservation measures and Rainwater harvesting systems.

TEX	T 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.				
Т3	"Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.				
REF	ERENCE BOOKS:				
R1	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	R3 Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, Ne Delhi, 2002				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5001	OPERATION AND MAINTENANCE OF FARM MACHINERY LABORATORY	0	0	3	1.5

Course Objective	<ul> <li>The students will be introduced to the practice of different farm machinery in the field on</li> <li>Tillage, sowing, plant protection, harvesting and threshing</li> <li>Care and maintenance; lubrication</li> <li>Fits and tolerances and replacements</li> <li>Adjustments of farm machines</li> </ul>
	• Dismantling and reassembling of a disc harrow, seed-cum fertilizer drill, and sprayer and engine pumps.

S.NO	LIST OF EXPERIMENTS	
1	Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.	
2	Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller procedure for starting, running and stopping the power tiller.	
3	Field operation and adjustments of ploughs	
4	Field operation and adjustments of harrows	
5	Field operation and adjustments of cultivators	
6	Field operation of sowing and planting equipment and their adjustments	

7	Field operation of plant protection equipment
8	Field operation on mowers and reapers
9	Field operation of combine and determination of field losses
10	Field operation of threshers and their performance evaluation
11	Studies on methods of repair, maintenance and off-season storage of farm equipment
12	Opening and reassembly of disc harrows, determination and adjustment of tilt and disc angles
13	Hitching of agricultural implements and trailers
14	Study and operation of bulldozer
15	Visit to agro-manufacturers

Course Outcome	During this course, students have an ability		
	<ul> <li>To identify farm equipment</li> <li>To calculate and predict the actual field problem during the operation.</li> <li>To trained to do adjustments of farm implements and Hitching of agricultural implements and trailers.</li> </ul>		

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

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.			
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC			

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG5002	CAD FOR AGRICULTURAL ENGINEERING	0	0	4	2

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

S.NO	LIST OF EXPERIMENTS	
1	Design and Drawing of Underground pipeline system	
2	Design and Drawing of Check dam	
3	Design and Drawing of Mould board plough	
4	Design and Drawing of Disk plough	
5	Design and Drawing of Post harvest technology units (threshers and winnowers)	
6	Design and Drawing of Biogas plant.	
7	Introduction & demonstration on 3D modeling softwares like Pro/E, Creo, Solid works, Solid Edge etc.	

Course Outcome	<ul> <li>The student will be able to understand the plan and layout of underground pipes, post harvesting units and check dams.</li> <li>The students also will be able to design and draw the components using computer aided methods.</li> </ul>
-------------------	--

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

REI	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.		
R4	Vijay Duggal. "A general guide to Computer Aided Design & Drafting, Mailmax Publications, 2000		
R5	Tadeusz Stolarski et al. "Engineering Analysis with ANSYS Software", Butterworth Heinemann Publications, 2006		
R6	Louis Gary Lamit, "Introduction to Pro/ENGINEER" SDC Publications, 2004.		
СН	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

#### **VI SEMESTER**

Sl.No	Course Code	Course Title	L	Т	Р	С	CIA	ESE	TOT AL	Ca teg ory
THEO	RY									
1	19AG6201	Hydrology and Water	3	0	0	3	25	75	100	ES
		Resources Engineering								
2	19AG6202	Solar and Wind Energy	3	1	0	4	25	75	100	PC
		Engineering								
3	19AG6181	Professional Ethics	3	0	0	3	25	75	100	HS
4	19AG63XX	Professional Elective-II	3	0	0	3	25	75	100	PE

5	19XX64XX	Open Elective-I	3	0	0	3	25	75	100	OE
THEO	RY WITH LABO	DRATORY COMPONENT								
6	19AG6251	Food and Dairy Engineering	2	0	2	3	50	50	100	PC
LABOI	RATORY ORAT	CORY COURSES								
7	19AG6252	ICT in Agricultural Engineering	0	0	4	2	50	50	100	PC
8	19AG6701	Industrial Training	0	0	0	1				EE C
		Total	17	1	6	22			700	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6201	HYDROLOGY AND WATER RESOURCES ENGINEERING	3	0	0	3

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

Unit	Description	Instructional Hours
	PRECIPITATION AND ABSTRACTIONS	
I	Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.	9
	F RUNOFF	
п	Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH	9
	FLOOD AND DROUGHT	
ш	Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method- NDVI analysis- Drought Prone Area Programme (DPAP)	9
	RESERVOIRS	
IV	Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs –	9

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

Course Outcome	The students completing the course will have
	• An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
	• Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.
	<ul> <li>Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs</li> </ul>
	• Understand the concept and methods of ground water management.

TEX	T BOOKS	
T1	Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2	010
T2	Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.	
Т3	Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", International Book Company, 1995.	McGraw Hill
REF	ERENCE BOOKS	
R1	David Keith Todd. "Groundwater Hydrology", John Wiley & Sor	ns, Inc. 2007
R2	Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydro International Book Company, 1998.	logy", McGraw Hill
R3	Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.	
СНА	IRMAN/BOARD OF STUDIES	PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6202	SOLAR AND WIND ENERGY ENGINEERING	3	1	0	4

Objective

its applications, alternate energy sources etc,

Unit	Description	Instructional Hours
Ι	Solar radiation avaiLaboratory ility status - radiation measurement – transmittance - absorptance – flat plate collectors - heat transfer correlations - collector efficiency - heat balance – absorber plate – types - selective surfaces. Solar driers – types – heat transfer - performance of solar dryers – agro industrial applications - liquid flat plate collectors - their performance.	9
II	SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY Optically concentrating collectors – types – reflectors - solar thermal power stations – principle and applications - solar stills - types - solar pond - performance – characteristics – applications – solar refrigeration. Photovoltaics - types – characteristics – load estimation - batteries – invertors – operation - system controls. PV system installations – standalone systems - PV powered water pumping – system sizing and optimization - hybrid system - solar technologies in green buildings.	9
III	WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND Nature of wind – wind structure and measurement - wind power laws - velocity and power duration curves - aero foil - tip speed ratio - torque and power characteristics power coefficients – Betz coefficient.	9
IV	WIND MILL DESIGN AND APPLICATIONS Turbines - Wind mill – classification– power curve. Upwind and downwind systems - transmission rotors – pump - generators - standalone system - grid system – batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.	9
V	ALTERNATE ENERGY SOURCES Ocean energy- off shore and on shore ocean energy conversion technologies- OTEC principles – open and closed cycles. Tidal energy – high and low tides – tidal power- tidal energy conversion schemes. Geothermal energy – resources – classification and types of geothermal power plants - Nuclear energy – reactions – fusion fission hybrid. Fuel cell – principle and operation – classification and types. Energy storage – pumped hydro and underground pumped hydro – compressed air - battery – flywheel.	9
	Total Instructional Hours	45

Course Outcome	<ul> <li>Define basic properties of different renewable sources of energy and technologies for their utilization,</li> <li>Describe main elements of technical systems designed for utilization of renewable sources of energy</li> </ul>
	<ul> <li>Explain the correlation between different operational parameters</li> </ul>

<ul> <li>Select engineering approach to problem solving when implementing the projects or renewable sources.</li> </ul>	
---	--

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				
Т3	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.				
CHAIRMAN/BOARD OF STUDIES		PRINCIPAL/DEAN ACADEMIC			

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6181	PROFESSIONAL ETHICS	3	0	0	3

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

Unit	Description	Instructional Hours	
I	HUMAN VALUES	9	
	Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue		
	<ul> <li>Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage –</li> <li>Valuing time – Cooperation – Commitment – Empathy – Self confidence –</li> <li>Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.</li> </ul>		
-----	--	----	
	ENGINEERING ETHICS		
Π	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	

<b>Course Outcome</b>	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.

-

TEX	TEXT BOOKS		
T1	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.		
Т2	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.		
СНА	IRMAN/BOARD OF STUDIES	PRINCIPAL/DEAN ACADEMIC	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6301	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

Course Objective	<ul> <li>To know the basics, importance of global warming</li> <li>To know the concept of mitigation measures against global warming</li> <li>To learn about the global warming and climate change.</li> </ul>
---------------------	--

Unit	Description	Instructional Hours
	EARTH'S CLIMATE SYSTEM	
Ι	Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect - Radioactive effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.	9
	ATMOSPHERE AND ITS COMPONENTS	
II	Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability - Temperature profile of the atmosphere-Lapse rates-Temperature inversion - inversion on pollution dispersion.	9
	IMPACTS OF CLIMATE CHANGE	
ш	Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem –Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.	9
	OBSERVED CHANGES AND ITS CAUSES	
IV	Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC– IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .	9

V	Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW) & Bio waste – Biomedical Industrial waste – International and Regional	9
	(MSW) & Bio waste - Biomedical, Industrial waste – International and Regional cooperation.	
	Total Instructional Hours	45

Course Outcome	After successful completion of this course students are expected to be able to:		
	<ul> <li>Demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale</li> <li>Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts</li> <li>Understand and critically evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation,</li> </ul>		

TEX	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			
Т3	Dash Sushil Kumar, Climate Change – An Indian Perspective, Cambridge University Press India Pvt. Ltd, 2007			
REF	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 / Acade	emic Press 2006.		
R3	IPCC Fourth Assessment Report – The AR4 Synthesis Report			
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC			

Program	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6302	HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERS	3	0	0	3

Г

1

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

٦

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	
Π	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	
ш	Radiation heat transfer - concept of black and grey body-Laws of Radiation - Stefan-Boltzmann Law, Kirchhoff's Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields	9
	HEAT EXCHANGERS	
IV	Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient	9
v	MASS TRANSFER	
	Mass transfer- introduction - Fick law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases - diffusion through a varying cross sectional area- diffusion coefficients for gases - molecular diffusion in liquids.	9
	Total Instructional Hours	45

• Understand conduction, students will able to in different geometries

Course Outcome	<ul> <li>Asses the concepts and types of conversion in heat transfer mechanism</li> <li>Recognize the radiation problems in various geometries</li> <li>Analyze the performance of heat exchangers and evaporators</li> <li>Understand the various modes of mass transfer and apply them in engineering problems</li> </ul>
	problems

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				
REF	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	R3 Heat and Mass Transfer, S Chand and Company, New Delhi, 2009				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6303	DISASTER MANAGEMENT	3	0	0	3

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

Unit	Description	Instructional Hours
_	SITUATIONAL DISASTERS	
	Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc -Classification, Causes, Impacts	9

	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.	
	DISASTER RISK REDUCTION (DRR)	
п	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
	VULNERABILITIES, IMPACTS AND DEVELOPMENTS	
ш	Factors influencing Disaster Vulnerabilities - differential impacts - Development projects - dams, embankments, Highways - Land use – Electricity Power Lines - Industrialization - Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.	9
	DISASTER RISK MANAGEMENT	
IV	Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements(Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.	9
	CATEGORICAL CASE STUDIES	
V	Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.	9
	Total Instructional Hours	45

Course Outcome	The students will be able to
	<ul> <li>Differentiate the types of disasters, causes and their impact on environment and society</li> <li>Assess vulnerability and various methods of risk reduction measures as well as mitigation.</li> <li>Draw the hazard and vulnerability profiles and Scenarios in the Indian context for Disaster damage assessment and management.</li> </ul>

TEXT BOOKS

T1	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN				
T2	2 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN				
Т3	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.				
REF	REFERENCE BOOKS				
R1	R1 Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005				
R2	Government of India, National Disaster Management Policy, 2009.				
CHA	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6304	HORTICULTURAL CROP PROCESSING	3	0	0	3

	• To impart knowledge and skill to the students on different unit operations in processing of horticultural crops
Course Objective	• To make the students understand the working principles of different machineries used for processing of fruits, vegetables and spices
	• 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
П	PRELIMINARY PROCESSING SEQUENCES	
	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 -	9

	effects on food (nutrition, colour, pigment,texture).	
	CHILLING AND FREEZING PRELUDES	
Ш	Chilling and freezing: Application of refrigeration in different perishable food products - Thermophilic, mesophilic & Psychrophilic micro-organisms - Chilling requirements of different fruits and vegetables - Freezing of food - freezing time calculations – slow paced and fast freezing - Equipment for chilling and freezing (mechanical & cryogenic) - Effect on food during chilling and freezing, Cold Storage - heat load calculations - cold storage design - refrigerated vehicle and cold chain system.	9
	DRYING AND PACKAGING	
IV	Dryers for fruits and vegetables, Osmo-dehydration; Handling and transportation of fruits and vegetables, Pack house technology, Minimal processing; Common methods of storage, Low temperature storage, evaporative cooled storage, Controlled atmospheric storage, Modified atmospheric packaging; Post harvest management and equipment for spices; Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials commonly used for raw and processed fruits and vegetables products, bulk and retail packages and packaging machines.	9
	GRADES AND QUALITY CONTROL	
v	Quality control in Fruit and vegetable processing industry - Study of fruit graders, Study of peeler and slicer, Study of juicer and pulper - Study of blanching equipment, Testing adequacy of blanching - Study of cold storage and its design - Study of CAP and MAP storage - Minimal processing of vegetables - Preparation of value added products.	9
	Total Instructional Hours	45

Course Outcome	By the end of the course the students will be able to			
	<ul> <li>Use the different types of sorting, grading, peeling, slicing, blanching and other equipment for processing of fruits and vegetables</li> <li>Identify the suitable equipment, materials and methods for storage, processing, packaging and value addition of fruits and vegetables</li> <li>Develop at least 4 types of value added products from fruits and vegetables</li> <li>Understand the technical and management aspects of operation of fruits and vegetable processing industries.</li> </ul>			

TEX	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	3 Fellows, P. 2008. Food Processing Technology. Woodhead		
CHAIRMAN/BOARD OF STUDIES		PRINCIPAL/DEAN ACADEMIC	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6305	ORGANIC FARMING TECHNOLOGIES	3	0	0	3

Course Objective	<ul> <li>To study the historical, physio chemical, biological and ecological basis of organic farming including various crop and soil management practices</li> <li>To study the agronomic practices and techniques for different crops, cropping systems under organic farming</li> </ul>
	• To introduce the concepts related to the legislation, inspection certification and marketing of organic produces

Unit	Description	Instructional Hours
	INTRODUCTION	
Ι	Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture;	9
П	ORGANIC ECOSYSTEM AND CONCEPTS	
	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 avaiLaboratory le in the ecosystem and their management.	9
III	NUTRIENTS, PESTS AND DISEASE MANAGEMENT	
	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

IV	CERTIFICATION PROCESS		
	Operational structure of NPOP; Certification process; standards of organic farming; Criteria	9	
v	ECONOMICS		
	Processing, leveling, economic considerations and viability, marketing and export potential of organic products- Cost estimation and evaluation	9	
	Total Instructional Hours	45	

Course Outcome	<ul> <li>Students gained knowledge on the concepts of organic farming</li> <li>Students gained the knowledge on the crop management practices and technologies of various crops and cropping systems</li> <li>Students learnt the standards, certification process and marketing strategy of organic produces.</li> </ul>
----------------	---

ТЕХ	TEXT BOOKS:			
T1	Das, D.K., 2011. Introductory Soil Science (3rd Edition), Kalyani Publisher, Ludhiana (India).			
T2	alkar 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.			
CHA	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC			

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG401	<b>RESEARCH METHODOLOGY</b>	3	0	0	3

	The main objective is to find out the truth which is hidden and which has not been discovered as yet.
Course Objective	To give the work plan of research
	To provides training in choosing methods materials, scientific tools and techniques relevant to the solution of the problem.

Unit	Description	Instructional Hours
	INTRODUCTION TO RESEARCH	
Ι	process of research-Research applications in social and business sciences- responsibility of ethics in research.	6
	RESEARCH PROBLEM AND DATA COLLECTION	
п	Defining the Research problem- Components of the research problem- Problem identification process-Classification of Data- Secondary Data- Primary Data Collection –method of data collection-Observation method-Focus Group discussion- Personal Interview method.	9
	RESEARCH DESIGN	
III	Classification of Research Designs-Exploratory Research Designs- Descriptive Research Designs- Questionnaire Design. Attitude Measurement and Scaling.	9
	SAMPLING AND DATA PROCESSING	
IV	Sampling concepts-Sampling Design- Probability and Non Probability Sampling design- Determination of Sample size - Estimating the population proportion-Data Editing-Testing of Hypotheses -Analysis of Variance	12
	RESEARCH REPORT WRITING	
V	Types of research reports – Brief reports and Detailed reports; Report writing- Structure of the research report- Preliminary section, Main report-Interpretations of Results and Suggested Recommendations- Report writing-Formulation rules for writing the report- Guidelines for presenting tabular data, Guidelines for visual Representations.	9
	Total Instructional Hours	45

Course Outcome	By the end of the course the students will be able to			
	<ul> <li>Understanding the nature of problem.</li> <li>Reviewing literature to understand how others have approached</li> <li>Collecting data in an organized and controlled manner so as to arrive at valid decisions.</li> <li>Analyzing data appropriate to the problem.</li> </ul>			

TEXT BOOKS			
T1	Dr. Shajahan S. (2006) Research Methods for Management, JAICO publishing house.		
T2	Kothari C.R. (2014) Research Methodology Methods & Techniques, New age international publisher.		
Т3	Panneerselvam, R (2014) Research Methodology, PHI Pvt. Ltd, New Delhi.		

REFERENCE BOOKS		
R1	Wilson J. (2010) Essential of Research Methods, SAGE Publication.	
R2	Chawla D. & Sondhi N. Research Methodology Concepts and Cases, S. Chand & Company Ltd.	
R3	Sachdeva J.K. (2017) Business Research Methodology, Himalya Pulishing.	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6251	FOOD AND DAIRY ENGINEERING	2	0	2	3

Unit	Description	Instructional Hours
	PROPERTIES AND PROCESSING OF MILK	
I	Dairy Industry – importance and status – Milk Types – Composition and properties of milk - Production of high quality milk - Method of raw milk procurement and preservation - Processing –Staining - Filtering and Clarification - cream separation – Pasteurization – Homogenization -sterilization, UHT processing and aseptic packaging – emulsification - Fortification.	9
	DAIRY PRODUCTS	
п	Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk – Buttermilk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal.	9
	FOOD AND ITS PROPERTIES, REACTION AND KINETICS	
ш	Constituents of food - thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning - Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves - water activity, sorption behaviour of foods – isotherm models - monolayer value, BET isotherms, Raoult's law, Norrish, Ross, Salwin - Slawson equations.	9

	PROCESSING AND PRESERVATION OF FOODS	
IV	Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.	9
	PACKAGING AND QUALITY CONTROL	
V	Food packaging, importance, flexible pouches - retort pouches - aseptic packaging, granules, powder and liquid packaging machines - nanotechnology – principles - applications in food processing – food plant location - Quality control of processed food products - Factors affecting quality.	9
	Total Instructional Hours	45

TEX	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.				
Т3	Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1999.				
REF	ERENCE BOOKS				
R1	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.				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6252	ICT IN AGRICULTURAL ENGINEERING	0	0	4	2

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

S.NO	LIST OF EXPERIMENTS
1	Configuring timers for automatic switching "on and off" of irrigation systems
2	Experience with solenoid valves for pressurized irrigation
3	Using sensors for Agro meteorological measurements
4	Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5	Use of mobile apps for controlling or triggering an agricultural system
6	Construction of crop growth functions (best fit) for crop yields simulations
7	Image processing as tool for biotic and abiotic stress identification
8	Experience with existing open source crop simulation models
9	Exposing cloud resources for agricultural applications
10	Developing automated agro advisory systems

Course Outcome	By the end of the course, the students will be able to						
	<ul> <li>Gain practical knowledge on various technologies in information and communication for agriculture.</li> <li>Write various languages (<i>like.</i>, Java, C, Javascript, swift and PHP) to activate model .</li> </ul>						

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	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 Agu, M. N. (2013). Application of ICT in agricultural sector: Women's perspective. International Journal of **R**1 Soft Computing and Engineering, 2(6), 58-60. De Silva, H. and Ratnadiwakara, D., 2008. Using ICT to reduce transaction costs in agriculture through R2 better communication: A case-study from Sri Lanka. LIRNEasia, Colombo, Sri Lanka, Nov Gelb, E. and Voet, H., 2009. ICT Adoption Trends in Agriculture: A summary of the EFITA ICT Adoption R3 Questionnaires (1999-2009). Abrufbar unter: http://departments. agri. huji. ac. il/economics/voet-gelb. pdf. Letzter Zugriff, 20, p.2010. Tolulope Kehinde, K.A., Agwu, D. and Edwin, M., 2015. Application of ICT to Agriculture as a Panacea to R4 Unemployment in Nigeria 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 R6 innovation. **CHAIRMAN/BOARD OF STUDIES** PRINCIPAL/DEAN ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG6701	INDUSTRIAL TRAINING	0	0	0	1

Course Objective
<ul> <li>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</li> <li>The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration.</li> </ul>

**Course Outcome** 

By the end of the course, the students will be able to gain working experience and skills in

	carrying out engineering tasks related to various fields of agriculture

PRINCIPAL/DEAN ACADEMIC

# VII SEMESTER

Sl.No	Course Code	Course Title	L	Т	Р	C	CIA	ESE		Ca teg
									AL	ory
THEO	THEORY									
1	19AG7201	Agricultural Extension	3	0	0	3	25	75	100	PC
2	19AG7202	Remote Sensing and Geographical Information System	3	0	0	0	25	75	100	PC
3	19AG73XX	Professional Elective-III	3	0	0	3	25	75	100	PC
4	19XX74XX	Open Elective-II	3	0	0	3	25	75	100	OE
THEO	RY WITH LA	BORATORY COMPONENT								
5	19AG7251	Precision Farming and Protected Cultivation	2	0	2	3	50	50	100	PC
LABO	RATORY ORA	TORY COURSES								
6	19AG7001	Renewable Energy Laboratory	0	0	3	1.5	50	50	100	PC
7	19AG7002	GIS Laboratory for Agricultural Engineers	0	0	3	1.5	50	50	100	PC
PROJ	PROJECT WORK									
8	19AG7901	Innovative Project	0	0	4	2	50	50	100	EE C
		Total	14	0	12	20			800	

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7201	AGRICULTURAL EXTENSION	3	0	0	3

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

Unit	Description	Instructional Hours
	Principles of Extension	
Ι	Extension-definition-principles-Philosophy-Objectives- Extension teaching methods- definition-meaning and functions-selection of teaching methods and factors influencing the selection.	9
	Methods of contact	
II	Individual contact-farm and home visit -official call, telephone call -personal letter and result demonstration-observation and trail plots-Group contact -method demonstration-meetings -lecture, symposium, panel-brain storming and buzz session. Exhibition-campaign and public speaking purposes- procedure advantage and limitations. Field trips and tours -purpose procedure, advantage and limitations	9
	Methods of communication	
ш	Mass contact -written communication, circular letter, leaflet, folder, pamphlet and newspaper-purpose procedure advantages and limitations. Organizing youth club - farmer club mahila mandal purpose and procedure.	9
	Visual communication	
IV	Audio -visual aids-definition, importance, selection ,use and factors influencing selection , merits and demerits-Electronic media -radio, television and video procedure – purpose techniques – advantage and limitations- Transfer of technology -meaning , importance and major components – communication - definition, meaning, scope and importance-functions and types- communication process -elements and models – Aristotle litterer ,westley -Maclean, Berlo and Leagan.	9
	Methods of Feedback	
v	Feedback-types, factors affecting audience response -Adoption -definition, difference between adoption and diffusion, stages and information sources- Adopter categories and factors influencing adoption- Attributes of innovation and their relationship with adoption.	9

	<b>Total Instructional Hours</b>	45
Course Outcome	By the End of the course student will be able to critically analyze of Extension approaches.	lifferent Agricultura

- Understand Agricultural Knowledge Information System
- Understand Advances in Extension Cyber extension, ICT enabled extension services Market Led Extension, Public Private Partnership, Mainstreaming gender in extension organizational Innovations.

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 Ind	c. Newyork.			
Т3	Dahama, O.P. and O.P.Bhatnagar, 1985; Education and communica publishing Co., New Delhi.	ation for development, Oxford and IBH			
REF	ERENCE 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	R3 Rogers E. 1985; Diffusion of innovation, Collier McMillan publishers, London.				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7202	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	3	0	0	3

Course Objective	<ul> <li>To introduce the basic principles and concepts of Remote Sensing and GIS as applicable to the multi-facets of Agricultural Engineering</li> <li>To introduce the spatial data models, analysis and presentation techniques.</li> </ul>
---------------------	---

Unit	Description	Instructional Hours
I	CONCEPTS OF REMOTE SENSING AND SATELLITES	9
•	Definition- Historical background - Components of remote sensing - Energy	

	source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing - Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT,SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution - Recent satellites with applications.	
	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	Crop Acreage estimation - 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 - Application of Remote Sensing and GIS in Precision Agriculture - Monitor Crop Health - Management Decision Support Systems.	9
	Total Instructional Hours	45

Course Outcome	• The students will understand the remote sensing principles, remote sensing systems satellite data processing and availability data products.
	• The students will understand decision making process using DBMS and utilization of these advanced techniques in addressing the real world problems.

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.		

<b>REFERENCE BOOKS</b>					
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, No	ew Delhi, 2001.			
R3	Jeffery Star and John Estes, "Geographical Information System – An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.				
R4	R4 Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers, Jodhpur 1992.				
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7301	POST HARVEST TECHNOLOGY	3	0	0	3

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

Unit	Description	Instructional Hours	
	BASICS OF POST HARVEST OPERATIONS		
I	Post harvest technology – introduction –objectives –post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content –measurement –direct and indirect methods – moisture meters – equilibrium moisture content.	9	
	PSYCHROMETRY AND DRYING		
II	Psychrometry – importance – Psychrometric charts – Drying – principles and theory of drying – Moisture Content expressions - thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers.	9	
III	CLEANING AND GRADING		
	Principles of Cleaning - air screen cleaners – adjustments - cylinder separator - spiral separator – magnetic separator - colour sorter - inclined belt separator –	9	

	length separators - effectiveness of separation and performance index.	
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
	CROP PROCESSING	
V	Paddy processing – parboiling of paddy – methods – merits and demerits dehusking of paddy –methods – merits and demerits – rice polishers –types – constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing – millets processing.	9
	Total Instructional Hours	45

Course Outcome	• At the end of the study the student will have knowledge on material handling equipment's
	• Different Post Harvest operations and processing methods of harvested crops.
	• Fundamentals of various unit operations of Agricultural 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	R1 Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.			
R2	R2 Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.			
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN			

ACADEMIC

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7302	Dairy Process Technology	3	0	0	3

Course Objective	To introduce the students to dairy industry, properties, Technologies involved and processin milk, manufacturing of dairy products.
Objective	milk, manufacturing of dairy products.

Unit	Description	Instructional Hours
	Chemistry of Milk	
I	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
	Separation Equipment	
П	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
	Homogenizers, Pasteurizers and Sterilizers	
ш	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
	Mechanization in manufacture of Indigenous Dairy Products	
IV	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
	Packaging machines for Milk & Milk Products	
v	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	The students will gain knowledge about Dairy technology and Understand the process of manufacturing of dairy products.
----------------	--

Г

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

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7303	STORAGE AND PACKAGING TECHNOLOGY	3	0	0	3

Course Objective	<ul> <li>To understand the underlying principles of spoilage and storage</li> <li>To provide knowledge on different storage methods and packaging techniques.</li> </ul>
---------------------	--

Unit	Description	Instructional Hours
	SPOILAGE AND STORAGE	
Ι	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
	STORAGE METHODS	
п	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	FUNCTIONS OF PACKAGING MATERIALS	
	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

<b>Course Outcome</b>	The students will have a clear understanding of various methods of storage and different
	packaging techniques for food.

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, Ne	w Delhi.			
Т3	Pandey, P.H.2002. Post-harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.				
REF	REFERENCE BOOKS				
R1	1 Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur				
R2	2 Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7305	PROCESS ENGINEERING OF FRUITS AND VEGETABLES	3	0	0	3

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

Unit	Description	Instructional Hours
------	-------------	------------------------

	STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE	
Ι	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
	CLEANING, GRADING AND ON-FARM PROCESSING	
Π	Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipments – construction and working – pre-cooling – importance, methods, pretreatments and advantages.	9
	PRESERVATION OF FRUITS AND VEGETABLES	
ш	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
	DRYING AND DEHYDRATION	
IV	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	At the end of this course, the student will be thorough in various methods of processing,
	preservation and storage of fruits and vegetables using latest technologies.

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.		
Т3	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.			
REF	ERENCE BOOKS			
R1	1 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	R4 Humberto vega and Gustavo v Barbosa. 1996. Dehydration of foods. Springer Science, Business Media, Chapman&Hall Publishers, U.K.			
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7305	FAT AND OIL PROCESSING	3	0	0	3

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

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
п	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,	9

	winterisation; Chemical modification - Hydrogenation, esterification; Blending, Emulsification, Interesterification, Votation; Fats and oils products - vegetable oils, vegetable fats, animal oils, animal fats, fat substitutes.	
	Analysis of fats and oils	
IV	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
	New technologies in oilseed processing and lipid deterioration	
V	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

The student will be familiarized with the composition, analysis and processing of oil seeds.

\_

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.			
REF	ERENCE BOOKS			
R1	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.			
R2	<ul> <li>Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York.</li> <li>1955. 3. Mohsenin, N.N. Physical Properties of Plant and Animal Materials Gordon and Breach Publishers, Ludhiana, 1970.</li> </ul>			
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				
L				

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7401	Nanotechnology in Agriculture	3	0	0	3

Course
Objective

Unit	Description	Instructional Hours
	Nanotechnology	
I	Nanotechnology - Introduction, History, potential of nanotechnology, Current status of Nanotechnology in the food market; Nanotechnology in Agriculture - Precision Farming, Smart Delivery Systems, Other Developments in the Agricultural Sector due to Nanotechnology; Nanotechnology in the Food Industry - Packaging and Food Safety, Food Processing.	9
	Nanotechnology in Agriculture	
II	Nanotechnology in pesticides and fertilizers - Control of plant pests, Nanoinsicticidal potential, Antimicrobial activity, Nanotechnology application as nanofungicides, Nanotechnology for controlling plant virus, nanoformulations of agrochemicals for applying pesticides and fertilizers for crop improvement; the application of nanosensors in crop protection for the identification of diseases and residues of agrochemicals, nanodevices for the genetic engineering of plants, plant disease diagnostics, animal health, animal breeding, poultry production and postharvest management.	9
	Nano - Food System	
ш	Introduction and scope of Nanotechnology in food processing - Bio active compounds, Source – importance – isolation techniques - Nano- nutraceuticals – nano-cochleates – nano-clusters. Nano-laminates – materials used, properties – preparation and application - Nano emulsion, Encapsulation, Nano filtration, Nano filters - construction and working principle – efficiency calculation, Nano composites – bio-nano composites - Fabrication process – equipments used - Nano films – nano bottles – characteristics – testing standards - Usage of nano material in food packaging – solid and liquid food – overall migration - Safety issues of nano food systems	9
	<b>Application of Biosensors in Agriculture</b> Principles of Biosensor- working mechanism. Parts of biosensors: Sensor	
IV	technologies; importance of sensitivity, specificity, reproducibility, detection limit and response time in biosensors. Applications- Biosensor for food analysis, Biosensors for toxins, pest and pathogens-Aflatoxin, biosensor for moisture and pesticide content- organophosphorous pesticides- nutrient content in soil – microbes- Environmental monitoring.	9
v	Toxicology, ethics and regulation of nanomaterials	9
•	Toxicology- introduction, dose relationship, factors affecting toxicity -	)

 Effects of Nanomaterials. Total Instructional Hours	45
Detoxification mechanisms- Hazard classification-Risk assessment and management - Mode of action of pesticides - Bioaccumulation of toxic materials - Health effects of nanoparticles- factors determine the toxicity of nanoparticles - Nanoparticles Interactions with Biological Systems - Dermal	

<b>Course Outcome</b>	The student will be familiarized with the concept of nanotechnology and its application in
	food and agriculture sector.

TEXT BOOKS					
T1	A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.				
T2	N John Dinardo, "Nanoscale Charecterisation of surfaces Cambridge, Wiley-VCH, 2000.	s & Interfaces", 2nd edition, Weinheim			
REF	ERENCE BOOKS				
R1	Frieder Schelfer And Florian Schubert, "Biosensors" Techniques And Instrumentation In Analytical Chemistry -Volume 11, Elsevier Science Publishers B.V., (1992), Amsterdam, The Netherlands (ISBN 0-444-98783-5)				
R2	Ajit Sadana, Engineering Biosensors: Kinetics And Design, Applications, Academic Press, (2002), USA.(ISBN: 0-12-613763-3)				
R3	Brian R. Eggins, Chemical Sensors And Biosensors, John Wiley & Sons, Ltd, (2004) England.(ISBN: 0 471 89914 3)				
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7251	Precision Farming and Protected Cultivation	2	0	2	3

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

Unit	Description	Instructional Hours
Т	PROTECTED CULTIVATION FEATURES	9
	Conceptual features of protected cultivation in horticultural crops -	

	Total Instructional Hours	45		
V	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		
	PRECISION FARMING OF HORTICULTURAL CROPS			
IV	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		
	PRECISION FARMING TECHNIQUES			
III	<b>PROTECTED CULTIVATION OF FLOWER CROPS</b> Protected cultivation technology for flower crops - Hi-tech protectedcultivation of cut roses, cut chrysanthemum, carnation, gerbera,asiatic lilies, anthurium, orchids, cut foliages and fillers – integratedpest and disease management – postharvest handling.	9		
	disease management – post harvest handling.			
II	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		
	PROTECTED CULTIVATION OF VEGETABLE 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.			

Course Outcome	• The students will be able to appreciate the different methods of protected cultivation practices available for vegetable crops and flowers.
	• A clear understanding of precision farming techniques and its

application to horticultural crops is possible.

TEXT BOOKS:			
T1	Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.		
T2	Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.		
<b>REFERENCE BOOKS:</b>			
R1	Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.		
R2	David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA.		
R3	Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.		

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7001	RENEWABLE ENERGY LABORATORY	0	0	0	3

Course	To help the students gain the practical knowledge on various renewable energy sources,
Objective	gadgets and contrivances.

S.NO	LIST OF EXPERIMENTS
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	Study of UASB biomethanation plant
5	Purification of biogas – CO2 and H2S removal
6	Performance evaluation of agro based gasifier

Study on pyrolysis unit – Biochar, Charcoal and Tar making process
Testing of biogas/producer gas engines
Study on briquetting and Stoichiometric calculations
Automatic weather station – Analysis of wind data and prediction
Testing of solar water heater
Testing of natural convection solar dryer
Study on Solar power and I-V Characteristics
Testing of solar photovoltaic water pumping system

<b>Course Outcome</b>	On completion of the Laboratory course, the students will be familiarized to renewable
	energy sources and their application.

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 - Laboratory Scale	1
8	Pyrolysis unit	1
9	Biogas/ Producer gas dual fuel Engine	1
10	Briquetting Machine - Laboratory Scale	1
11	Automatic weather station	1
12	Solar water heater	1
13	Solar dryer.	1
14	Solar PV training kit	1
15	Solar PV water pumping system	1

\*The equipments 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.		
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7002	GIS LABORATORY FOR AGRICULTURAL ENGINEERS	0	0	0	3

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

Т

Г

S.NO	LIST OF EXPERIMENTS
1	Measurement of relief displacement using parallax bar
2	Stereoscopic vision test
3	Aerial photo interpretation - visual
4	Satellite images interpretation – visual
5	Introduction to QGIS
6	Geo-referencing of images
7	Image enhancement practice
8	Supervised classification practice
9	Unsupervised classification practice
10	Database Management Systems

11	Spatial data input and editing - Digitizing
12	Raster analysis problems – Database query
13	GIS applications in DEM and its analysis
14	GIS application in watershed analysis
15	GIS application in rainfall-runoff modelling
16	GIS application in soil erosion modelling

<b>Course Outcome</b>	On completion of the Laboratory course, 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 GIS software	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	R4 Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote Sensing.		
СПА	CHAIKIVIAN/BUAKD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG7901	INNOVATION PROJECT	0	0	4	2

Course	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
Objective .	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.

mpletion of the project work, students will be in a position to take up any challenging cal problem and find solution by formulating proper methodology.
1

CHAIRMAN/BOARD OF STUDIES	PRINCIPAL/DEAN ACADEMIC

## **VIII SEMESTER**

Sl.No	Course Code	Course Title	L	Т	Р	С	CIA	ESE	TOT AL	Ca teg
THEORY										
1	19AG83XX	Professional Elective-IV	3	0	0	3	25	75	100	PE
2	19AG83XX	Professional Elective-V	3	0	0	3	25	75	100	PE
PROJECT WORK										
3	19AG8901	Project Phase-II	0	0	24	12		100	100	EE
										C
		Total	6	0	24	18			800	

	Program	Course Code	Name of the Course	L	Т	Р	С
	B.E.	19AG8301	AGRI BUSINESS MANAGEMENT AND ENTREPRENEURSHIP	3	0	0	3
Г							

	• To study about the concept and importance of Agri business system
Course Objective	• To develop the management competencies required by student in the field of Agriculture to establish and support profitable agribusiness in a competitive global business environment
	• The ability to use effectively business management techniques in an international environment

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
п	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.	9
III	FUNCTIONAL AREA - I	9
	Operations management - planning and scheduling - supply chain management in agribusiness - Human resource management - job analysis, recruitment and selection process	
----	---	----
	FUNCTIONAL AREA - II	
IV	Marketing Management - market segmentation, consumer buying behaviour and marketing mix - Financial management - concept and financial planning for agribusinesses	9
	ENTREPRENEURSHIP	
V	Entrepreneur - entrepreneurship - types, characteristics and process - Innovation, business incubation and financing entrepreneurs.	9
	Total Instructional Hours	45

Course Outcome	• This course enables the students for Agribusiness Management principles, marketing and processing of agricultural commodities in context with new economic era.
	• Build up the students in globalization and international emerging business environment.

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.				
REF	ERENCE 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.				
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course		Т	Р	С
B.E.	19AG8302	ON FARM WATER MANAGEMENT	3	0	0	3

Course Objective

• To understand the fundamentals of minor irrigation, its types, operation and maintenance and people's participation.

• Command Area Development, On farm structures, policy, operation and maintenance.

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

Course Outcome	The students will have a clear understanding of various practices of water management on farm

TEX	T BOOKS:
T1	Michael, A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006.

<b>REFERENCE BOOKS:</b>				
R1	Keller, .J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York			
R2	Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.			
R3	Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.			
R4	Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi			
R5	R5 Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi			
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC			

Programme	Course Code	Name of the Course		Т	Р	С
<b>B.E.</b>	19AG8303	INTELLECTUAL PROPERTY RIGHTS	3	0	0	3

Course<br/>ObjectiveTo impart knowledge to students on various methods of agricultural waste<br/>management for eco-friendly energy and manure production.

Unit	Description	Instructional Hours	
I	<b>INTRODUCTION</b> 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	
п	<b>REGISTRATION OF IPRs</b> IIMeaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad		
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	9	
IV	<b>DIGITAL PRODUCTS AND LAW</b> 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	<b>ENFORCEMENT OF IPRs</b> Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies Ethanol production from lingo cellulosic wastes - Processing of	9	

Biomass to Ethanol – pretreatment – fermentation - distillation.	
Total Instructional Hours	45

**Course Outcome** Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEX	TEXT BOOKS				
T1	V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt Ltd, 2012 2. S.				
T2	V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002				
REF	ERENCE BOOKS:				
P1 Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, P		of Trademarks, Copyrights, Patents and			
KI	Trade Secrets", Cengage Learning, Third Edition, 2012.				
R2	Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw				
112	Hill Education, 2011				
R3	3 Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property,				
	Edward Elgar Publishing Ltd., 2013.				
CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC					

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG8304	AGRICULTURAL WASTE MANAGEMENT	3	0	0	3

Course	To impart knowledge to students on various methods of agricultural waste management for
Objective	eco-friendly energy and manure production.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.	9
П	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	9

	of briquetting – setting up of briquetting plant- appliances for biomass briquettes.	
	BIOCHAR PRODUCTION	
IV	Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.	9
	BIOGAS AND BIO ETHANOL PRODUCTION	
V	Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol – pretreatment-fermentation-distillation.	9
	Total Instructional Hours	45

Course Outcome	At the end of the course student will be able to understand
	<ul> <li>Various eco-friendly methods for agricultural waste management.</li> <li>Nutritive value and energy production potential of agro wastes.</li> </ul>

TEXT BOOKS			
T1	Raymond C Loehr, "Agricultural Waste Management- problems, processes and approaches". First edition, Academic press, 1974.		
T2	Diaz, I.F., M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1- 380		
Т3	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		
REF	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.		

### CHAIRMAN/BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG8305	ENERGY CONSERVATION IN AGRO BASED INDUSTRY	3	0	0	3

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

Unit	Description	Instructional Hours
I	<b>BASICS OF ENERGY</b> 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
Ш	<b>ENERGY EFFICIENCY IN ELECTRICAL UTILITIES</b> 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.	12
ш	<b>ENERGY EFFICIENCY IN THERMAL UTILITIES</b> 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.	12
IV	<b>ENERGY CONSERVATION BUILDING CODE (ECBC)</b> ECBC and its salient features. Tips for energy savings in buildings - New Buildings - Existing Buildings.	6
v	<b>ENERGY AUDIT</b> Types and methodology -Energy audit instruments - Energy auditing reporting format.	6
	Total Instructional Hours	45

<b>Course Outcome</b>	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
------------------------------

TEX	T BOOKS		
т1	Guide books for National Certification Examination for Energy Managers and Energy Auditors,		
11	Book 1, 2, 3 & 4. Bureau Energy Efficiency, New Delhi. 2005.		
тэ	Murphy, W.R. and McKay, G. Energy Management. Butterworth & Co., Publishers Ltd., London.		
12	1982.		
т2	Craig B. Smith. Energy Management Principles, Applications, benefits & savings. Pergamon Press		
15	Inc. 1981		
т4	Murgai, M.P. and Ram Chandra. Progress in Energy Auditing and Conservation - Boiler		
14	Operations, Wiley Eastern Ltd. 1990.		
REF	ERENCE BOOKS		
<b>D</b> 1	Victor B.Ottaviano, Energy Management. An OTIS Publication. Ottaviano Technical Service Inc.		
KI	150. Broad Hollow Road, Melville, New York. 11747.		
DJ	Richard Porter and Tim Roberts, 1985. Energy saving by Waste recycling. Elsevier applied science		
K2	publishers		
R3	R3   Energy Management - Bi-monthly journal published by National Productivity Council, New Del		

# ProgrammeCourse CodeName of the CourseLTPCB.E.19AG8306SPECIAL FARM EQUIPMENTS3003

PRINCIPAL/DEAN ACADEMIC

Course Objective

CHAIRMAN/BOARD OF STUDIES

To study the special 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.	9
п	Sprayers and Dusters	
	Sprayers – Sprayer operation – boom sprayer – precaution – coverage – factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) – Electrostatic sprayers – Aerial spraying – Air assist sprayers – orchard sprayers – Dusters – types – mist blower cum duster – other plant protection devices, care and maintenance.	9
III	Threshers and Harvesters	9
	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.	
	Threshers and Other Machineries	
IV	Thresher – 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, the students will have a thorough knowledge on special farm
Course Outcome	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.	
REFERENCE BOOKS		
R1	Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.	
R2	Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi	
R3	Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi	

# CHAIRMAN/BOARD OF STUDIES

Programme	Course Code	Name of the Course		Т	Р	С
B.E.	19AG8307	MECHANICS OF TILLAGE AND TRACTION	3	0	0	3

Course Objective	The objective of mechanics of tillage tools is to provide a method for describing the application of forces to the soil and for describing the soil's reaction to the forces.
Objecute	appread of 1010005 to the soft and for deserioning the soft 5 federion to the forees.

Unit	Description	Instructional Hours
	Introduction to mechanics of tillage tools	
Ι	History of tillage –Soil machine crop system –Mechanics of tillage tools- Analysis of soil machine dynamics in tillage. Physical properties of soils- Mechanical properties of soils – Assessment of the dynamic properties of soil.	9
	Design of tillage tools and principles of soil cutting	
II	Design of tillage tools - design factors-Shape-Macroshape-Mould board plow surface – principles of soil cutting – Design equation.	9
	Application of dimensional analysis in soil dynamics	
ш	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
	Soil compaction and plant growth	
V	soil compaction- mechanical and hydraulic properties of compacted soil- soil physical properties and plant growth-measure for optimizing crop growth by avoiding excessive soil compaction- GIS for soil variability study.	9
	Total Instructional Hours	45

<b>Course Outcome</b>	Mechanics of soil cutting Traction force, torque-slip relationship and traction aid for
	tractor and other traction machineries.

TEXT BOOKS		
T1	WILLIAM R. GILL. SOIL DYNAMICS in TILLAGE AND TRACTION. Agricultural Research Service UNITED STATES DEPARTMENT OF AGRICULTURE	
T2	D. Anantha Krishnan and Ananthachar. Mechanics of Tillage and Traction. Agrimoon.com.	
REFERENCE BOOKS:		
R1	MEREDITH, H. L. and PATRICK, W. H., JR. 1961. EFFECTS OF SOIL COMPACTION ON SUBSOIL	

	ROOT PENETRATION AND PHYSICAL PROPERTIES OF Jour. 53: 163-167, illus.	THREE SOILS IN LOUISIANA. Agron.	
R2	MÖLLER, R. 1959. DRAFT REQUIREMENTS AND WC SPRING CULTIVATOR TINES. Grundlagen der Landtechnik 1	ORKING EFFICIENCY OF RIGID AND 1: 85-94, illus.	
R3	3 KAWAMURA, N. 1958. DYNAMIC BEHAVIOR OF SOIL. II. HIGH SPEED TRIAXIAL COMPRESSION TEST. Soc. Agr. Mach. Jour. (Japan) 20: 101- 103, illus.		
R4	HARRIS, W. L., BUCHELE, W. F., and MALVERN, L. E. 1964. RELATIONSHIP OF MEAN STRESS, VOLUMETRIC STRAIN AND DYNAMIC LOADS IN SOIL. Amei*. Soc. Agr. Engin. Trans. 7: 362-364, 369, illus.		
R5	R5 AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS. 1959. ANNOTATED BIBLIOGRAPHY ON SOIL COMPACTION. 31 pp. Amer. Soc. Agr. Engin. St. Joseph, Mich.		
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

Programme	Course Code	Name of the Course		Т	Р	C
B.E.	19AG8308	WATERSHED HYDROLOGY AND MANAGEMENT		0	0	3

Course	
Objective	and requirements and should be able to quantify, control and regulate the water resources.

Unit	Description	Instructional Hours
	PRECIPITATION AND ABSTRACTIONS	
I	Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.	9
	RUNOFF	
Π	Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH.	9

	FLOOD AND DROUGHT	
ш	Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method- NDVI analysis- Drought Prone Area Programme (DPAP).	9
	RESERVOIRS	
IV	Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.	9
	GROUNDWATER AND MANAGEMENT	
V	Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas.	9
	Total Instructional Hours	45

Course Outcome	The students completing the course will have :
	<ul> <li>An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments.</li> <li>Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.</li> <li>Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs.</li> <li>Understand the concept and methods of ground water management.</li> </ul>

-----

TEX	TEXT BOOKS		
T1	Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2	010	
T2	Jayarami Reddy.P. "Hydrology", Tata McGraw Hill, 2008.		
Т3	Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995		
REF	REFERENCE BOOKS		
R1	1 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	R3 Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.		
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC		

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG8309	MICRO IRRIGATION SYSTEMS	3	0	0	3
• To expose the students to basic conceptual differences in the design of Pressure						

Course Objective	<ul> <li>Irrigation systems viz., Drip, Sprinkler, Surge and Capillary modes</li> <li>To help the students gain a thorough design and layout understanding based on the Hydraulics of pipe-flow coupled with friction loss calculations</li> <li>To impart technical confidence in the minds of students in making choice based and corrections imbibed layout designs with cost economics.</li> </ul>
---------------------	--

Unit	Description	Instructional Hours
	CONCEPTS AND HYDRAULICS OF MICROIRRIGATION	
I	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
	DESIGN AND LAYOUT OF DRIP IRRIGATION	
п	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
	DESIGN AND LAYOUT OF SPRINKLER IRRIGATION	
ш	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

	DESIGN AND LAYOUT OF SURGE IRRIGATION	
IV	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	<ul> <li>The students gain confidence with the exposure to different water saving micro- irrigation systems alongside the field-oriented designs and layouts</li> <li>The students will be able to interact with farmers for cost effective micro irrigation layouts benefitting them for sustained productivity alongside optimal water usage even under scarcity situations.</li> </ul>

TEX	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.		
Т3	Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.		
REF	REFERENCE BOOKS		
R1	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.		

# CHAIRMAN/BOARD OF STUDIES

Programme	Course Code	Name of the Course	L	Т	Р	С
B.E.	19AG8310	AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	3	0	0	3

Course	<ul> <li>To impart the fundamental knowledge and basic concepts of Economics and Farm</li></ul>
Objective	Management <li>To understand the types of resources and Investment analysis in agriculture sector</li>

Farm financial analysis, Investment and Budgeting for farms.

Unit	Description	Instructional Hours
	FARM MANAGEMENT	
Ι	Agricultural Economics – definition and scope – Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts – Farm appraisal techniques – Valuation .	9
	LAWS OF ECONOMICS	
П	Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - Cost concepts – types - Opportunity cost – comparison of costs – Factor relationship – concepts.	9
	COST CURVES	
ш	Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs-Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves – Optimum input and output levels – Factor –factor relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops – Preparation of interview schedule and farm visit for data collection.	9
	MANAGEMENT OF RESOURCES	
IV	Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, Laboratory our, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.	9
	FARM MANAGEMENT AND FINANCIAL ANALYSIS	
V	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** Students are able to plan the financial aspects related to farm management in a cost effective manner.

TEXT BOOKS					
T1	Johl, S.S., and Kapur, T.R., Fundamentals of Farm Business Man 2007.	Johl, S.S., and Kapur, T.R., Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.			
T2	Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bh	avani			
Т3	Devi, I., "Agricultural Economics" Oxford and IBH Publishing C	o. Pvt. Ltd., New Delhi, 2006.			
REF	ERENCE BOOKS				
R1	Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.				
R2	Subba Reddy, S., and Raghu Ram, P. " "Agricultural Finance and				
R3	Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.				
R4	Sankhayan, P.L. ""Introduction to Farm Management", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001				
R5	R5 Muniraj, R., "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.				
СНА	CHAIRMAN/BOARD OF STUDIES PRINCIPAL/DEAN ACADEMIC				

Programme	Course Code	Name of the Course		Т	Р	С
B.E.	19AG8901	PROJECT WORK	0	0	24	12

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

Course Outcome	On completion of the project work, students will be in a position to take up any challenging practical problem and find solution by formulating proper methodology.
----------------	---

CHAIRMAN/BOARD OF STUDIES	PRINCIPAL/DEAN ACADEMIC

Course code		Course title	LTP C
19HE107	72 CAREER (	GUIDANCE – LEVEL I	2 0 0 1
	Personality, Ap	otitude and Career Guidance	
Pre-requisite		None	Syllabus version
			1
Course Objec	tives:		
• Introdu 1]	uce students to building blocks of I	Logical reasoning and Quantita	ative Aptitude [SLO
• Train s	students on essential grammar for p	placements [SLO 2]	
• Introd	uce students on scientific technique	es to pick up skills [SLO 3]	
• Provid build o	le an orientation for recruiter expection one's career with placements in min	tation in terms of non-verbal s nd [SLO 4]	kills, and for how to
Expected Cou	rse Outcome:		
Enable student	s to approach learning Aptitude wi	th ease, and understand recruit	er
expectation.			
Student Learr Outcomes (SL	<b>ing</b> 1, 2, 3 and 4 <b>(O):</b>		
Module:1	Lessons on excellence	2 hours	<b>SLO:</b> 3
Skill introspect	tion, Skill acquisition, consistent pr	ractice	
Module:2	Logical Reasoning	11 hours	<b>SLO:</b> 1
Thinking Ski			52011
Prob	lem Solving		
• Criti	cal Thinking		
• Late	ral Thinking		
Taught through	thought-provoking word and rebu	is puzzles, and word-link build	ler questions
Coding & do	coding Sories Anglogy Add mg	n out and Visual reasoning	
	ing and Decoding	in out and visual reasoning	
<ul> <li>Serie</li> </ul>			
	(1)		

- Odd Man Out
- Visual Reasoning

#### Sudoku puzzles

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

#### Attention to detail

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

## Chairman, Board of Studies

Course coue	C	ourse title	LT	Р	С		
19HE2072	CAREER GU	IDANCE – LEVEL II	2 0	0	1		
	Personality, Apti	tude and Career Guidance					
Pre-requisite	ſ	None		Syllabus version			
				1			
Course Objectives	:	to intermediate level [SLO6]					
• Solve Logr	titative Antitude questions of easy	to intermediate level [SLO 0] asy to intermediate level [SLO $^{\circ}$	71				
• Solve Verb	al Ability questions of easy to i	ntermediate level [SLO 8]	,]				
Expected Course (	Dutcome:						
Enable students to s	solve questions on Verbal, Logic	cal and Quantitative Aptitude of	f				
placement level							
Student Learning	6, 7, 8						
Outcomes (SI O)							
Outcomes (SLO):							
Outcomes (SLO): Module:1 Log	ical Reasoning	8 hours		SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate	cical Reasoning gorization questions	8 hours		SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in	<b>ical Reasoning</b> gorization questions volving students grouping word	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in	<b>sical Reasoning</b> gorization questions volving students grouping word	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen	gical Reasoning gorization questions volving students grouping word hts and Blood relations	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>its and Blood relations</b>	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-din	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>hts and Blood relations</b> Arrangement Arrangement mensional Arrangement	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-din • Blood Re	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-dir • Blood Re	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>hts and Blood relations</b> arrangement Arrangement mensional Arrangement elations	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-din • Blood Re	<b>gical Reasoning</b> gorization questions volving students grouping word ats and Blood relations arrangement Arrangement mensional Arrangement elations	<b>8 hours</b> s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen - Linear A - Circular - Multi-din - Blood Re	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations	8 hours s into right group orders of logi	cal sense	SLO	: 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-dii • Blood Re Module:2 Qua Ratio and Propert	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations	8 hours s into right group orders of logi 12 hours	cal sense	SLO	<b>:</b> 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations <b>antitative Aptitude</b> <b>ion</b>	8 hours s into right group orders of logi 12 hours	cal sense	SLO	: 6 ): 7		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-dii • Blood Re Module:2 Qua Ratio and Proport • Ratio • Proporti	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations <b>antitative Aptitude</b> <b>ion</b>	8 hours s into right group orders of logi 12 hours	cal sense	SLO	<b>:</b> 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen Linear A Circular Multi-din Blood Re Module:2 Qua Ratio and Proport Proportio Variation	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement mensional Arrangement elations <b>antitative Aptitude</b> <b>ion</b>	8 hours s into right group orders of logi 12 hours	cal sense	SLO	<b>:</b> 6 <b>:</b> 7		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen • Linear A • Circular • Multi-dii • Blood Ra Module:2 Qua Ratio and Proport • Ratio • Proportio • Variation • Simple e	<b>gical Reasoning</b> <b>gorization questions</b> volving students grouping word <b>ats and Blood relations</b> arrangement Arrangement Marangement elations <b>antitative Aptitude</b> <b>ion</b> on n	8 hours s into right group orders of logi 12 hours	cal sense	SLO	<b>:</b> 6		
Outcomes (SLO): Module:1 Log Word group cate Puzzle type class in Cryptarithmetic Data arrangemen Linear A Circular Multi-dir Blood Re Module:2 Qua Ratio and Proport Ratio Proportio Simple e Problem	cical Reasoning gorization questions volving students grouping word ats and Blood relations arrangement Arrangement mensional Arrangement elations antitative Aptitude ion on n equations s on Ages	8 hours s into right group orders of logi 12 hours	cal sense	SLO	: 6 : 7		

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

• Relation Between Simple and Compound Interest

#### Number System

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

# Module:3 Verbal Ability

#### Essential grammar for placements

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

#### **Reading Comprehension for placements**

- Types of questions
- Comprehension strategies
- Practice exercises

#### **Articles, Prepositions and Interrogatives**

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

#### **Vocabulary for placements**

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

Total Lecture hours: 30 hours

PRINCIPAL/DEAN ACADEMIC

Chairman, Board of Studies

10 hours

**SLO:** 8

Course co	ode	Course title		LTP C
19H	E3071	CAREER GUIDA	NCE – LEVEL III	2001
		Personality, Aptitude and Career Guidance		
Pre-requi	site	None		Syllabus version
~ ~				1
Course O	bjectives:			
• So	olve Logical Reaso	ning questions of easy to i	ntermediate level [SLO 6]	
• Se	olve Quantitative A	ptitude questions of easy t	to intermediate level [SLO	7]
• 50	olve Verbal Ability	questions of easy to interi	mediate level [SLO 8]	
۰D	isplay good writing	skills while dealing with	essays [SLO 12]	
Expected	Course Outcome:			
Enable stu	idents to solve Apti	tude questions of placeme	nt level with ease, as well	as
write effect	ctive essays.	····· 1······ ·· F······		
	•			
Student L	earning	6, 7, 8, 12		
Outcomes	s (SLO):			
Module:1	Logical Reas	oning	9 hours	<b>SLO:</b> 6
Clocks,	calendars, Directio	on sense and Cubes		
•	Clocks			
•	Calendars			
•	Direction Sense			
•	Cubes			
Data inte	rpretation and Da	ta sufficiency		
•	Data Interpretation	n – Tables		
•	Data Interpretation	n - Pie Chart		
•	Data Interpretation	n - Bar Graph		
•	Data Sufficiency			
		A 414 1	101	
Time and	Quantitative	Aptitude	12 nours	SLU: /
	Work with differe	nt efficiencies		
•	Dines and sistems	int efficiencies		
•	Pipes and cisterns			
•	work equivalence			
•	Division of wages			
Time, Spe	eed and Distance			
•	Basics of time, spe	eed and distance		
•	Relative speed			
•	Problems based or	n trains		
•	Problems based or	n boats and streams		

• Problems based on races

#### Profit and loss, Partnerships and averages

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

#### Module:3 Verbal Ability

#### **Sentence Correction**

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

#### Sentence Completion and Para-jumbles

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

Module:4	Writing skills for placements	2 hours	<b>SLO:</b> 12
Essay wri	ting		
٠	Idea generation for topics		
•	Best practices		
•	Practice and feedback		
	<b>Total Lecture hours:</b>	30 hours	

#### Chairman, Board of Studies

#### PRINCIPAL/DEAN ACADEMIC

7 hours

**SLO:** 8

Course co	de	Course title			Т	Р	С
19HF	E <b>4071</b>	CAREER GUIDA	NCE – LEVEL IV	2	0	0	1
		Personality, Aptitude	and Career Guidance				
Pre-requis	ite	None	!	Syllab	us '	versio	m
					1	L	
Course Ob	ojectives:						
• So • So • So • Cr • Be	lve Logical Reasoni lve Quantitative Ap lve Verbal Ability q ack mock interview introduced to probl	ing questions of easy to in titude questions of easy t questions of easy to interr s with ease [SLO 13] lem-solving techniques an	ntermediate level [SLO 6] o intermediate level [SLO nediate level [SLO 8] nd algorithms [SLO 14]	7]			
Expected (	Course Outcome:						
Enable stuc write effect	lents to solve Aptitu tive essays.	ide questions of placement	nt level with ease, as well	as			
Student Lo Outcomes	earning (SLO):	6, 7, 8, 13, 14					
Module:1	Logical Reaso	ning	5 hours			SL	<b>:</b> 6
Logical co	nnectives, Syllogisn	n and Venn diagrams					
•	Logical Connective	S					
•	Syllogisms						
•	Venn Diagrams – In Venn Diagrams - S	nterpretation Solving					
Module:2	<b>Ouantitative</b> A	Aptitude	8 hours			SLC	<b>):</b> 7
Logarithm	ns, Progressions, G	eometry and Quadratic	equations				
•	Logarithm	• •	•				
•	Arithmetic Progress	sion					
•	Geometric Progress	ion					
•	Geometry						
•	Mensuration						
• (	Coded inequalities						
•	Quadratic Equation	s					
Permutati	on, Combination a	nd Probability					
•	Fundamental Count	ing Principle					
•	Permutation and Co	ombination					
•	Computation of Per	mutation					
•	Circular Permutatio	ns					
•	Computation of Con	mbination					
•	Probability						

#### Chairman, Board of Studies