SETHU INSTITUTE OF TECHNOLOGY

PULLOOR, KARIAPATTI – 626115

(An Autonomous Institution affiliated to Anna University, Chennai)

CURRICULUM & SYLLABI

B.E AGRICULTURE ENGINEERING

REGULATIONS 2015

(Applicable to candidates admitted in the Academic Year 2016 - 2017)

CHAIRPERSON
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SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115

(***An Autonomous Institution***)

B.E. Degree Programme

CURRICULUM & SYLLABI

Regulations 2015

Bachelor of Engineering in Agriculture Engineering

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Humanities and Social Sciences (HS)	3	6	3
Basic Sciences (BS)	11	29	16
Engineering Sciences (ES)	6	15	9
Professional Core(PC)	32	89	51
Professional Electives (PE)	6	18	11
Open Electives (OE)	3	9	5
Project Work (PW)	2	8	5
TOTAL	63	174	100

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
Agriculture Engineering	22	22	24	25	23	23	21	14	174

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN101	Technical English (Common to ALL Branches)	2	0	0	2
2.	15UMA102	Engineering Mathematics – I (Common to ALL Branches)	3	2	0	4
3.	15UPH103	Engineering Physics (Common to ALL Branches)	3	0	0	3
4.	15UCY107	Chemistry for Agriculturist	3	0	0	3
5.	15UCS107	Computer Programming (Common to ALL Branches)	3	0	0	3
6.	15UME108	Engineering Graphics (Common to ALL Branches)	3	2	0	4
PRACTICAL						
7.	15UCS109	Computer Programming Laboratory (Common to ALL Branches)	0	0	2	1
8.	15UME110	Engineering Practices Laboratory (Common to ALL Branches)	0	0	2	1
9.	15UGS112	Basic Sciences Laboratory – I (Common to ALL Branches)	0	0	2	1
TOTAL			**16**	**2**	**9**	**22**
TOTAL NO. OF CREDITS - 22						

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN201	Business English and Presentation Skills (Common to ALL Branches)	3	0	0	3
2.	15UMA202	Engineering Mathematics – II (Common to ALL Branches)	3	2	0	4
3.	15UPH207	Physics for Agricultural Engineering	3	0	0	3
4.	15UAG204	Principles of Agricultural Engineering	3	0	0	3
5.	15UCY207	Environmental Science (Common to ALL Branches)	3	0	0	3
6.	15UEE208	Basic Electrical and Electronics Engineering (Common to ALL Branches)	3	0	0	3
PRACTICAL						
7.	15UAG206	Agricultural Engineering Practices Lab	0	0	3	2
8.	15UGS210	Basic Sciences Laboratory – II (Common to ALL Branches)	0	0	2	1
TOTAL			**18**	**2**	**5**	**22**
TOTAL NO. OF CREDITS - 22						

SEMESTER III

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UMA321	Transforms and Partial Differential Equations	3	2	0	4
2.	15UAG302	Unit Operations in Agricultural Processing	3	0	0	3
3.	15UAG303	Fundamentals of Engineering Mechanics	3	0	0	3
4.	15UAG304	Fluid Mechanics and Hydraulics	4	0	0	4
5.	15UAG305	Fundamentals of Theory of Machines	3	0	0	3
6.	15UAG306	Principles and Practices of Crop Production	3	0	0	3
7.	15UGS331	Value Education and Human Rights	2	0	0	P/F
PRACTICAL						
8.	15UAG307	Crop Husbandry Laboratory	0	0	3	2
9.	15UAG308	Fluid Mechanics Laboratory	0	0	3	2
TOTAL			**21**	**2**	**6**	**24**
TOTAL NO. OF CREDITS - 24						

SEMESTER IV

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UMA425	Probability and Statistics	3	1	0	4
2.	15UAG402	Post Harvest Technology	3	0	0	3
3.	15UAG403	Farm Tractors	3	0	0	3
4.	15UAG404	Soil and Water Conservation Engineering	3	0	0	3
5.	15UAG405	Fundamental of Thermodynamics	4	0	0	4
6.	15UAG406	Surveying for Agriculture	3	0	0	3
7.	15UGS431	Reasoning and Quantitative Aptitude (Common to ALL Branches)	1	0	0	1
PRACTICAL						
8.	15UAG407	Surveying Laboratory	0	0	3	2
9.	15UAG408	Tractors and Farm Engines Laboratory	0	0	3	2
TOTAL			**20**	**1**	**6**	**25**
TOTAL NO. OF CREDITS - 25						

SEMESTER V

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UAG501	Irrigation and Drainage Engineering	3	0	0	3
2.	15UAG502	Tillage and Sowing Implements	3	0	0	3
3.	15UAG503	Plant Protection and Harvesting Equipments	3	0	0	3
4.	15UAG504	Heat and Mass Transfer for Agriculture Engineers	3	0	0	3
5.		Professional Elective – I	3	0	0	3
6.		Professional Elective – II	3	0	0	3
PRACTICAL						
7.	15UAG507	Tillage and Sowing Equipments Laboratory	0	0	3	2
8.	15UAG508	Plant Protection and Harvesting Equipments Laboratory	0	0	3	2
9.	15UGS531	Soft skills and Communication – Laboratory (Common to CSE. ECE,EEE &AGRI)	0	0	2	1
TOTAL			**18**	**0**	**8**	**23**
TOTAL NO. OF CREDITS - 23						

SEMESTER VI

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UAG601	Solar and Wind Energy Engineering	3	0	0	3
2.	15UAG602	Hydrology and Water Resources Engineering	3	0	0	3
3.	15UAG603	Design of Agricultural Machinery	4	0	0	4
4.		Professional Elective – III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – I	3	0	0	3
PRACTICAL						
7.	15UAG607	CAD for Agricultural Engineering	0	0	3	2
8.	15UAG608	Innovative and Creative Project	0	0	3	2
TOTAL			**19**	**0**	**6**	**23**
TOTAL NO. OF CREDITS - 23						

SEMESTER VII

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UAG701	Bio-Energy Resource Technology	3	0	0	3
2.	15UAG702	Dairy and Food Engineering	3	0	0	3
3.	15UAG703	Farm Management and Finance	3	0	0	3
4.		Professional Elective – V	3	0	0	3
5.		Open Elective – II	3	0	0	3
PRACTICAL						
6.	15UAG706	Bio-Energy Laboratory	0	0	3	2
7.	15UAG707	Post Harvest and Food Process Engineering Laboratory	0	0	3	2
8.	15UGS531	Industrial Training (4 weeks)	0	0	0	2
TOTAL			**15**	**0**	**6**	**21**
TOTAL NO. OF CREDITS -21						

SEMESTER VIII

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UME801	Professional Ethics (Common to ALL Branches)	2	0	0	2
2.		Professional Elective – VI	3	0	0	3
3.		Open Elective – III	3	0	0	3
PRACTICAL						
4.	15UAG804	Project work	0	0	12	6
TOTAL			**8**	**0**	**12**	**14**
TOTAL NO. OF CREDITS - 14						

PROFESSIONAL ELECTIVES

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
AGRICULTURAL AND FOOD PROCESS ENGINEERING						
1.	15UAG901	REFRIGERATION AND AIR-CONDTIONING FOR AGRICULTURE ENGINEERS	3	0	0	3
2.	15UAG902	STORAGE AND PACKAGING TECHNOLOGY	3	0	0	3
3.	15UAG903	SEED TECHNOLOGY APPLICATIONS	3	0	0	3
4.	15UAG909	FRUITS AND VEGETABLES PROCESSING	3	0	0	3
5.	15UAG915	DESIGN OF FOOD PROCESSING EQUIPMENT	3	0	0	3
FARM MACHINERY AND POWER						
6.	15UAG907	FARM POWER AND MACHINERY MANAGEMENT	3	0	0	3
7.	15UAG908	MECHANICS OF TILLAGE AND TRACTION	3	0	0	3
8.	15UAG916	MANUFACTURING PROCESSES	3	0	0	3
9.	15UAG917	TESTING AND MANAGEMENT OF FARM MACHINERY	3	0	0	3
LAND AND WATER CONSERVATION ENGINEERING						
10.	15UAG904	WATERSHED MANAGEMENT	3	0	0	3
11.	15UAG905	MICRO IRRIGATION	3	0	0	3
12.	15UAG906	ON FARM WATER MANAGEMENT	3	0	0	3
13.	15UAG918	DESIGN AND CONSTRUCTION OF GREEN HOUSE	3	0	0	3
14.	15UAG919	FARM STRUCTURES	3	0	0	3
15.	15UAG922	GROUND AND WELL WATER ENGINEERING	3	0	0	3
BIOENERGY						
16.	15UAG920	ENERGY AUDITING AND MANAGEMENT	3	0	0	3
17.	15UAG921	BIO AND THERMOCHEMICAL CONVERSION OFBIOMASS	3	0	0	3
OTHERS						
18.	15UAG910	SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING	3	0	0	3
19.	15UAG911	AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	3	0	0	3
20.	15UAG912	AGRICULTURAL EXTENSION	3	0	0	3
21.	15UAG913	IT IN AGRICULTURAL SYSTEMS	3	0	0	3
22.	15UAG914	SOIL SCIENCE AND ENGINEERING	3	0	0	3

OPEN ELECTIVES

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	15UAG971	PRINCIPLES OF AGRONOMY	3	0	0	3
2.	15UAG972	AGRIBUSINESS MANAGEMENT	3	0	0	3
3.	15UAG973	FUNDAMENTALS OF HORTICULTURE	3	0	0	3
4.	15UAG974	ORGANIC FARMING TECHNOLOGY	3	0	0	3
5.	15UAG975	SUTAINABLE AGRICULTURE AND FOOD SECURITY	3	0	0	3
6.	15UAG976	SEED PRODUCTION TECHNOLOGY	3	0	0	3
7.	15UAG977	SERICULTURE TECHNOLOGY	3	0	0	3
8.	15UAG978	BASICS OF LANDSCAPE GARDENING	3	0	0	3

ONE CREDIT COURSES

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	15UAG861	INTRODUCTION TO RENEWABLE ENERGY	1	0	0	1
2.	15UAG862	MUSHROOM CUTIVATION	1	0	0	1
3.	15UAG863	VERMICOMPOST TECHNOLOGY	1	0	0	1
4.	15UAG864	GREEN HOUSE TECHNOLOGY	1	0	0	1
5.	15UAG865	WATER HARVESTING TECHNOLOGY	1	0	0	1
6.	15UAG866	ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT	1	0	0	1
7.	15UAG867	ENERGY AUDIT AND MANAGEMENT	1	0	0	1
8.	15UAG868	FARM MACHINERY,MANAGEMENT AND COST ECONOMICS	1	0	0	1
9.	15UAG870	LIQUID BIOFUELS	1	0	0	1
10.	15UAG871	SOLAR PV SYSTEM	1	0	0	1

15UEN101	TECHNICAL ENGLISH (Common to all Branches of Engineering)	L	T	P	C
		2	0	0	2

OBJECTIVES

- To enhance the vocabulary of students
- To strengthen the application of traditional grammar and basic skills
- Improve the language proficiency of students

UNIT I **6**

Grammar - Parts of Speech-Tense– **Vocabulary** –Technical Word Formation- Prefix- suffix - Synonyms and Antonyms– **Writing** – Instructions – Formal Letters - **Reading** Comprehension - Prose: A Nation's Strength – Dr. Karan Singh

UNIT II **6**

Grammar –Concord -'Wh' Questions – **Vocabulary** –One Word Substitutes–Listening & Speaking–Conducting Meetings – **Writing** - Preparation of the Checklist – **Reading** -Prose: My Vision for India-Dr.A.P.J.Abdul Kalam

UNIT III **6**

Grammar –Voice– **Vocabulary** –Compound Nouns **Writing** –Minutes–Agenda -Transformation of Information (Transcoding)- **Reading Prose:** Professions of Women-Virginia Woolf.

UNIT IV **6**

Grammar - Conditional clauses - **Vocabulary** - Idioms & Phrases - **Writing** Letters to Editor – Making Invitations - Acceptance & Declining - Summarizing – **Reading** - Prose: Computers-Peter Laurie

UNIT V **6**

Grammar – Determiners – **Vocabulary** – Homophones & Homonyms – **Writing** Recommendations-Note Making - Report Writing- **Reading** – Prose: What We Must Learn From the West-Narayana Murthy

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

- Use grammar effectively in writing meaningful sentences and paragraphs.
- Exhibit improved reading comprehension and vocabulary.
- Demonstrate writing skills in various formal situations.
- Demonstrate improved oral fluency.
- Presenting reports on various purposes.

TEXT BOOK

1. Meenakshi Raman, Sangeetha Sharma: Technical Communication English for Engineers, Chennai, Oxford University Press, 2008.

REFERENCE BOOKS

1. Asraf Rizvi.M, Effective Technical Communication, New Delhi, Tata McGraw-Hill Publishing Company Limited, 2007.
2. Lakshminarayanan. K.R,English for Technical Communication, Chennai, Scitech Publications (India) Pvt. Ltd, 2004.
3. Faculty members of English, SIT, *Technical English,* 2015.

15UMA102	ENGINEERING MATHEMATICS – I (Common to ALL Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES

- To make the students capable of identifying algebraic eigen value problems from practical areas and obtain the eigen solutions in certain cases.
- To make the students knowledgeable in integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients that they might encounter in their studies of other subjects in the same or higher semesters.

UNIT I DIFFERENTIAL CALCULUS 9 + 6

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (n^{th} derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9 + 6

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT III INTEGRAL CALCULUS 8 + 6

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions .

UNIT IV MULTIPLE INTEGRALS 8 + 6

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double integral - Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Volume as triple integral.

UNIT V MATRICES 8 + 6

Eigen value and eigenvector of a real matrix – Characteristic equation – Properties – Cayley-Hamilton theorem (excluding Proof) – Orthogonal reduction –(transformation of a symmetric matrix to diagonal form) – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation .

SUPPLEMENT TOPIC (for internal evaluation only-) 3

Evocation /Application of Mathematics , Quick Mathematics – Speed Multiplication and Division Applications of Matrices .

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

1. Analyze functions using limits, continuity and derivatives to solve problems involving these functions.
2. Use the Lagrange multiplier method to predict extreme values of functions with constraints and to find the absolute maximum and minimum of a function on different domains.
3. Apply the various methods of integration for evaluating definite integrals.
4. Apply the knowledge of multiple integrals to find the area and volume of region bounded by the given curves.
5. Find Eigen values and Eigenvectors for symmetric and non-symmetric matrices

TEXT BOOKS

1. BALI N. P and MANISH GOYAL, "A Text book of Engineering Mathematics", Laxmi Publications (P) Ltd, New Delhi, 8th Edition, (2011).
2. GREWAL. B.S, "Higher Engineering Mathematics", Khanna Publications, New Delhi, 42nd Edition, (2012).

REFERENCE BOOKS

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, "Advanced Engineering Mathematics", Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K," Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, "Vedic Mathematics - Mental Calculation", Motilal Banarsidass Publications, New Delhi, 1st Edition, (1965).
5. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
6. P.SIVARAMAKRISHNA DAS, E.RUKMANGADACHARI "Engineering mathematics", volume1, Pearson Edison New Delhi, 2nd Edition, (2013).

15UMA102- ENGINEERRING MATHEMATICS- I

ASSESSMENT QUESTIONS

REMEMBER

1. What is the value of $\lim_{\theta \to 0} \frac{\sin\theta}{\theta}$
2. State Newton's law of cooling.
3. Write the Heat Flow equation.
4. If u and v are differentiable functions, v(x) $\neq 0$ then find $\frac{\mathbf{d}(u/v)}{\mathbf{d}x}$

UNDERSTAND

1. Find $\lim_{x \to 0} \frac{3x+|x|}{7x-5|x|}$, if it exists.
2. Differentiate $e^x \cos x$ with respect to x.
3. Differentiate $x^2 e^x \sin x$
4. Find the derivative of $\frac{2x-3}{4x+5}$ with respect to x

APPLY

1. Using Leibnitz's theorem, find the n^{th} derivative of $x^2 \log x$
2. If $\cos^{-1}\left(\frac{y}{b}\right) = \log\left(\frac{x}{n}\right)^n$ then Using Leibnitz's theorem prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + 2n^2 y_n = 0$
3. If $p^2 = a^2 cos^2\theta + b^2 sin^2\theta$, then prove that $p + \frac{d^2p}{d\theta^2} = \frac{a^2b^2}{p^3}$
4. Find $\int sin^5 x \, cos^{3/4} x \, dx$.

ANALYZE

1. A pot of boiling water 100°C is removed from the fire and allowed to cool at 30°C room temperature. Two minutes later, the temperature of the water in the pot is 90°C. What will be the temperature of the water after 5 minutes?
2. The initial mass of an Iodine isotope was 200g. Determine the Iodine mass after 30 days if the half life of the isotope is 8 days.
3. Suppose that a corpse was discovered in a hotel room at midnight and its temperature was 80°F. The temperature of the room is kept constant at 60°F. Two hours later the temperature of the corpse dropped to 75°F. Find the time of death.
4. An RL circuit has an emf of 5V, a resistance of 50Ω, an inductance of 1H, and no initial current. Find the current in the circuit at any time t.

EVALUATE

1. Expand (i) $e^{\sin x}$ (ii) tan x by Maclaurin's series up to the term containing x^4
2. Evaluate $\lim_{x \to 3} \frac{x^2+7x+11}{x^2-9}$
3. Change the independent variable to θ in $\frac{d^2y}{dx^2} + \frac{2x}{1+x^2}\frac{dy}{dx} + \frac{y}{(1+x^2)^2} = 0$ by means of the transformation x = tan θ
4. Assuming the validity of expansion, prove that $e^x \cos x = 1 + x - \frac{2x^3}{3!} - \frac{2^2x^4}{4!} - \frac{2^2x^5}{5!} + \cdots$

ASSESSMENT PATTERN

S.No.	Bloom's Taxonomy	PT1	PT2	PT3	End Semester
1.	Remember	5	8	10	10
2.	Understand	5	7	10	10
3.	Apply	20	30	40	40
4.	Analyze	10	15	20	20
5.	Evaluate	10	15	20	20
6.	Create	---	---	---	---
Total		50	75	100	100

15UPH103	ENGINEERING PHYSICS (Common to **ALL** Branches of Engineering)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To develop the research interest in crystal physics
- To make students to understand classification of sound and applications of Ultrasonics
- To use the principles of Lasers and its types
- To apply principles of Quantum physics in engineering field
- To develop knowledge on principles of Thermal Physics

UNIT I CRYSTAL PHYSICS 9

Crystalline – Amorphous materials – single and poly crystal- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – parameters of Unit cell – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal growth technique- Bridgeman method.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound – decibel- weber- Fechner law – Units of Loudness- decibel- phon- sone- Reverberation – Absorption Coefficient –Introduction to ultrasonic- Magnetostriction effect – piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves - properties – Cavitations -Velocity measurement – acoustic grating - Industrial applications – SONAR .

UNIT III WAVE OPTICS AND LASERS 9

Introduction – interference – refractive index –Expression for plane, circularly and elliptically polarized light LASER: Introduction- Principles of Laser- Einstein theory of stimulated emission- Population inversion Methods - Types of lasers – Co2 laser - semiconductor laser – homojunction – heterojunction - Applications.

UNIT IV QUANTUM PHYSICS 9

Introduction to black body- de Broglie wavelength – Schrödinger's wave equation – Time dependent – Time independent equation – Physical significance of wave function - Compton Effect – Theory and experimental verification .

UNIT V PROPERTIES OF SOLIDS AND THERMAL PHYSICS 9

Elasticity- Hooke's law – Different types of moduli of elasticity– stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending - Thermal conductivity- Newton's law of cooling – Lee's disc method - Concept of Entropy.

TOTAL : 45

COURSE OUTCOMES

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

- apply the crystal growth techniques
- Discuss the basic concepts of Acoustics and Ultrasonics.
- Acquire knowledge about wave optics and Lasers
- Summarize the principles of quantum physics
- Explain the methods of thermal conduction.

TEXT BOOK

1. Dr. Mani.P, “A Text Book of Engineering Physics”, Dhanam Publications, Edition ,2014, Chennai.
2. Rajendran.V, “Engineering,Physics”, Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition 2013.
3. Palanisami P.K., “Physics For Engineers”, Scitech Publications (India), Pvt Ltd., Chennai, 2014.

REFERENCE BOOKS

1. Raghuvenshi G.S., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2014.
2. Arul doss .G., “Engineering Physics”, PHI Learning Limited, New Delhi, Revised Edition 2013.
3. Marikani .A., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2012.
4. Sankar B.N., and Pillai .S.O., “A Text book of Engineering Physics”, New Age International Publishers Private Limited, New Delhi, Revised Edition 2013.
5. Avadhanulu M.N. and Kshirsagar P.G., “A Textbook: of Engineering Physics”, S.Chand& Company Ltd., New Delhi, 2015.

15UCY107	CHEMISTRY FOR AGRICULTURIST	L	T	P	C
		3	0	0	3

OBJECTIVES

- Introduction to the fundamental concepts of chemical bonds.
- Imparting knowledge on the principles of water characterization and domestic applications.
- Introduce the concept of corrosion and its control methods.
- Understand the properties of soil based on chemical process.
- Acquire knowledge about the application of enzymes in food processing

MODULE- I CHEMICAL BONDING **9**

Chemical Bonding: Electronic Configuration– Ionic Bond - Covalent Bond – Metallic bond –Aufbau principle, Octet Rule, Pauli Exclusion principle, Molecular Orbital theory, Valence bond theory and its limitations, Various types of hybridization (SP, SP2 , SP3)(Homo nuclear& H2, N2, O2) and shapes of molecules based on MO theory -bond strength and bond energy, Born-Haber cycle, Fajan's rule–Non Covalent Bonding-Hydrogen bonding, Vander Waals forces.

MODULE- II WATER ANALYSIS **9**

Introduction- Hard water and soft water – Hardness of water – Estimation of hardness by EDTA method – alkalinity – Characteristics of water – treatment of water for domestic supply – Boiler feed water and its requirements – softening methods – external and internal conditioning – Desalination of brackish water. Various impurities present in water- Parameters to gauge water quality- Water for domestic use – Drinking water standards.

MODULE- III ELECTROCHEMISTRY AND CORROSION **9**

Electrochemistry: Introduction -Electrochemical cells- reversible and irreversible cells – EMF – measurement of emf-Single electrode potential-Nernst equation.

Chemical corrosion: Introduction- Definion- Types - (Dry corrosion, mechanism and its Example)-Electrochemical corrosion (Wet corrosion, mechanism and its Types – Galvanic & Differential aeration Corrosion- Pitting, crevice & Wire fence corrosion) Factors influencing rate of corrosion. Corrosion prevention - control by cathodic protection, Corrosion inhibitors, and Protective coatings – Paint, Electroplating – Gold plating-Risk Analysis -Electroless plating – Nickel plating.

MODULE- IV SOIL CHEMISTRY **9**

Soil Materials – Mineral materials, organic matter; Surface properties of Inorganic Soil Materials – Surface area, Charge of particles, Classification; Sorption processes in the soil, ion exchange – Adsorption isotherm, Buffering Capacity, Cation exchange, pH measurement, Soil acidity, Lime content, Sodic soils – Redox properties of soil, sources of oxidation and reduction, Redox potential depending pH.

MODULE- V FOOD CHEMISTRY **9**

Principle of Food Chemistry- introduction to lipids, proteins, carbohydrates, vitamins, food preservators, colouring and flavouring reagents of food-Enzymes and their use in the manufacturing of ethanol and acetic acid by fermentation methods-Food Resources-Changes caused by overgrazing and agriculture.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Have sound knowledge on the basics of chemistry related to bonding.
- Provide a strong platform to understand water quality parameters.
- Know the principles, various types of corrosion and corrosion control techniques.
- To explore the chemistry of different types of soils.
- Gain knowledge on various effects of agriculture methods and food resources.

TEXT BOOKS

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, DhanpatRai Publishing Company (P)Ltd., New Delhi, 2010

2. Michael S. Mamlouk, John P. Zaniewski, “Materials For Civil and Construction Engineers” Third Edition, Prentice Hall, Newyork, USA.

REFERENCE BOOKS

1. Physical chemistry – Samuel Glasstone, Macmillan II edition, 1969.
2. A. K. Kaw, *Mechanics of Composite Materials*, CRC Press, New Delhi 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Bolt, G.H, Bruggen wert, M.G.M, 1978, soil chemistry, Elsevier.

15UCS107	COMPUTER PROGRAMMING (Common to ALL Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C

UNIT I INTRODUCTION **9**

Generation and Classification of Computers - Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **9**

Introduction to „ C" programming – fundamentals – structure of a "C" program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in "C" – Managing Input and Output operations

UNIT III DECISION MAKING AND LOOPING STATEMENTS **9**

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements – Problem solving with decision making and looping statements.

UNIT IV ARRAYS, STRINGS AND FUNCTIONS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions.

UNIT V POINTERS, STRUCTURES AND UNIONS **9**

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic Memory allocation – Structure - need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Pre-processor directives

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Have sound knowledge on the basics of chemistry related to bonding.
- Provide a strong platform to understand water quality parameters.
- Know the principles, various types of corrosion and corrosion control techniques.
- To explore the chemistry of different types of soils.
- Gain knowledge on various engineering materials and their industrial application

TEXT BOOKS

1. Sutha . J, “Computer Programming”, Littlemoon Publications, Kariapatti, Third Edition, (2015).
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, First Edition, (2009).
3. Behrouz A. Forouzan, Richard F.Gilberg, “A Structured Programming Approach using C”, Third Edition, Thomson Course Technology, (2007).

REFERENCE BOOKS

1. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, (2011).
2. Kernighan.B.W ,Ritchie.D.M, “The C Programming language”, Pearson Education, Second Edition, (2006).
3. Stephen G.Kochan, “Programming in C”, Pearson Education India, Third Edition, (2005).
4. Anita Goel ,Ajay Mittal, ” Computer Fundamentals and Programming in C””, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, (2011).
5. Byron S Gottfried, ” Programming with C ”, Schaum‟s Outlines, Tata McGraw-Hill, Second Edition, (2006).

15UME108	ENGINEERING GRAPHICS (Common to ALL Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To develop in students graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings
- To impart knowledge in development of surfaces, isometric and perspective projections

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **1**

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning

UNIT I PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANESURFACES **9+5**

Plane Curves: (Not for Examination)

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Projections

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II PROJECTION OF SOLIDS **9+6**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to Horizontal plane (HP) only.

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **9+6**

Sectioning of above solids in simple vertical position by cutting planes inclined to Horizontal plane (HP) and perpendicular to the VP – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids inclined to Horizontal plane(HP) only – Prisms, pyramids, cylinders and cones

UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTIONS **9+6**

Isometric Projections

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones when cutting plane inclined to Horizontal plane (HP) only.

Perspective Projections (Not for Examination)

Perspective projection of prisms, pyramids and cylinders by visual ray method

UNIT V ORTHOGRAPHIC PROJECTION **9+6**

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills of multiple views from pictorial views of objects

TOTAL : 75 PERIODS

COURSE OUTCOMES

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

1. Discuss first angle projection to project straight line, planes and solids.
2. Illustrate simple solids like prisms, pyramids, cylinder and cone.
3. Construct section of solids and development of surfaces for engineering applications.
4. Prepare isometric views of objects like truncated solids and frustums.
5. Prepare orthographic views from isometric drawings.

TEXT BOOKS

1. SeeniKannan P., PitchayyaPillai G., and ArunBalasubramanian K., “Engineering Graphics”, Little Moon Publication, Revised edition 2016.
2. Bhatt N.D., “Engineering Drawing”, 46th Edition, Charotar Publishing House, (2003).

REFERENCE BOOKS

1. Natarajan K.V., “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, (2006).
2. Venugopal K., and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, (2008).
3. Gopalakrishnan K.R., “Engineering Drawing” (Vol .I&II), Subhas Publications,(1998).
4. DhananjayA.Jolhe, “Engineering Drawing with an introduction to Auto CAD”, Tata McGraw Hill Publishing Company Limited, (2008).

15UCS109	COMPUTER PROGRAMMING LABORATORY (Common to ALL Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES

- To make the students to work with Office software.
- To familiarize the implementation of programs in C.

LIST OF EXPERIMENTS

a. Word processing - Document creation, Formatting, Table Creation, Mail merge

b. Spread Sheet - Chart - Line, XY, Bar and Pie, Formula - formula editor.

c. C Programming

- Programs using simple statements
- Programs using decision making statements
- Programs using looping statements
- Programs using one dimensional and two dimensional arrays
- Solving problems using string functions
- Programs using user defined functions and recursive functions
- Programs using pointers
- Programs using structures and unions

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Create the document in Word Processing software.
- Write programs using control constructs.
- Apply functions to reduce redundancy.
- Design and implement C programs for simple applications.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

- LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE

- OS – UNIX CLONE (License free Linux)
- APPLICATION PACKAGE – OFFICE SUITE
- COMPILER – C

15UME110	ENGINEERING PRACTICES LABORATORY (Common to Mech, EEE, Civil, Chemical and Agri)	L	T	P	C
		0	0	2	1

OBJECTIVES

- To demonstrate the plumbing and carpentry works.
- To train the students to perform welding and drilling operations.
- To demonstrate residential house wiring, fluorescent lamp wiring, measurement of earth resistance, colour coding of resistors, logic gates and soldering

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE

LIST OF EXPERIMENTS

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Preparation of plumbing line sketches for water supply and sewage works.
3. Hands-on-exercise: Basic pipe connections–Mixed pipe material connection Pipe connections with different joining components.
4. Demonstration of plumbing requirements of high-rise buildings.
5. Study of the joints in roofs, doors, windows and furniture.
6. Hands-on-exercise: Wood work, joints by sawing, planning and cutting

MECHANICAL ENGINEERING PRACTICE

LIST OF EXPERIMENTS

1. Preparation of arc welding of butt joints, lap joints and tee joints.
2. Drilling Practice
3. Model making – Trays, funnels, etc.
4. Study of Different type of joints.
5. Study of centrifugal pump
6. Study of air Conditioner

A minimum of Five experiments shall be offered in GROUP A (CIVIL & MECHANICAL)

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE

LIST OF EXPERIMENTS

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter and Stair case wiring
2. Fluorescent lamp wiring.
3. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE
LIST OF EXPERIMENTS

a. Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms, period, frequency) using CRO.
b. Study of logic gates AND, OR, EX-OR and NOT Gate.
c. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

1. Perform basic plumbing and carpentry works.
2. Demonstrate the welding and drilling.
3. Build sheet metal models like tray and funnel.
4. Accomplish basic residential house wiring.
5. Acquire knowledge in soldering practice and logic gates.

EQUIPMENT REQUIREMENT

CIVIL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted components for plumbing consisting of metallic Pipes, Plastic pipes, Flexible pipes, Couplings, Unions, Elbows, Plugs and other fittings	5 Sets
2.	Carpentry vice (fitted to workbench)	15 Nos
3.	Standard working tools	15 sets
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power tool rotary hammer	2 Nos
6.	Demolition hammer	2 Nos
7.	Planer	2 Nos
8.	Hand drilling machine	2 Nos
9.	Jigsaw	2 Nos

MECHANICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Arc welding transformer with cable sand holders	5 Nos
2.	Welding booth with exhaust facility	5 Nos
3.	Welding accessories like welding shield, chipping hammer,	5 sets
	wire brush, etc.	
4.	Oxygen and acetylene gas cylinders, blow pipe and other	2 Nos
	welding outfit	
5.	Smithy tools	2 sets
6.	Moulding table, foundry tools	2 sets
7.	Study-purpose items: centrifugal pump, air-conditioner	One Each

ELECTRICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted electrical componentsforhouse wiring	15 sets
2.	Electrical measuring instruments	10 sets
3.	Megger (250V/500V)	1 No
4.	Study purpose items: Iron box, fanand regulator, emergency lamp	One each
5.	Power Tools:	
	(a) Range Finder	2 No
	(b) Digital Live-wire detector	2 No

ELECTRONICS ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Logic trainer kit	2 No
2.	CRO,AFO	2 Each
3.	Small multipurpose PCBs	10 No
4.	Soldering guns	10 No
5.	Multimeters	5 No
6.	Assorted electronic components for making circuits	Required quantity

15UGS112	BASIC SCIENCES LABORATORY –I (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES

- To create scientific temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

PHYSICS LABORATORY

LIST OF EXPERIMENTS

1. Laser – Determination of particle size and wavelength of Laser source. using Diode Laser.
2. Ultrasonic Interferometer - Determination of velocity of sound and compressibility of liquid.
3. Poiseuille's method - Determination of Coefficient of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Compound pendulum – Determination of the acceleration due to gravity
6. Air Wedge method - Determination of thickness of a thin wire.

A minimum of FIVE experiments shall be offered

COURSE OUTCOME

After the successful completion of this course, the student will be able to

- Determine the thickness of various micro level objects using air wedge method.
- Analyze the viscous properties of various liquids using Poiseuille's method.
- Compare the velocity of ultrasonic waves in various liquids by ultrasonic interferometer method.

CHEMISTRY LABORATORY

OBJECTIVES

- To impart knowledge on basic concepts in application of chemical analysis
- To train the students in instrumental methods
- To develop skills in estimation of various ions by chemical and instrumentation methods

LIST OF EXPERIMENTS

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Conduct to metric Titration of Mixture of Acids
3. Estimation of Fe^{2+} ion by potentiometry.
4. Determination of Strength of given acid using pH metry
5. Determination of suspended and dissolved solids in water.
6. Comparison of the electrical conductivity of two samples-conductometric method
7. Estimation of copper in brass by EDTA method

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Estimate the ions present in the given sample
- Determine the rate of corrosion, molecular weight and amount of solids in water.
- Estimate the acidity of water sample

A minimum of FIVE experiments shall be offered for every course

TOTAL : 30 PERIODS

Laboratory classes on alternate weeks for Physics and Chemistry

15UEN201	BUSINESS ENGLISH & PRESENTATION SKILLS (Common to **ALL** Branches of Engineering)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To use linguistic tools confidently in an English speaking context
- To listen and speak during normal business activities such as interviews, meetings, telephone conversations and negotiations.
- To write business letters, emails, reports, articles and comprehend information on the Internet and other media.
- To gain language skills for real business life situations

UNIT I	**9**

Grammar- Numerical Adjective; **Vocabulary** - Job title and describing jobs; **Listening** - Listening to company culture; **Reading** - Quiz; **Writing** - Writing formal and semi formal business letters; **Speaking** – Personal information, Companies and products.

UNIT II	**9**

Grammar –Modals; **Vocabulary –** Collocations; **Listening** - Business Proceedings; **Reading** - Designing websites and e– mail ; **Writing** – Memo - **Speaking -** Role play on various business situation.

UNIT III	**9**

Grammar –prepositions–Articles; Vocabulary – Jargons related to Shares and stock Listening – Interviews of celebrities; Reading – Shares and stock exchange transactions of; Writing – Business report–the Meeting; Speaking – Presentations, Making a Minutes business talk.

UNIT IV	**9**

Grammar - Connectives; **Vocabulary** –Words related to finance; **Listening** - Listening tostatistical information; **Reading** - Interpreting business related bar charts; **Writing** - Letters to express interest in new products; **Speaking** - Presenting a summary of an article.

UNIT V	**9**

Grammar - Reported speech; **Vocabulary** –Words related to employment ; **Listening**-Listening to audio and video speech of business people; **Reading** - Reading Newspaper article/magazine articles on business; **Writing** - Writing a Proposal; **Speaking** - Discussing company policies

TOTAL :	**45 PERIODS**

COURSE OUTCOMES

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

- Use business vocabulary effectively to present the ideas.
- Accomplish verbal and written communications.
- Write effectively in a wide range of business letters.
- Prepare Business Proposals and Business Reports for various business purposes.
- Make a presentation in English in various business avenues.

TEXT BOOK

Elankathiravan B.A, *Business English and Presentation Skills,* Sivakasi, Wakeup Publications, 2016.

REFERENCE BOOKS

1. Michael McCarthy, Felicity O'Dell, English Collocations in Use, Noida, Cambridge University Press, 2006.
2. Allan Pease, Body Language, New Delhi, Sudha Publications (P) Ltd, 2005.
3. Malcolm Goodale, Professional Presentations, New Delhi, Cambridge University Press, 2006.
4. Randolph Hudson. H & Bernard Selzler. J. Business Communication, Jaico Publishing House, 2006

15UMA202	ENGINEERING MATHEMATICS – II (Common to ALL Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To develop an understanding of the basics of vector calculus comprising of gradient, divergence and curl, and line, surface and volume integrals and the classical theorems involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- To make the student acquire sound knowledge of Laplace transform and its properties and sufficient exposure to the solution of certain linear differential equations using the Laplace transform technique.

UNIT I ANALYTICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8 + 6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE (Bacterial growth, Population growth, Decayed problems).

UNIT II VECTOR CALCULUS 8 + 6

Gradient Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopiped.

UNIT III ANALYTIC FUNCTIONS 8 + 6

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+c, cz, 1/z, and Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9 + 6

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT V LAPLACE TRANSFORM 9 + 6

Existence conditions – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function, impulse function and periodic function - Inverse Laplace transform – Convolution theorem (excluding Proof) –Solution of linear ODE of second order with constant coefficients.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation / Application of Mathematics, Arithmetical, Ability – Time and Work – Time and Distance.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Solve first and higher order ordinary differential equations analytically and apply in real life engineering problems.
- Calculate the gradients and directional derivatives of functions of several variables.
- Find the image of a region under conformal mapping and construct analytic functions using its properties.
- Apply the knowledge of standard techniques of complex variables for evaluating different functions
- Apply Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs.

TEXT BOOKS:

1. VEERARAJAN.T "Engineering Mathematics" Tata McGraw Hill Publishing Company, New Delhi, vol 15.
2. BALI N. P and MANISH GOYAL, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., New Delhi, 3rd Edition, (2008).

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
3. JAIN R.K and IYENGAR S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).
4. AGARWAL R.S., "Quantitative Aptitude", S. Chand Publications, New Delhi, 7th Edition, (2008), pp. 341-370, 384-404.
5. GREWAL. B.S, "Higher Engineering Mathematics", Khanna Publications, New Delhi, 43rd Edition, (2014).

ASSESSMENT QUESTIONS

REMEMBER

1. What is the order and degree of $y''' + 2(y'')^5 + y = 0$
2. Write is The Wronskian formula
3. What is d(sin ax)
4. Write the three types for finding Complementary function
5. If $\vec{v} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + \lambda z)\vec{k}$ is solenoidal, find the value of **'λ'**.

UNDERSTAND

1. Solve $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$
2. Find the particular integral of $(D+1)^2 y = e^{-x}\cos x$
3. Find complementary function of $(4D^2 - 3D - 1)y = 2\sin 2x$
4. Write the complete solution of $(x^2D^2 - 3xD - 5)y = 0$
5. Find the Directional derivatives $\phi = x^2yz + 4xz^2$ at (1,-2,-1) in the direction of $2\vec{i} - \vec{j} - 2\vec{k}$

APPLY

1. Solve $(x^2D^2 + 4xD + 2)y = x \log x$
2. Solve $[(x+1)^2D^2 + (x+1)D + 1]y = 2\sin[\log(x+1)]$
3. Use the fact that the world population was 2560 million people in 1950 and 3040 million in 1960 to model the population of the world in the second half of the 20th century. What is the relative growth rate k? Estimate the world population in 1993 and predict the population in the year 2020?
4. What is the half-life of Radium-226 if its decay rate is 0.000436?

ANALYZE

1. Prove that $(x^2D^2 - 2xD - 4)y = 32(\log x)^2$
2. Verify $(x^2D^2 - xD + 1)y = \left(\frac{\log x}{x}\right)^2$
3. Prove that $(x^2D^2 + 4xD + 2)y = e^x$
4. Verify $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \log x \sin(\log x)$

EVALUATE

1. Evaluate $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \log x \sin(\log x)$
2. Evaluate $[(x+1)^2D^2 + (x+1)D + 1]y = 4\sin[\log(x+1)]$
3. Evaluate $[(3x+2)^2D^2 + 3(3x+2)D - 36]y = 3x^2 + 4x + 1$
4. Evaluate $(x+2)^2\frac{d^2y}{dx^2} - (x+2)\frac{dy}{dx} + y = 3x + 4$

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy	Periodical Test – I	Periodical Test – II	Periodical Test – III	End Semester
1.	Remember	5	8	10	10
2.	Understand	5	7	10	10
3.	Apply	20	30	40	40
4.	Analyze	10	15	20	20
5.	Evaluate	10	15	20	20
6.	Create	----	----	----	----
	Total	**50**	**75**	**100**	**100**

15UPH207	PHYSICS FOR AGRICULTURAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the essential principles of physics related to agricultural engineering.
- To gain knowledge about the physical properties of the various materials.
- To cover the fundamental scientific principles for the different synthesis techniques and assembly of the advanced materials.

UNIT I CONDUCTORS AND SOIL PHYSICS **9**

Conductors — Electrical and thermal conductivity – Wiedemann – Franz law – Fermi distribution function- Dielectric Materials: Introduction – Electrical susceptibility-Dielectric constant-Electronic, ionic, orientation and space charge polarization – Internal field – Claussius-Mosotti relation (Derivation)- Soil Physics-Introduction-properties-Physical parameters- Texture- Structure-Methods of textural analysis-Soil aeration and its characterization- Thermal properties of soils-Energy balance and mode of heat transfer in soils-Factors affecting soil temperature- Measurement of soil temperature

UNIT II ENERGY PHYSICS **9**

Introduction - various forms of energy - fossil fuels- conventional energy systems - Non-Conventional Energy Sources - Biomass energy - classification - Thermo-chemical Conversion, Combustion, Gasification, Biomass gasifiers and types -Bio-fuels: Importance, Production and applications.

UNIT III ADVANCED ENGINEERING MATERIALS **9**

Metallic glasses– preparation – properties & applications - Nanomaterial: synthesis-plasma arcing –Solgel- Chemical vapour deposition – ball milling - properties and applications – Introduction to CNT- Application of nano-materials in Agriculture

UNIT IV REMOTE SENSING IN AGRICULTURE AND IRRIGATION **9**

Electromagnetic spectrum: The photon and radiometric quantities - radiant energy - radiant flux density - radiant intensity - transmittance - absorptance - reflectance - distribution of radiant energies - spectral signatures - sensor technology - sensor types - passive and active - spatial resolution - processing and classification of remote sensed data

UNIT V FOOD IRRADIATION AND PRESERVATION **9**

Effects of ionizing radiation on biological organism - Effects of ionizing radiation on foods - applications of food irradiation - low dose - medium dose and high dose - Food irradiation using electron beams, X-rays - nuclear radiation - Processing of seeds, spices, fruits and vegetables.

TOTAL : 45

COURSE OUTCOMES

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

- Summarize the properties of conductors and dielectrics.
- Explain conventional and non-conventional energy sources.
- Understand nano particles and new engineering materials.
- Give details of the numerical explanation of solar radiation and remote sensing analysis in agriculture.
- Sum up the different food processing methods especially in high energy irradiation process

REFERENCE BOOKS

1. William D. Callister, Jr. “Material Science and Engineering”, Seventh Edition, John Wiley &
   Sons Inc. New Delhi, 2010
2. Electronic radiation of foods - An Introduction to Technology, R.B.Miller, Springer, 2005.
3. Fundamentals of Remote Sensing, George Joseph, University Press Pvt.Ltd., 2005.
4. Non –Conventional Energy Sources, G.D.Rai, Khanna Publishers,2015
5. Biomass Gasification Principles and Technology, Energy technology review No. 67, -T.B.Read (Noyes Data Corp. , 1981) 2013.

15UAG204 PRINCIPLES OF AGRICULTURAL ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

COURSE OBJECTIVES

- To present the basic theory and practice for various areas of Agricultural Engineering
- Application of engineering to the problems of agricultural production.

UNIT I : INTRODUCTION, SOIL & WATER CONSERVATION AND IRRIGATION 10

Agricultural Engineering – Introduction – Branches - Importance in national and global scenario – Institutes & organizations – Soil & water - Land development, Soil irritability classification - Soil erosion and control, Soil conservation methods, Watershed management - Agro meteorology - Soil Water Plant relationship – Sources of water – Tanks – W ells & Reservoirs – Canal Network – Irrigation Scheduling – Irrigation methods – Micro irrigation - Participatory management of Irrigation Systems

UNIT II : FARM MACHINERY & EQUIPMENT 8

Tractor and Power Tiller – Tillage equipment – Sowing, Planting, Fertilizer application, Fertigation equipment - Spraying, Weeding and intercultural – Harvesting and Mowing Equipment, Pumps

UNIT III : AGRICULTURAL PROCESS ENGINEERING 10

Post harvest of crops, Unit operations in agricultural processing, Ripening chamber and Cold Storage - Packing of agricultural produces – Material handling equipment's – Milk processing and dairy products

UNIT IV : AGRO ENERGY 9

Energy requirement in agricultural operations - Solar (Thermal and Photovoltaic), Wind mills, Bio- gas energy and their utilization in agriculture – Gasification of biomass for IC Engines - Energy efficient cooking stoves and alternative cooking fuels – agricultural waste and their utilization.

UNIT V :FARM STRUCTURES 8

Farm stead, Farm Roads, Cattle sheds, Stanchion barn, Poultry shed, Hog housing, Machinery and implement shed, Storage structures for food grain, feed & forage -Structures for Plant environment Green houses, Poly houses – Shade net.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- The knowledge gained on soil and water conservation and Irrigation Management system
- To understand the working principles of various farm machinery & equipment
- A strong platform to understand the concepts on agricultural process engineering
- The knowledge gained on different renewable energy sources
- To understand the uses of different types of farm structures

TEXT BOOKS:

1. Michael, A.M. & Ojha, T.P. “Principles of Agricultural Engineering Vol. I & II”, Seventh Edition, Jain Brothers, New Delhi, 2011.
2. Jagdishwar Sahay. “Elements of Agricultural Engineering”, Standard Publishers
3. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007.

REFERENCE BOOKS:

1. Earle, R.L., “Unit operations in Food Processing”, Pergamon Press, Oxford, U.K, 1985.
2. Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co.
3. Rai. G.D. “Non-Conventional Sources of Energy”, Khanna Publishers, New Delhi, 2002
4. Murthy, V.V.N., “Land and Water Management Engineering”, Kalyani Publishers,

15UAG204 - ASSESSMENT QUESTIONS

UNIT I

1. Trickle irrigation is also known as: **[Remember]**
   a) Sprinkler irrigation b) Furrow irrigation
   c) Drip irrigation d) Flood irrigation
2. Enumerate the advantages of drip irrigation system. **[Understand]**
3. What is soil erosion? Explain the various soil erosion conservation methods. **[Evaluate]**
4. Define irrigation. Discuss the different Irrigation methods with a neat sketch. **[Analyze]**

UNIT II

1. Mechanization possibility is strongly influenced by: **[Remember]**
   a) Farm size
   b) Cost of farm power
   c) Availability of suitable machines
   d) All of the above
2. What you mean by primary tillage? **[Analyze]**
3. Write short notes on the objectives of tillage. Discuss the importance of primary and secondary tillage implements with neat sketch. **[Analyze]**
4. What is farm mechanization? Discuss about the implements used for sowing and fertilizer application. **[Remember]**

UNIT III

1. LSU dryer is: **[Analyze]**
   a) Rotary type
   b) Floating bed type
   c) Continuous flow type
   d) Fixed bed type
2. Define specific heat. **[Understand]**
3. What is the unit operations involved in agricultural processing? Explain the working principle of rubber roll sheller with neat sketch. **[Remember]**
4. Explain the different types of material handling equipment's with neat sketch. **[Analyze]**

UNIT IV

1. Biogas is a mixture of:
   a) Oxygen, Carbon dioxide, Nitrogen
   b) Methane, Nitrogen, Oxygen **[Remember]**
   c) Methane, Nitrogen, Hydrogen
   d) None of these
2. Differentiate renewable and non-renewable energy. **[Analyze]**
3. i) What is biogas? Discuss its advantages and disadvantages.
   ii) With a neat sketch, explain the working principle of KVIC model biogas plant. **[Remember]**
4. i) Explain the working principle of photovoltaic cell with neat sketch. **[Remember]**
   ii) Explain the working principles of downdraft gasification system.

UNIT V

1. Define Greenhouses. **[Understand]**
2. List out four modern storage structures. **[Remember]**
3. Discuss the design requirements of poultry shed with suitable diagram. **[Analyze]**
4. Explain the different storage structures used for food grains with neat sketch. **[Understand]**

Assessment Pattern

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember		6	6	10
Understand	16	12	12	10
Apply	34	32	32	80
Analyze				
Evaluate				
Create				
Total (50)	50	50	50	100

15UCY207	ENVIRONMENTAL SCIENCE (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understanding the concepts of ecosystem and biodiversity.
- Acquire knowledge about the impact of environmental pollution.
- Awareness on various types of resources.
- Understand the importance of environmental issues in the soceity.
- Awareness about the impact of environment related to human health

MODULE- I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – Need for public awareness – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – 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: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

MODULE- II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: Causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides

MODULE- III FUTURE POLICY AND ALTERNATIVES 9

Future policy and alternatives-fossil fuels-nuclear energy-solar energy-wind energy-hydroelectric energy-geothermal energy-tidal energy-sustainability-green power-nanotechnology-international policy.

MODULE- IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – Public awareness.

MODULE- V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Comprehend the importance of environmental impact on ecosystem and biodiversity
- Understand current environmental challenges like pollution and its management.
- Remembering the fundamentals of physical and biological principles that govern natural processes.
- Perform their role in protecting the environment from social issues.
- Learn the importance of population explosion and its controlling measures

TEXT BOOKS

1. AnubhaKaushik, kaushik C.P., "Environmental Science and Engineering", Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph "Environmental Science and Engineering", Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science',
2. Pearson Education,Upper saddle River, New Jersey, 2008.
3. Miller T.G. Jr., Environmental Science", Wadsworth Publishing Company, Belmont, California, 2005.
4. De A.K., "Environmental Chemistry", Wiley Eastern Ltd., New Delhi, 2001.

15UEE208	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to Mech, Civil, Chemical & Agri)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the principles of DC and AC fundamentals
- To study the Construction and operations of Electrical machines & measuring instruments
- To attain basic knowledge on semiconductor devices and digital principles
- To introduce the basic concepts of communication engineering

UNIT I	FUNDAMENTALS OF DC CIRCUITS AND AC CIRCUITS	9

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division. Generation of AC, Average and RMS values, Form and peak factors.

UNIT II	ELECTRICAL MACHINES AND MEASURING INSTRUMENTS	9

Working principle, construction and applications of DC machines (Generator and Motor), AC machines (single phase induction motors: split phase, capacitor start and capacitor run motors) and single phase transformers. Basic principles and classification of instruments -Moving coil and moving iron instruments.

UNIT III	SEMICONDUCTOR DEVICES	9

Passive components – resistors, capacitors & inductors (properties, common types, I-V relationship and uses). Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT.

UNIT IV	INTRODUCTION TO DIGITAL ELECTRONICS	9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

UNIT V	FUNDAMENTALS OF COMMUNICATION ENGINEERING	9

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Satellite and Optical Fiber. (Block Diagram Approach only).

TOTAL :	45 PERIODS

COURSE OUTCOMES

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

- Apply the principles of DC and AC fundamentals
- Explain the Construction and operations of Electrical machines & measuring instruments
- Analyze the characteristics of semiconductor devices
- Wire Boolean expressions using logic gates
- Explain the concepts of communication engineering

TEXT BOOKS

1. Mehta V K, “Principles of Electronics”, S.Chand& Company Ltd, fifth Edition New Delhi,2008
2. R. Muthusubramanian, S. Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education, Reprint 2012
3. Smarajt Ghosh, “Fundamentals of Electrical & Electronics Engineering”, PHI Learning - 2011.
4. B. Somanathan Nair, S.R. Deepa, “Basic Electronics”, I.K. International Pvt. Ltd., 2009.

REFERENCE BOOKS

1. Kothari D. P and Nagrath IJ, “Basic Electrical Engineering”, Tata McGraw - Hill, 2009.

2. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson Eduaction, 2011

15UAG206	AGRICULTURAL ENGINEERING PRACTICES LAB	L	T	P	C
		0	**0**	**3**	**2**

OBJECTIVES:

- Students should be able to understand the various aspects of agricultural engineering studied in theory by performing basic experiments in lab.

LIST OF EXPERIMENTS

1. Site selection and layout for agromet observatory
2. Measurement of solar radiation (pyranometers), sunshine hours (sunshine recorder)
3. Measurement of relative humidity by wet and dry bulb thermometer
4. Measurement of wind direction and wind speed
5. Measurement of rainfall – ordinary and self recording rain gauges
6. Measurement of evaporation – open pan evaporimeter
7. To study of automatic weather station(AWS)
8. To study of the primary tillage implements
9. To study the harvesting equipments
10. To study material handling equipments

TOTAL: **30 PERIODS**

COURSE OUTCOMES:

After the successful completion of this course, the student shall be able to

- To Measurement of agro meteorological parameters
- To gain the knowledge on Agricultural machineries and equipment
- To study concept of automatic weather station(AWS)
- To understand the concepts of agricultural process engineering

REFERENCES

1. Michael, A.M. & Ojha, T.P. Principles of Agricultural Engineering Vol. I & II, Seventh Edition, Jain Brothers, New Delhi, 2011.
2. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007.

LIST OF INSTRUMENTS AND IMPLEMENTS REQUIRED (30 STUDENTS/PER BATCH)

Sl. No.	Description of Equipment	Quantity Required
1.	Rain gauge – Recording type	1
2.	Non-recording type	1
3.	Automatic Weather Station	1
4.	Open Pan Evaporimeter	1
5.	Sunshine recorder	1
6.	Hygrometer	1
7.	Wind vane	1
8.	Anemometer	1
9.	Stevenson‟s screen	1
10.	Hot air oven	1
11.	Soil moisturemeter	1
12.	Tensiometer	1
13.	Soil auger	1
14.	Weighing balance	1
15.	pH meter	1
16.	EC and TDS meter	1
17.	Drip irrigation and Sprinkler irrigation setup with all features	1
18.	Mould board plough	1
19.	Disc plough	1

15UGS210	BASIC SCIENCES LABORATORY –II (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES

- To create scientific temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

PHYSICS LABORATORY

LIST OF EXPERIMENTS

1. Laser – Determination of particle size and wavelength of Laser source. using Diode Laser.
2. Ultrasonic Interferometer - Determination of velocity of sound and compressibility of liquid.
3. Poiseuille's method - Determination of Coefficient of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Compound pendulum – Determination of the acceleration due to gravity
6. Air Wedge method - Determination of thickness of a thin wire.

A minimum of FIVE experiments shall be offered

COURSE OUTCOME

After the successful completion of this course, the student will be able to

- Determine the thickness of various micro level objects using air wedge method.
- Analyze the viscous properties of various liquids using Poiseuille's method.
- Compare the velocity of ultrasonic waves in various liquids by ultrasonic interferometer method.

CHEMISTRY LABORATORY

OBJECTIVES

- To impart knowledge on basic concepts in application of chemical analysis
- To train the students in instrumental methods
- To develop skills in estimation of various ions by chemical and instrumentation methods

LIST OF EXPERIMENTS

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Conduct to metric Titration of Mixture of Acids
3. Estimation of Fe^{2+} ion by potentiometry.
4. Determination of Strength of given acid using pH metry
5. Determination of suspended and dissolved solids in water.
6. Comparison of the electrical conductivity of two samples-conductometric method
7. Estimation of copper in brass by EDTA method

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Estimate the ions present in the given sample
- Determine the rate of corrosion, molecular weight and amount of solids in water.
- Estimate the acidity of water sample

A minimum of FIVE experiments shall be offered for every course

TOTAL : 30 PERIODS

Laboratory classes on alternate weeks for Physics and Chemistry

TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

		L	T	P	C
15UMA321	**(Common to MECH, ECE, EEE, CIVIL, CHEMICAL, AGRI, BIO MEDICAL)**	**3**	**2**	**0**	**4**

OBJECTIVES

- To make the student knowledgeable in formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- To familiarize the students to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them numerically and interpret the results.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I FOURIER SERIES 9 + 6

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic analysis

UNIT II FOURIER TRANSFORM 9 + 6

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity -

UNIT III Z-TRANSFORM AND DIFFERENCE EQUATIONS 9 + 6

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations – Solution of difference equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations – Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Introduction of Partial differential equations - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

TOTAL : 45 (L) + 30 (T) = 75 Periods

Suppliment Topic- Application of Fourier series - Gibb's ,

Application of Fourier Transform.Phenomenon.

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Write any periodic function as a combination of series of sine and cosine which are harmonically related to each other.
- Apply the acquired knowledge of Fourier transform and its properties which are used to transform signals between time and frequency domain.
- Apply the acquired knowledge of Z transform and its properties for the analysis of linear discrete systems.
- Form partial differential equation and solve linear first order and second order partial differential equations.
- Apply Fourier series to solve partial differential equations representing one dimensional and two dimensional heat and wave equations.

TEXT BOOKS:

1. GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
2. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, S.Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

REFERENCE BOOKS:

1. BALI N.P., MANISH GOYAL and WATAINS, "Advanced Engineering Mathematics", Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).
2. RAMANA.B.V, "Higher Engineering Mathematics" Tata McGraw Hill, New Delhi, 11th Reprint (2010).
3. GLYN JAMES, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 3rd Edition, (2007).
4. ERWIN KREYSZIG, "Advanced Engineering Mathematics", Wiley India, 10th Edition, (2011).

ASSESSMENT QUESTIONS

REMEMBER

1. In a one dimensional wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$, c^2= _____.

   (i) T^2/m^2 (ii) T/m (iii) T/m^2 (iv) T^2/m.

2. State and prove Modulation theorem
3. State Dirichlets condition
4. State Parseval's Identity

UNDERSTAND

1. The difference equation of $y_n = a2^n + b(-2)^n$ is _____

   a) $y_{n+2} - 4y_n = 0$ b)$y_{n+2} + 4y_n = 0$ c)$y_{n+2} - y_n = 0$ d)$y_{n+2} + y_n = 0$

2. The partial differential equation of all planes through the origin is ----------

   (i) $z = px + qy^2$ (ii) $z = px - qy^2$ (iii) $z = px + qy$ (iv) $z = px - qy$

3. The singular integral of $z = px + qy + pq$.

   (i) $z = -xy$ (ii) $z = x^2 y$ (iii) $z = xy$ (iv) $z = -xy^3$

4. Find Z – Transform of $\left(\frac{1}{n}\right)$ & $\left(\frac{1}{n!}\right)$

APPLY

1. Find the Fourier Transform of $f(x) = \begin{cases} 1-x^2 & if\ |x| < 1 \\ 0 & if\ |x| > 1 \end{cases}$

   and hence deduce that $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\left(\frac{x}{2}\right)dx$

2. Find the Fourier Transform of $f(x) = \begin{cases} 1 & if\ |x| < a \\ 0 & if\ |x| > a \end{cases}$ and hence evaluate $i)\int_0^\infty \frac{\sin x}{x}dx$

   ii) $\int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx$

3. Find Fourier Transform of $f(x) = \begin{cases} 1-|x| & if\ |x| < 1 \\ 0 & if\ |x| > 1 \end{cases}$ and hence evaluate

   i) $\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx$ **ii)** $\int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx$

4. Find Fourier sine Transform of e^{-ax} ,x>0 and hence deduce that $\int_0^\infty \frac{x\sin sx}{\left(a^2 + x^2\right)}dx$

EVALUATE

1. Evaluate $\int_0^\infty \frac{x^2}{\left(x^2+a^2\right)^2}dx$

2. Evaluate $\int_0^\infty \frac{dx}{\left(x^2+a^2\right)^2}$

3. Evaluate i) $\int_0^\infty \frac{dx}{\left(x^2+a^2\right)\left(x^2+b^2\right)}$ ii) $\int_0^\infty \frac{x^2dx}{\left(x^2+a^2\right)\left(x^2+b^2\right)}$

4. If $f(x)=\begin{cases}0 & , \quad (-\pi,0)\\ \sin x & , \quad (0,\pi)\end{cases}$ Hence deduce that $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-.....=\frac{\pi-2}{4}$

ASSESSMENT PATTERN

S.No.	Bloom's Taxonomy	PT1	PT2	PT3	End Semester
1.	Remember	5	5	5	10
2.	Understand	5	5	5	10
3.	Apply	20	20	20	40
4.	Analyze	10	10	10	20
5.	Evaluate	10	10	10	20
6.	Create	---	---	---	---
Total		**50**	**50**	**50**	**100**

15UAG302	UNIT OPERATIONS IN AGRICULTURAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- 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 9

Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation-performance of evaporators and boiling point elevation – capacity – economy and heat balance-types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator.

UNIT II FILTRATION AND SEDIMENTATION 9

Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press-sedimentation – gravitational sedimentation of particles in a fluid – Stoke‟s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.

UNIT III SIZE REDUCTION 9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger‟s, Bond‟s and Kick‟s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.

UNIT IV PROCESSING 9

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium – equilibrium concentration relationships – operating conditions-calculation of separation in contact – equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment-properties of tower packing – types – construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – equipments.

UNIT V CRYSTALLISATION AND DISTILLATION 9

Crystallization-Equilibrium –Rate of crystal growth stage-Equilibrium crystallization-Crystallizers-Equipment-Classification- Construction and operation – Crystallizers-Tank-Agitated batch-Swenson-Walker and Vacuum crystallizers-Distillation-Binary mixtures-Flash and differential distillation-Steam distillation –Theory-Continuous distillation with rectification –Vacuum distillation - Batch distillation-Operation and process-Advantages and limitation-Distillation equipments-Construction and operation-Factors influencing the operation.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Understand about various types of evaporators and their economy in concentration process
- Classify filtration and sedimentation process
- Understand the size reduction methods and working principle of various mills
- Relate gas-liquid and solid-liquid equilibrium
- Acquire knowledge on crystallization and distillation techniques.

TEXT BOOKS

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 Inc., Kosaido Printing Ltd., Tokyo, 1990.
3. K.M Sahay and K.K. Singh “Unit operation of Agricultural Processing” Vikas Publication.

REFERENCE BOOKS

5. Coulson, J.M., and Richardson, J.F., “Chemical Engineering”, Vol. 1, ThePergamon Press, New York, 1977.

15UAG302 - ASSESSMENT QUESTIONS

UNIT I

1. _____^{o}C is the maximum steam temperature for evaporators.

   a) 100

   b) 70

   c) 50

   d) 150

   [Remember]

2. What is latent heat of vapourization? **[Understand]**

3. Explain the application of engineering aspects in food processing as per your thought process. **[Evaluate]**

4. Prove that the area of heat transfer is same in single effect evaporator as that of multiple effect evaporator when the operating conditions are same for the same quantity of liquids. **[Analyze]**

UNIT II

1. _____µm is the pore size of the membrane in nano-filtration.

   a) 100

   b) 10

   c) 0.01

   d) 0.0001

   [Remember]

2. What is filtration? **[Understand]**

3. Explain the principles of a rapid sand filter. **[Analyze]**

4. Explain the principles of centrifugal separation. **[Remember]**

UNIT III

1. Ball mill is working on the basis of_____principle.

   a) Impact

   b) shear force

   c) pull

   d) Point load

   [Analyze]

2. What is crushing efficiency? **[Understand]**

3. Explain the design considerations for size reduction equipments? **[Remember]**

4. Explain different types of size reduction equipments. **[Analyze]**

UNIT IV

1. Purpose of a agitator is to_____.
   a) Stirring
   b) Mixing **[Remember]**
   c) Washing
   d) Loading
2. What is solvent extraction? **[Understand]**
3. Explain contact equilibrium separation process and principles of extraction tower? **[Analyze]**
4. Explain the flow through packed towers and derive rate of extraction. **[Remember]**

UNIT V

1. Application of crystallization is practiced in _____.
   a)Chemical industries
   b)Food Industries **[Understand]**
   c)Pharmaceutical industries
   d) All
2. What is Distillation? **[Remember]**
3. Explain continuous distillation process with rectification column. **[Analyze]**
4. Explain walker and vacuum crystallizers. **[Understand]**

Assessment Pattern

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	18	18	25
Understand	16	16	16	25
Apply	16	16	16	50
Analyze				
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG303	FUNDAMENTALS OF ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES 9

Introduction – Units and Dimensions – Laws of Mechanics – Lami‟s theorem, Parallelogram and triangular Law of forces –– Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon‟s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula.

UNIT IV DYNAMICS OF PARTICLES 9

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion Newton‟s laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Apply the principles of scalar and vector quantity to resolve the forces using analytical and graphical method.
- Classify the different types of beams and to solve the engineering problems related to virtual work.
- Apply the laws of friction, machine and classify the different types of reversible machine and non-reversible machine.
- Ability to apply and solve the engineering problems dealing with force, displacement, velocity and acceleration.
- Understand the concept of rigid body subjected to dynamic forces

TEXT BOOKS

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Koteeswaran, "Engineering Mechanics"

REFERENCE BOOKS

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.

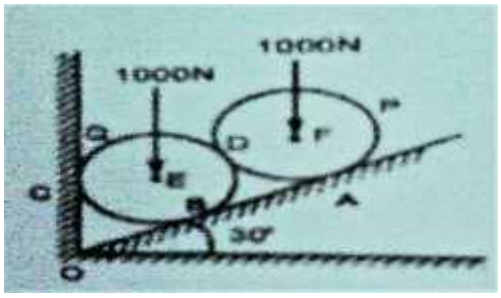
15UAG303 - ASSESSMENT QUESTIONS

UNIT I

1. Forces are concurrent when their lines of action meet in: **[Evaluate]**
   a) One point b) Two points
   c) Plane d) Perpendicular planes
2. State triangular law of forces and Lami's theorem. **[Remember]**
3. Two forces of magnitude 20 N and 40 N are acting on a particle such that the angle between the two forces is 135°. If both these forces are acting away from the particle, calculate their resultant and find its direction. **[Analyze]**
4. The line of action of forces concurrent at the origin O passes through P, Q and R having co-ordinates (2, 0, -2), (3, -3, 4), (-2, 3, 5) respectively, if the magnitude of the forces is 20N, 40N and 60N. Find the magnitude and direction of the resultant force. **[Analyze]**

UNIT II

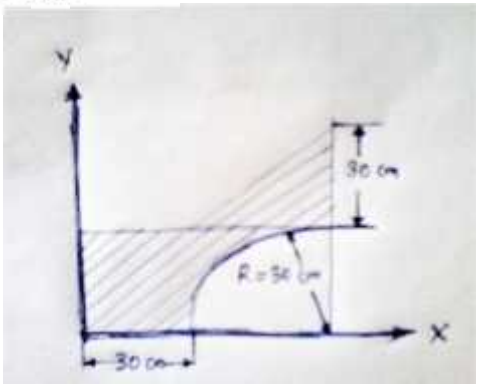
1. If a number of forces act simultaneously on a particle, it is possible to replace them by a: **[Remember]**
   a) Single force through C. G. b) Single force
   c) Couple d) Couple and a force
2. What is the difference between moment and a couple? **[Analyze]**
3. Three like parallel forces 20 kN, 40 kN and 60 kN are acting at points A, B, and C respectively on a straight-line ABC. The distances are AB=3cm and BC=4cm. find the resultant and also the distance of the resultant from point A on line ABC. **[Analyze]**
4. Two identical rollers, each of weight W = 1000 N, are supported by an inclined plane and a vertical wall as shown in Fig. Find the reactions at the point of supports A, B and C. Assume all the surfaces to be smooth. **[Analyze]**



UNIT III

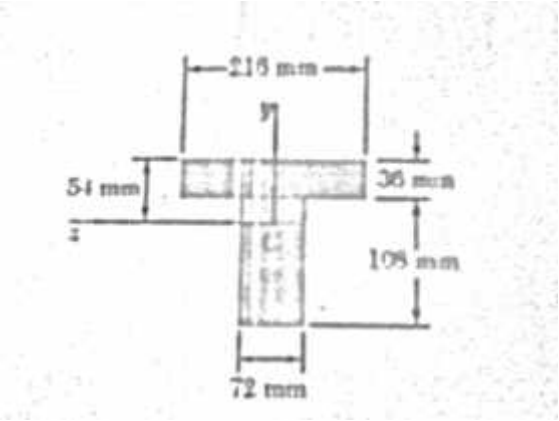
1. The unit of mass moment of inertia is: **[Remember]**
   a) kg-m^2 b) kg/m^2 c) kg-m d) kg/m
2. State perpendicular axis theorem. **[Understand]**

3. Determine the co-ordinates of centroid of the shaded area shown in figure. Find (i) $\bar{X}$ (ii) $\bar{Y}$



[Analyze]

4. Determine the moment of the section about the horizontal and vertical axes, passing through the centre of gravity of the T-section as shown in the figure.



[Analyze]

UNIT IV

1. Define D' Alembert's principle. **[Remember]**

2. The slope on the road surface generally provided on the curves is known as: **[Understand]**

   a) Angle of friction b) Angle of repose

   c) Angle of banking d) Angle of slope

3. A body is projected at an angle such that its horizontal range is 3 times the maximum height. Find the angle of projection. **[Remember]**

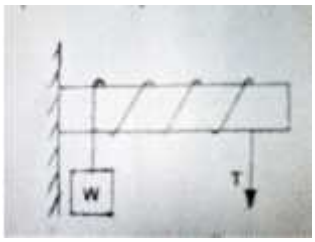
4. Two bodies weighing 300N and 450N are hung to the ends of a rope passing over an ideal pulley. **[Remember]**

   i) With what acceleration the heavier body comes down?

   ii) What is the tension in the string?

UNIT V

1. What is a wedge? **[Analyze]**
2. Coulomb friction is the friction between: **[Remember]**
   a) Bodies having relative motion b) Two dry surfaces
   b) Two lubricated surfaces d) Solids and liquids
3. A rope is wrapped three and a half times around a cylinder as shown in Fig. Determine the force T_1 exerted on the free end of the rope that is required to support a 1kN weight. The coefficient of friction between the rope and the cylinder is 0.25. **[Understand]**



4. Two bodies of weights 40 N and 15 N are connected to the two ends of a light inextensible string, which passes over a smooth pulley. The weight 40 N is placed on a smooth inclined plane, while the weight 15 N is hanging free in air. If the angle of the plane is 15°, determine: **[Apply]**
   i) Acceleration of the system
   ii) Tension in the string

   Take g = 9.81 m/s^2

Assessment Pattern

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	9
Understand	16	9	9	9
Apply	16	20	20	20
Analyze		12	12	12
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG304	FLUID MECHANICS AND HYDRAULICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions.
- The dynamics of fluids is introduced through the control volume approach which gives anintegrated understanding of the transport of mass, momentum and energy.

UNIT I PROPERTIES OF FLUIDS **9+3**

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 – meta centre – metacentric height.

UNIT II FLUID FLOW ANALYSIS **9+3**

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

UNIT III FLOW MEASUREMENTS **9+3**

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter - rota meter – 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

UNIT IV OPEN CHANNEL FLOW **9+3**

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

UNIT V DIMENSIONAL ANALYSIS & PUMPS **9+3**

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. Turbine and submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump-Hydraulic ram.

TOTAL : 60 PERIODS

COURSE OUTCOMES

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

- Acquire the knowledge about fluids in static, kinematic and dynamic equilibrium.
- Apply physical laws in addressing problems in hydraulics.
- Determine fluid flows, their measurements and pressure in designing irrigation systems
- Choose specific types of fluid pumping systems for different irrigation as well as industrial requirements.

TEXT BOOKS

1. Modi, P.N. and SethS.M.,Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.
2. Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.
3. Jagdish Lal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000

REFERENCE BOOKS

1. Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002.
2. Michael A.M. and S.D.Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co. New Delhi, 2005.
3. Michael A.M. Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 2008.

15UAG304 - ASSESSMENT QUESTIONS

UNIT I

1.	The liquid used in manometers should have a) low density b) high density c) low surface tension d) high surface tension	**[Understand]**
2.	What is mean by absolute and gauge pressure and vacuum pressure	**[Remember]**
3.	A U - Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs. U tube is 11 cm and the free surface of mercury is in level with over the centre of the pipe. If the pressure of water in pipe line is reduced to 9180N/m2, Calculate the new difference in the level of mercury. Sketch the arrangement in both cases**.**	**[Apply]**
4.	Two large plane surface are 2.4 cm apart. The space between the surface is filled with glycerine. what force required to drag a very thin plate of surface area $0.5m^2$ between the two large plane surface at a speed of 0.6m/s If(i) The thin plate is in the middle of the two plane surfaces(ii)The thin plate is at a distance of 0.8cm from one of the plane surface?	**[Apply]**

UNIT II

1.	If R<2000 the flow is said to be a) Steady flow b)Laminar flow c)Transition flow d) Turbulant flow	**[Understand]**
2.	Define flow net and mention its uses**.**	**[Remember]**
3.	The velocity components in a two dimensional incompressible flow are $u= y^3+6x-3x^2y$ $v=3xy^2-6y-x^3$.(i) Is the flow continous and irrotational (ii) Incase the flow is irrotational, find the velocity potential function and stream function at p(1,2).	**[Apply]**
4.	Explain in detail about the types of fluid flow**.**	**[Remember]**

UNIT III

1.	For ideal flow a) Fx is negligible b) Fv is negligible c) Ft is negligible d) Fp is negligible	**[Understand]**
2.	Explain the limitations of bernouillis theorem	**[Remember]**
3.	A crude oil of viscocity 0.97 poise and relative density 0.9 flowing through a horizontal circular pipe of dia 100mm and length 10m.calculate the difference of pressure at the two ends of the pipe if 100kg of oil is collected in a tank in 30sec	**[Apply]**
4.	Derive the expression for darcy weisbach equation**.**	**[Remember]**

UNIT IV

1. For a given discharge in a horizontal frictionless channel two depths may have the same specific force. These two depths are known as a.) Specific depths b.) Sequent depths c.)Alternate depths d.) Normal depth and critical depth **[Understand]**
2. Write short note on Economical channel section **[Remember]**
3. For a wide rectangular channel, derive the relation between (i) Critical depth and Discharge (ii) Critical depth and Minimum specific energy **[Apply]**
4. Explain Parshalls Flume in detail? **[Remember]**

UNIT V

1. The expression ML^2T^{-2} represents **[Understand]**
   a)Momentum b)pressure c) Kinetic energy d)Power
2. Explain in detail about the components of centrifugal pump and explain itz working principle. **[Remember]**
3. Using Buckingham's π - theorem, show that discharge Q consumed by an oil ring is given by **[Apply]**

$$Q = Nd^3\, \emptyset\left[\frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{\omega}{\rho N^2 d}\right]$$

Where d is the internal diameter of the ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and ω is the specific weight of oil.

4. Explain in detail about the components of centrifugal pump and explain its working principle. **[Remember]**

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG305 FUNDAMENTALS OF THEORY OF MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES

- To familiarize the concept of machines, mechanisms and related terminologies.
- To impart knowledge to analyze a mechanism for displacement, velocity and acceleration at any point in amoving link.
- To given idea about theory of gears, gear trains, cams and brakes.

UNIT I BASICS OF MECHANISMS 9

Definitions - Link, Kinematic pair, Kinematic chain, Mechanism and Machine.Degree of Freedom - Mobility - Kutzbach criterion (Gruebler's equation) -Grashoff's law -Kinematic Inversions of four-bar chain and slider crank chain. Description of common Mechanisms Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke's joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 9

Analysis of simple mechanisms (Single slider crank mechanism, four bar mechanism and Toggle mechanism) - Graphical Methods for displacement, velocity and acceleration - Shaping machine mechanism -Computer applications in the kinematics analysis of simple mechanisms.

UNIT III KINEMATICS OF CAMS 9

Classifications - pressure angle - undercutting. Displacement diagrams –Uniform velocity, uniform acceleration and retardation, Simple harmonic and Cycloidal motions - Graphical construction of displacement diagrams and Layout of plate cam profiles for differenttypes of followers - knife edged, roller, mushroom, flat type

UNIT IV GEARS 9

Classification of gears - Gear tooth terminology- Spur gear terminology and definitions - Fundamental Law of toothed gearing and involute gearing - Length of path of contact and contact ratio - Interference and undercutting. Helical, rack and pinion gears (basics only).

UNIT V GEAR TRAIN 9

Gear trains - Simple, compound and Epicyclic gear trains, Automotive transmission gear trains - Differentials.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

1. The concepts of various mechanisms like linkages, four-bar chain, straight line motion and Steering gear mechanisms
2. Estimate the velocity and acceleration of different mechanisms.
3. Discuss gear tooth terminology and laws.
4. Construct different types of cam profile.
5. Calculate number of teeth in gear for the given mechanism of gear train.

TEXT BOOKS

1. Khurmi R.S, GupthaJ. K, “Theory of Machines”, S.Chand Company Ltd., Prentice Hall of India, Fourteenth Revised Edition, New Delhi, 2012.
2. Ramamurti. V, “Mechanism and Machine Theory”, Narosa Publishing House, SecondEdition, 2005.

REFERENCE BOOKS

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
2. Uicker J.J, Pennock G.R, Shigley J.E, “Theory ofMachines and Mechanisms”, (Indian edition) OxfordUniversity Press, 2003.
3. Ghosh A, Mallick.A.K, “Theory of Mechanisms and Machines”, Affiliated East- West Pvt. Ltd, New Delhi, 1998.
4. Rao J.S, Dukkipati R.V, “Mechanism and Machine Theory”, Wiley-Eastern Ltd, New Delhi, 1992.

15UAG305 - ASSESSMENT QUESTIONS

UNIT I

1. Which of the following is an open pair? **[Remember]**
   a) Journal bearing c) Ball and socket joint
   b) Leave screw and nut d) None of the above
2. Define inversion of mechanism. **[Understand]**
3. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and resolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. the angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitude and angular positions. **[Remember]**
4. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine (i) Linear velocity and acceleration of the midpoint of the connecting rod, and (ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from the inner dead center position. **[Analyze]**

UNIT II

1. …… is the inversion of Double slider crank chain. **[Remember]**
   a) Coupling rod of a locomotive c) Scotch yoke mechanism
   b) Hand pump d) Reciprocating engine
2. Differentiate constrained kinematic chain and unconstrained kinematic chain. **[Analyze]**
3. Discuss the various types of friction experienced by a body. State the law of static, solid, dynamic and fluid friction. **[Remember]**
4. The mean diameter of a square threaded screw jack is 50 mm. the pitch of the thread is 10 mm. The co-efficient of friction is 0.15. What force must be applied at the end of a 0.7 m lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it? **[Analyze]**

UNIT III

1. A rigid body possess …… degrees of freedom: **[Remember]**
   a) One b) Two c) Four d) Six
2. Define pressure angle in cam profile. **[Understand]**
3. A cam is to give the following motion to a knife edged follower: outstroke during 60° of cam rotation, dwell for the next 30° of cam **[Analyze]**

rotation, return stroke for the next 60° of cam rotation and dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and the return strokes. Draw the profile of the cam when:

a) The axis of the follower passes through the axis of the cam shaft.
b) The axis of the follower is offset by 20 mm from the axis of the cam shaft.

4. A cam drives a flat reciprocating follower in the following manner:

   During the first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with SHM. The follower dwells during next 30° of the cam rotations. During the next 120° of cam rotation, the follower moves inwards with SHM. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. **[Analyze]**

UNIT IV

1. Define law of gearing. **[Remember]**

2. The type of gears used to connect two non-parallel and non-intersecting shafts is: **[Understand]**

   a) Spur gear c) Helical gear

   b) Bevel gear d) Spiral gear

3. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20-degree pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **[Remember]**

4. Two mating gears have 20 and 40 involute teeth of module 10 mm and 20-degree pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of path of contact, arc of contact and contact ratio. **[Remember]**

UNIT V

1. Define reverted gear train and state its application. **[Analyze]**

2. In which of the following type of gear train, the first gear and the last gear are co-axial. **[Remember]**

   a) Simple gear train c) Compound gear train

   b) Reverted gear train d) None of the above

3. i) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. **[Understand]**

ii) What do you understand by gear train? Discuss the various types of gear trains.

4. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have same module and the number of teeth is: T_c= 28; T_d = 26; T_e= T_f= 18.

i) Sketch the arrangement.

[Apply]

ii) Find the number of teeth on A and B.

iii) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B.

iv) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clockwise, find the speed of wheel B.

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG306	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to principles of agricultural and horticultural crop production and to introduce the production practices of crops

UNIT I PRINCIPLES OF AGRONOMY AND CROPPING SYSTEM 9

Definition of agronomy – Factors affecting crop growth - seed bed preparation- Tillage – Definition – objectives – types of tillage - cropping systems – monoculture and multiple cropping – inter, mixed, relay, strip and multitier cropping

UNIT II CROP MANAGEMENT 9

Seeds and seed treatment – sowing methods – different methods of irrigation-nutrient management - fertigation scheduling- Crop protection management of weeds, pests and diseases

UNIT III PRODUCTION PRACTICES OF FIELD CROPS – I 9

Package of practices for important field crops – rice, maize, pulses – black gram, green gram and red gram - oilseeds -gingerly , groundnut and sunflower

UNIT IV PRODUCTION PRACTICES OF FIELD CROPS – II 9

Package of practices of cotton, Sugarcane- biofuel crops - Jatropa, sweet sorghum and sugar beet

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS 9

Important horticultural crops in Tamil Nadu- Importance of green house cultivation.-Cultivation practices of vegetable crops – Brinjal, tomato, Bhendi and Chilli - fruit crops – Mango-Sapota-Papaya.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Classify the tillage methods and cropping system
- To understand the knowledge in crop Management for different crops
- Apply the cultivation practices of cereals, pluses, oil seeds, fiber crops and biofuel crops.
- Apply the cultivation practices of vegetable crops and fruit crops.

TEXT BOOKS

1. Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, KrishiAnusandhanBhavan, Pusa, New Delhi, 2005.
2. Reddy T. Sankara G.H. YellamandaReddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 1995.
3. Handbook of Agriculture. ICAR Publications, New Delhi.

REFERENCE BOOKS

1. Kumar, N.,"Introduction to Horticulture", Rajalakshmi Publications. Nagercoil,1993.
2. Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. Introduction to spices, plantation crops, medicinal and aromatic plants. Rajalakshmi Publications, Nagercoil.

15UAG306 - ASSESSMENT QUESTIONS

UNIT I

1. What is seed bed preparation? **[Remember]**
2. Define multitier cropping **[Understand]**
3. Discuss about the factors affecting crop growth and steps involved in seed bed preparation **[Understand]**
4. Explain about the types of tillage practices and cropping systems **[Remember]**

UNIT II

1. What is crop management? **[Remember]**
2. Enumerate the types of sowing methods **[Remember]**
3. Discuss about the various seed treatments and methodologies in irrigating the field **[Understand]**
4. Explain about monoculture and multiple cropping, inter, mixed, relay, strip and multitier cropping **[Understand]**

UNIT III

1. What are oil seeds? **[Remember]**
2. Define production practice? **[Understand]**
3. Discuss the production practice of rice **[Remember]**
4. Explain about the practices involved in the production of maize **[Understand]**

UNIT IV

1. What are forage crops? **[Remember]**
2. What are cash crops? **[Remember]**
3. Discuss the production practice of sugarcane **[Remember]**
4. Explain about the practices involved in the production of cotton **[Understand]**

UNIT V

1. What is floriculture? **[Understand]**
2. Define horticultural crops? **[Remember]**
3. Discuss the general principles of orthographic projection **[Analyze]**
4. Explain about the practices involved in the production of sugar beet **[Understand]**

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	40
Analyze		12	12	10
Evaluate				
Create				
Total (50)	50	50	50	100

15UGS331	VALUE EDUCATION AND HUMAN RIGHTS	L	T	P	C
		2	0	0	P/F

OBJECTIVES

- To inculcate the values of Humanism, Culture and to have an awareness of Human Rights
- To impart knowledge and develop a sensitivity to the diverse Indian culture

UNIT I **6**

Introduction – Value education - Definition - Why values? - need for inculcation - sources of values-Personal values, Social values, Professional values, Moral values and Behavioral values.

UNIT II **6**

Values needed for life - love & Compassion, Truth & Tolerance, Fairness & Obedience – Respect Empathy – Protection – Humility & Harmony – Principles of happy living – Stress management

UNIT III **6**

Social values and personality – Role models- National leaders- freedom fighters, Social reformers & Value based anecdotes

UNIT IV **6**

Social values-Five responsibilities : to self family, environment, society and universe- peace within, family & universe; Unethical standards in words and how to correct in deeds, in thought, its deleterious effects in society, deterioration of culture and traditional values- remediation for better understanding of such values and its implications

UNIT V **6**

Human Rights – Universal Declaration of human rights - Human Rights violation - National Integration – Peace and non violence – the role of media in value building - Consumer awareness-Case Study

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

- Acquire a holistic vision and growth to become an integrated personality
- Imbibe the essence of spirituality by which they will manifest the noble virtues of a universal brotherhood and benevolence

TEXT BOOKS

1. S. Ignachimuthu, Values for Life, St.Paul Publications, Mumbai, 1994

REFERENCE BOOKS

1. Frankena, W.K., "Ethics ", Prentice Hall of India,, New Delhi, 1990.
2. Meron Theodor, "Human Rights and International Law Legal Policy Issues", Oxford University Press, First Edition, New Delhi, 2000.
3. R.P.Shukla, "Value Education and Human Rights, Sarup and Sons Publishing, New Delhi
4. Yogesh Kumar Singh and Reschika Nath. "Value Education". APH Publishing Corporation, New Delhi, 2005.

15UAG307	CROP HUSBANDRY LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations

LIST OF EXPERIMENTS

1. Identification of different crops, seeds, manures and fertilizers
2. Identification of farm tools and implements, primary and secondary tillage
3. Seed bed and nursery preparation
4. Selection of Seeds and seed treatment methods for selected crops
5. Working out of seed rate for different crops
6. Practicing different methods of sowing and planting
7. Work out the fertilizer requirement for different crops
8. Work out the crop water requirement for different crops
9. Irrigation methods for different crops
10. Weed management for selected crops
11. Integrated Pest Management studies
12. Assessing maturity indices for harvesting of horticultural crops

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Identify and classify seeds, manures, fertilizers and tillage implements
- Calculate the optimum seed rate and water requirement for selected crops
- Work out the fertilizer requirement and water requirement for different crops
- Manage the weeds and pests for selected crop
- Identify the crop maturity and harvesting technique

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	QUANTITY REQUIRED
1.	A wet land / garden land	5/Cents/group of students
2.	Open/bore well	1
3.	Spade	15 Nos
4.	Hand hoe	15 Nos
5.	Tractor	1No
6.	Seed drill	1 No
7.	Mould board plough	1 No
8.	Cultivator	1 No
9.	Sprayer	1 No

15UAG308	FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

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

LIST OF EXPERIMENTS

I. FLOW MEASUREMENT

1. Calibration of Rotometer
2. Flow through Venturimeter
3. Flow through a circular Orifice
4. Determination of mean velocity by Pitot tube
5. Verification of Bernoulli"s Theorem
6. Flow through a Triangular Notch
7. Flow through a Rectangular Notch

II. LOSSES IN PIPES

8. Determination of friction coefficient in pipes
9. Determination of losses due to bends, fittings and elbows

III.PUMPS

10. Characteristics of Centrifugal pump
11. Characteristics of Submersible pump
12. Characteristics of Reciprocating pump
13. Characteristics of Jet pump

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Measure flow in different notches and meters
- Work out bernoulli"s theorem related problems
- Describe the characteristics of different pumps

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Quantity
1.	Rotometer	1 Nos
2.	Venturimeter	1 Nos
3.	Orifice meter	1 Nos
4.	Triangular Notch	1 Nos
5.	Rectangular Notch	1 Nos
6.	Coefficient of friction apparatus	1 No
7.	Pipe setup with bends, fittings and elbows for estimating minor losses	1 No
8.	Centrifugal , Reciprocating, Submersible , Jet pump	Each 1 No
9.	Collecting tank, Stop watch – 1 no. for each experiment	

15UMA425	PROBABILITY, STATISTICS & NUMERICAL METHODS (AGRI)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To make the student acquire sound knowledge of fundamentals and applications of statistics which will greatly help at the data analysis stage of comparative experiments.
- To familiarize the student with the applications of numerical methods in various fields, solving practical, technical problems occurring in Mechanical Engineering using scientific and mathematical tools.

UNIT I PROBABILITY THEORY & DISTRIBUTIONS 9 + 6

Axioms of probability - Conditional probability - Total probability - Baye's theorem – Discrete and continuous random variables - Moments - Moment generating functions and their properties. Binomial, Poisson, Normal, Geometric, Uniform, Exponential and Gamma distributions.

UNIT II TESTING OF HYPOTHESIS 9 + 6

Sampling distributions - Normal, t, Chi-square and F distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes.

UNIT III DESIGN OF EXPERIMENTS 9 + 6

Completely randomized design – Randomized block design – Latin square design.

UNIT IV INTERPOLATION AND APPROXIMATION 9 + 6

Lagrange's interpolation – Newton's divided difference interpolation – Newton's forward and backward difference interpolation – cubic spline.

UNIT V NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 + 6

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two point and Three point Gaussian quadrature formulae – Double Integrals using Trapezoidal and Simpson's rules.

SUPPLEMENT TOPIC (for internal evaluation only)

Applications in real time problems.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply the acquired knowledge of standard distributions in real life phenomena**.**
- Conduct and interpret hypothesis tests for a single population proportion.
- Design and analyze a process, to evaluate which process inputs have a significant impact on the process output using design of experiments.
- Use Interpolation technique for equal and unequal intervals to find new data points within the range of known data points.
- Find numerical integration for single and double integrals.

TEXT BOOKS:

1. JOHNSON R.A. and GUPTA C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 8th edition, (2011).
2. GREWAL, B.S. and GREWAL, J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, (2009).

REFERENCE BOOKS:

1. WALPOLE. R.E., MYERS .R.H., MYERS S.L., and YE. K, "Probability and Statistics for Engineers and Scientists", Pearson Education, New Delhi, 8th edition, (2007).
2. SPIEGEL M.R., SCHILLER J. and SRINIVASAN R.A., "Schaum's Outlines Probability and Statistics", Tata McGraw Hill, New Delhi, (2004).
3. CHAPRA, S. C and CANALE, R. P., "Numerical Methods for Engineers", Tata McGraw-Hill, New Delhi, 5th Edition, (2007).
4. GERALD, C. F. and WHEATLEY, P. O., "Applied Numerical Analysis", Pearson Education, New Delhi, 6th Edition, (2006).

15UAG402	POST HARVEST TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- 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 crops

UNIT I FUNDAMENTALS OF POST HARVESTING 9

Post harvest technology – introduction –objectives –post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content –measurement –direct and indirect methods – moisture meters – equilibrium moisture content.

UNIT II PSYCHROMETRY AND DRYING 9

Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers.

UNIT III CLEANING AND GRADING 9

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

UNIT IV SHELLING AND HANDLING 9

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

UNIT V PADDY AND CROP PROCESSING 9

Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing – layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Acquire basic knowledge about post harvest technology
- Understand the importance of material handling equipments
- Apply different Post Harvest operations and processing methods of harvested crops.
- Apply the fundamentals of various unit operations of Agricultural Processing.

TEXT BOOKS

1. Chakraverty, A.Post harvest technology for Cereals, Pulses and oilseeds. Oxford & IBH publication Pvt Ltd, New Delhi, Third Edition, 2000.
2. Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi, 1994.

REFERENCE BOOKS

1. Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
2. Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.

15UAG402 - ASSESSMENT QUESTIONS

UNIT I

1. The point at which falling rate period of drying starts is called as _____.
   a) Equilibrium moisture content b) Critical moisture content
   c) Optimum moisture content d) Minimum moisture content **[Remember]**
2. What is sensible heating? **[Understand]**
3. Explain different types of moisture meters. **[Understand]**
4. Explain based on your views to improve the performance of traditional threshers. **[Analyze]**

UNIT II

1. _____is the amount of heat present in a substance.
   A) Enthalpy b) Entropy c) Specific heat d) Latent heat **[Remember]**
2. What is adiabatic drying? **[Remember]**
3. Explain principles of any type of dryers and your feeds to improve its efficiency. **[Analyze]**
4. Explain different methods of drying of air. **[Understand]**

UNIT III

1. Removal undesirable maters from the desired products are said to be_____.
   a) Cleaning b) Grading c) Sorting d) Scalping **[Remember]**
2. What is scalping? **[Understand]**
3. Explain cleaning efficiency and derive the equation for screen effectiveness? **[Understand]**
4. Explain any type of separator and give your logic to modify it for its better performance. **[Analyze]**

UNIT IV

1. Purpose of the tong in the maize sheller is to_____.
   a) Stir b) Mix c) hold d) Load **[Remember]**
2. What is pneumatic conveying? **[Understand]**
3. Explain different types principles followed in ground nut decortication? **[Remember]**
4. Explain any type of conveying equipment and your suggestions to modify it. **[Analyze]**

UNIT V

1. Temperature of parboiling in CFTRI method is_____°C.
   a) 90 b) 70 c) 60 d) 50 **[Understand]**
2. What is gelatinization? **[Remember]**
3. Explain wet and dry milling of dhal with flow chart. **[Understand]**
4. Explain construction and working principles of a rice milling equipment and give your ideas to improve it with any perspectives. **[Analyze]**

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	40
Analyze		12	12	10
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG403	FARM TRACTORS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to the different systems and working principles of tractor, power tiller, makes of tractors and power tillers.
- To acquire an in-depth knowledge on farm tractors and engine systems
- To develop skills on safe and efficient use of tractors

UNIT I TRACTORS **9**

Classification of tractors - Tractor engines – Basic terminology - IC engine and SI engine – Working principles - Construction of features IC engine - cylinder, piston, connecting rod and crankshaft, camshaft and flywheel. Firing order and firing interval of combustion chambers. Cost estimation and selection of tractor.

UNIT II ENGINE SYSTEMS **9**

Cooling systems - Introduction –Types – Air cooling and water cooling - Lubricating systems - Types – Splash and Force feed system. Fuel system –Properties – Fuel Supply System in Spark ignition engine – Carburetor – Fuel system in Diesel engine – Fuel injection system – Fuel filter – Air cleaner. Ignition system – Types – Battery – Components – Magneto ignition system – Heat of compression - troubles – Care and Maintenance of engine systems.

UNIT III TRANSMISSION SYSTEMS **9**

Transmission – Function clutch – types – Single plate and multiple plate gear box - sliding mesh and constant mesh - Torque converter - Differential unit and final drive. Steering systems – Tyre and front axle. Brake - types – system.

UNIT IV HYDRAULIC SYSTEMS **9**

Hydraulic system - working principles – Components – Types. Hitch - Three point linkages - weight transfer. Traction and traction theory - mechanics of tractor chassis – Centre of gravity – Suspension – Balancing – Weighting method

UNIT V TRACTOR TESTING **9**

Introduction - Preparation for tests - Procedure for testing - Tractor tests eligible for OECD approval compulsory tests and optional tests - BIS for tractors and power tiller - laboratory tests - field tests - haulage test - quality system - alternative fuels for ic engines - biodiesel - ethanol - blending

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Classify tractors and engine construction features
- Understand the working principle of engine system
- Understand the working principle of transmission system
- Understand the working principle of hydraulic system
- Possess the knowledge on test procedures to assess the performance of tractors and power tillers

TEXT BOOKS

- Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 1999.
- Kirpal Singh, “Automobile Engineering Vol 1 &2”, Standard Publishers, VII Edition, New Delhi, 1997.
- Jain .K.K, Asthana .R.B, “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi 2002.

REFERENCE BOOKS

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

15UAG403 - ASSESSMENT QUESTIONS

UNIT I

1. Classify the different types of tractors? **[Understand]**
2. Explain Power Tiller and its components with neat sketch? **[Remember]**
3. Describe about the construction of engine block and its components with neat sketch? **[Analyze]**
4. Construct the factors involved in selection of the tractor? **[Evaluate]**

UNIT II

1. Explain air cooling system and its components in a farm tractor **[Understand]**
2. Construct a Fuel system of Diesel Engine **[Analyze]**
3. Explain air cooling system and its components **[Remember]**
4. Construct a Fuel system of Diesel Engine **[Apply]**

UNIT III

1. Discuss elaborately about the construction and working principle of single plate clutch **[Apply]**
2. Explain the working principle of hydraulic brake system **[Understand]**
3. Explain Steering Geometry. Illustrate a Power steering **[Remember]**
4. Construct Semi floating axle and Full floating axle **[Analyze]**

UNIT IV

1. Explain the theory of traction. **[Remember]**
2. Construct Tractor chasis mechanics **[Apply]**
3. Explain Draft control and weight transfer **[Understand]**
4. Construct 3 point linkage and explain implement control. **[Analyze]**

UNIT V

1. Explain the test codes for performance testing of tractors **[Understand]**
2. Discuss about the Optimization of tractor field efficiency to save energy/fuel. **[Analyze]**
3. Explain the test procedures for testing tractors **[Understand]**
4. Discuss any two alternative sources of fuels **[Analyze]**

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	30
Analyze		12	12	20
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG404	SOIL AND WATER CONSERVATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To present the concepts of erosion so that students get a sound knowledge about the problems associated with it.
- To enable the students to make use of the principles and concepts to solve issues relatedto soil and water management.

UNIT I SOIL EROSION PRINCIPLES **9**

Introduction – Soil erosion – Types - Agents - Causes - Mechanics of soil erosion –factor affecting the soil erosion- Water erosion - Mechanics of Water Erosion – Types -Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion - Factor affecting water erosion – Stages of gully erosion - Classification of Gully – Temporary Gully control structures – - Woven Wire Dams - Brush Dams - Loose Rock Dam- Permanent gully control structures - Drop Spillway, Drop Inlet, Chute Spillways.

UNIT II ESTIMATION OF SOIL EROSION **9**

Runoff – Components - Factor affecting the runoff - computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations - Problems – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation-2 - Land use capability classification - Classification of eroded soils.

UNIT III EROSION CONTROL MEASURES **9**

Agronomical measures of water erosion control - Contour Cropping - Strip cropping – Mulching - Mechanical measures for water erosion control - Bunding- Types – Contour bund and Graded bund-Design Specification of Bunds - Mechanical measures for hill slopes – bench Terracing – Types – Maintenance – Grassed waterways: Purpose, construction and maintenance

UNIT IV WATER CONSERVATION MEASURES **9**

In-situ soil moisture conservation – Water harvesting Principles and Technique – Importance – Types: Rain/Runoff water harvesting – Flood water harvesting and Ground water Harvesting – Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.

UNIT V SEDIMENTATION **9**

Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Gain fundamental knowledge on the concepts of erosion and sedimentation.
- Estimate the soil erosion by different methods
- To understand the erosion control measures
- Acknowledge the importance of soil and water conservation measures.
- Estimate sedimentation in reservoir and tanks.

TEXT BOOKS

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

REFERENCE BOOKS

1. Murthy, V.V.N., “Land and Water Management Engineering”, Kalyani Publishers, Ludhiana, 1998.
2. Gurmail Singh, “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi,1982
3. Mal, B.C., “Introduction to Soil and Water Conservation Engineering”, Kalyani Publishers, New Delhi

15UAG404 - ASSESSMENT QUESTIONS

UNIT I

1. Evaluatethe factors affecting soil erosion. **[Evaluate]**
2. Explain the mechanics of soil erosion and water erosion. **[Remember]**
3. What are the different types of soil erosion. Explain in detail. **[Remember]**
4. Classify the water erosion as per the sequence of occurrence. **[Analyze]**
5. Give brief description on the temporary and permanent gully control structures with suitable diagrams. **[Understand]**

UNIT II

1. In SCS-CN method, catchments having soils of low permeability and having little or no vegetal cover is termed as: **[Remember]**
   a) Average
   b) Bad
   c) Good
   d) Moderate
2. Analyze the suitability of land for cultivation based on the land use capability classification. **[Analyze]**
3. Describe the different factors included in the Universal Soil Loss Equation. **[Analyze]**
4. Explain the SCS-CN method for finding runoff from a catchment. **[Remember]**
5. Explain the applications and limitations of USLE. **[Apply]**

UNIT III

1. Give brief description on the different types of Bench Terraces. **[Remember]**
2. Analyze the possibility of construction of different bunds in heavy rainfall areas. **[Analyze]**
3. Explain in detail about the Agronomical and Mechanical measures to control water erosion. **[Remember]**
4. Analyze the design specifications of contour and graded bund and differentiate them. **[Analyze]**
5. What is the purpose, construction and maintenance of grassed water ways? **[Remember]**

UNIT IV

1. Explain the design and construction of farm ponds. **[Remember]**
2. Explain the principles of water harvesting. **[Understand]**
3. What are the different measures for in-situ moisture conservation? Give brief description of each. **[Remember]**
4. Explain the term ‘Retaining wall’. **[Remember]**
5. Differentiate between flood water and groundwater harvesting. **[Understand]**

UNIT V

1. Explain about the different types of sediment loads. **[Understand]**
2. How can we estimate the Bed load? **[Remember]**
3. Enumerate the factors affecting sediment distribution pattern. **[Analyze]**
4. What are Silt Detention tanks? Write down their uses? **[Understand]**
5. The sediment graph is applicable to …….. watersheds where the main contribution to suspended sediment transported in the drainage channels as the result of runoff. **[Analyze]**
    a) Non-uniform
    b) Large
    c) Small uniform
    d) Medium

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG405 FUNDAMENTALS OF THERMODYNAMICS

L	T	P	C
4	0	0	4

OBJECTIVES

- To impart the basic thermodynamic principles and developing the skills to performthe analysis of thermodynamic system.
- To explain the general thermodynamic relations and thermodynamic properties.
- To familiarize the usage of steam tables, Mollier Chart and psychrometric chart

UNIT I BASIC CONCEPT AND FIRST LAW 12

Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work,modes of work, Zeroth law of thermodynamics - concept of temperature and heat. Conceptof ideal and real gases.First law of thermodynamics - application to closed andopen systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 12

Second law of thermodynamics - Kelvin's and Clausius statements of second law.Reversibility and irreversibility.Carnot theorem, Carnot cycle, efficiency, COP.Thermodynamic temperature scale, Clausius inequality, concept of entropy.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAMPOWER CYCLE 12

Properties of pure substances - Thermodynamic properties of pure substances in solid, liquidand vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams,PVTsurfaces,thermodynamic properties of steam. Calculations of work done and heat transfer in non- flowand flow processes. properties table, Mollier chart, Standard Rankine cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMICRELATIONS 12

Gas mixtures - properties ideal and real gases, Avogadro's Law, Vander Waal's equation of state, general thermodynamic relations - Dalton's law of partial pressure, exact differentials, T-D relations,Maxwell'srelations,ClausiusClapeyron equations, Joule -Thomson coefficient.

UNIT V PSYCHROMETRY 12

Psychrometry and psychrometric charts, Properties of atmospheric air, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling.

TOTAL : 60 PERIODS

NOTE: Use of Steam Table, Mollier Chart, Psychrometric Chart are permitted in the End Semester Examination.

COURSE OUTCOMES

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

- Explain the different thermodynamics laws and basic concepts.
- Solve the problems based on Carnot cycle.
- Use Mollier chart and steam tables for solving Rankine cycle problems.
- Illustrate the various thermodynamic relations.
- Discuss the properties of air and Psychometric process.

TEXT BOOKS

1. Nag.P.K, “Engineering Thermodynamics”, Tata McGraw-Hill, Third reprint, New Delhi, 2008.
2. Natarajan. E, “Engineering Thermodynamics”, Anuragam Publications, First Edition, 2012.

REFERENCE BOOKS

1. Rajput.R.K , “Engineering Thermodynamics”, Laxmi Publication, Fourth edition, New Delhi, 2010.
2. Holman.J.P, “Thermodynamics”, McGraw-Hill, Third Edition, 1995.
3. Venwylen, Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987.
4. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.

15UAG405 - ASSESSMENT QUESTIONS

UNIT I

1. The velocity and enthalpy of fluid at inlet of a certain nozzle are 50m/s and 2800kJ/kg respectively. The enthalpy at the exit of the nozzle is 2600kJ/kg. The nozzle in horizontal and insulated and no heat transfer taken place from it. Find **[Evaluate]**
   i. velocity of the fluid at exit of the nozzle.
   ii. mass flow rate, if the area at inlet of the nozzle in $0.09m^2$
   iii. exit area of the nozzle, if the specific volume at the exit of the nozzle is $0.495m^3/kg$
2. i. Explain the thermodynamic system with examples
   ii. Discuss about the point function and path function. **[Understand]**
   iii. What are the reason for irreversibility in a process
3. What is the difference between open system and closed system? **[Understand]**
4. Region in space is
   A. Thermodynamic cycle.
   B. Thermodynamic system **[Remember]**
   C. Thermodynamic surrounding
   D. Universe

UNIT II

1. Two-Carnot engine A and B are operated in series. The first one A receives heat at 870K and rejects to a reservoir at temperature T. The second engine B receives the heat rejected by the first engine and in turn rejects to a heat reservoir at 300K. Calculate the intermediate temperature T in ^0C between two heat engines for the following cases. **[Analyze]**
   a) The work output of the two engines are equal and
   b) The efficiencies of the two engines are equal.
2. A heat engine of 30% efficiency drives the heat pump of COP = 5. The heat is transferred both from engine and heat pump to circulating water for heating the building in winter. Find the ratio of heat transfer to the circulating water from the heat pump to the heat transfer to the circulating water from the heat engine **[Analyze]**
3. An inventor claims that his proposed engine has the following Specification.
   Power developed = 50kW
   Fuel burnt = 3kg/hr **[Remember]**
   Calorific value of the fuel = 75000kJ/kg
   Temperature limits = 27C to 627C
   Find out Whether it is possible or not.
4. A reversible heat engine operating between reservoirs at 900K and 300K drives a reversible refrigerator operating between the reservoirs 300K and 250K. The heat engine receives 1800KJ heat from 900K reservoir. The net output from the combined engine refrigerator is 360KJ. Find the **[Apply]**

heat transferred to the refrigerator and net heat rejected to the reservoir at 300K.

UNIT III

1. In Rankine cycle, the seam at inlet to turbine is saturated at a pressure of 35bar and the exhaust pressure is 0.2bar. Determine the
   (1) Pump work
   (2) Turbine work **[Apply]**
   (3) Rankine Efficiency
   (4) Condenser heat flow

   Dryness at the end of the expansion. Assume flow rate of 9.5kg/s.
2. A bullock drawn mower has drive wheel 90cm in dia. The power to drive the knife is transmitted to the crank wheel through a transmission gear train. The first step consists of 120 tooth gear on main axle, driving 20 tooth gear on counter shaft. The second step consists of a 60 tooth bevel pinion on the crankshaft; the guards are spaced 8cm apart with knife stroke 8cm. **[Create]**

   Calculate

   a) The number of stroke, the knife will make per minute when the mower is pulled at 4 km per hour speed and driven gear = 15 tooth

   b) The total length of knife stroke per minute
3. Describe in detail of phase change process of water to steam formation. **[Remember]**
4. A vessel of volume $0.04m^3$ contains a mixture of saturated water and steam at a temperature of 250^0C.The mass of the liquid present is 9kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy of the mixture. **[Analyze]**

UNIT IV

1. A mixture of ideal gases consists of 3kg of nitrogen and 5kg of carbon dioxide at a pressure of 300kPa and a temperature of 20^0 C, find:
   1. The mole fraction of each constituent. **[Analyze]**
   2. The equivalent molecular weight of the mixture.
   3. The equivalent gas constant of the mixture.
   4. The partial pressures and partial volumes.
2. 0.45kg of CO and 1kg of air is contained in a vessel of volume $0.4m^3$ at 15^0C. Air has 23.3% of O_2 and 76.7% of N_2 by mass. Calculate the partial pressure of each constituent and total pressure in the vessel. Molar masses of CO, CO_2, and N_2 are 28, 32, and 28 kg/kmol. **[Analyze]**
3. Consider an ideal gas at 303K and $0.86m^3$/kg. As a result of some disturbance the state of the gas changes to 304K and 0.87 m^3/kg. Estimate the change in pressure of the gas due to the result of this disturbance. **[Apply]**
4. A vessel of volume $0.3m^3$ contains 15 kg of air at 303K. Determine the pressure exerted by the air using **[Apply]**
   1. Perfect gas equation.
   2. Vander Waals equation.

UNIT V

1. Atmospheric air at a pressure of 1bar and 25^0C has a relative humidity of 75%. Find
   1. Partial pressure of water vapour and the air
   2. Specific volume
   3. DPT
   4. Specific humidity
   5. Degree of saturation
   6. Density of the mixture
   7. Water vapour condensed per kg of dry air when the mixture is cooled at a constant pressure to a temperature of 10^0C.

   [Understand]
2. One kg of air at 24^0C, 70% RH is mixed adiabatically with 2 kg of air air 16^0C, 10% RH. Determine final condition of the mixture. **[Analyze]**
3. An air-water vapour mixture enters an adiabatic saturator at 30^0C and leaves at 20^0C, which is the adiabatic saturation temperature. The pressure remains constant at 100 kPa. Determine the relative humidity and humidity ratio of the inlet mixture. **[Analyze]**
4. The atmospheric air has a dry bulb temperature of 25^0C and specific humidity of 0.0098kg/kg of dry air. If the barometer reads 760mm of Hg, Determine
   1. Partial pressure of vapour
   2. Relative humidity

   Dew point temperature

   [Analyze]

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	20
Understand	16	9	9	20
Apply	16	20	20	40
Analyze		12	12	20
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG406	SURVEYING FOR AGRICULTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the principle of surveying, various methods and applications to Agricultural Irrigation Engineering projects.

UNIT I FUNDAMENTALS AND CHAIN SURVEYING **9**

Definition- Classifications - Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting – applications- enlarging and reducing figures-Areas enclosed by straight lines - Irregular figures- digital Planimeter

UNIT II COMPASS AND PLANE TABLE SURVEYING **9**

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

UNIT III LEVELLING **9**

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

UNIT IV LEVELLING APPLICATIONS **9**

Longitudinal and Cross-section-Plotting - Contouring - Methods – Characteristics and uses of contours- Plotting – Methods of interpolating contours – computation of cross sectional area and volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams

UNIT V THEODOLITE AND MODERN SURVEYING **9**

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

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Possess the knowledge on the importance of chain surveying and its application in agriculture
- Apply and understand the principle of compass and plane table surveying
- Know the test procedure of leveling and different instruments used for leveling and its working principle
- Understand the leveling application
- Understand the different theodolite concepts and deep knowledge on modern surveying methods.

TEXT BOOKS

1. Kanetkar T.P., “Surveying and Levelling”, Vols. I and II, Standard Publishers, New Delhi 2008.
2. Punmia .B.C,”Surveying,” Vols. I and II, Laxmi Publications,2006.

REFERENCE BOOKS

1. Basak. V.N, 1994, “Surveying and Levelling”, Tata McGraw hill publications, New Delhi.

15UAG406 - ASSESSMENT QUESTIONS

UNIT I

1.	Which one is not standard metric chain length a) 5m b) 10m c) 20m d)25m	**[Understand]**
2.	How surveying is defined. Name the two basic principles of surveying	**[Remember]**
3.	The following perpendicular offsets were taken at 30m intervals from a chain line to a forest boundary line: 5.6,12.2,15.5,18.3,20.6,24.1,20.8,and 18.2m.compute the area bounded between the chain line and the boundary line by any suitable method	**[Apply]**
4.	What is ranging? Explain the methods of ranging.	**[Remember]**

UNIT II

1.	Mention the sources of error in plane table surveying	**[Remember]**
2.	Define True meridian and magnetic meridian	**[Remember]**
3.	Explain the methods of plane table surveying with neat sketch	**[Remember]**
4.	A closed traverse with sides is almost that of regular pentogan, one line of pentagon has a bearing of $54^{o}30'$.compute the bearing of the remaining sides, taking the sides in clockwise order.	**[Apply]**

UNIT III

1.	A fixed point of reference, whose elevation is known, is called a. Reduced level b. Bench mark c. Change point d. Station	**[Remember]**
2.	Define benchmark	**[Remember]**
3.	Explain curvature and refraction correction with neat sketch	**[Remember]**
4.	The following data are taken during reciprocal levelling conducted at A and B. The distance between the station is 1320m.find the error in the collimation adjustment of the instrument.	**[Analyze]**

UNIT IV

1.	Compare the levels of longitudinal sectioning & cross sectioning based on the applications.	**[Remember]**
2.	Define the term contour and contour interval	**[Remember]**
3.	Describe radial method of contouring	**[Remember]**
4.	What are the different methods of contouring? explain any one method with neat sketch	**[Remember]**

UNIT V

1. Define standards in theodolite **[Understand]**

For an open traverse, which of the following is correct?

2. a.) latitude = 0. b) departure = 0. **[Analyze]**

c) Both (b) & (c) d) None of the above.

3. Explain in detail about temporary and permanent adjustments in theodolite **[Understand]**

4. Describe the process of repetition and reinteration in horizontal angle measurement **[Analyze]**

ASSESSMENT PATTERN

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester examination
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UGS431	REASONING AND QUANTITATIVE APTITUDE (Common to ALL Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES

- To make the student acquire sound knowledge of the characteristic of quantitative and qualitative aptitude.
- To familiarize the student with various principles involved in solving mathematical problems.
- To develop an understanding of the basic concepts of reasoning skills.

UNIT I QUANTITATIVE APTITUDE 8

Numbers – HCF and LCM - Arithmetic and Geometric Progression – Averages –Percentages – Problems on ages – Profit and Loss – Simple and Compound Interest - Ratio and Proportion – Time – Speed –Distance- Work – Pipes and Cistern – Problems on Trains – Permutation and Combination – Clocks – Calendars.

UNIT II VERBAL AND NON VERBAL REASONING 7

Analytical Reasoning – Circular and Linear arrangement – Direction problems – Blood relations – Analogy – Odd Man Out – Venn Diagrams – Statement and Conclusion, Statement and Implications – Letter series & arrangement – Alpha Numeric Series – Syllogism - Coding – Decoding.

TOTAL : 15 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Solve the problems on commercial mathematics.
- Solve problems on Ratio and Proportions.
- Choose appropriate statistical tools for data analysis.
- Interpret the graphical and numerical data.
- Solve many Brain Teasers problems.

WEBSITES:

TEXT BOOKS:

1. Dr. R.S.Agarwal, “Quantitative Aptitude”, S. Chand Publications, New Delhi, 17th Edition, (2010).
2. Trishna Knowledge Systems, “Quantitative Aptitude”, Pearson Education, South Asia, 2nd Edition, (2009)

REFERENCES

1. Abijit Guha, “Quantitative Aptitude for Competitive Examinations”, Tata McGraw Hill Publication, New Delhi, 4th Edition, (2011).
2. Dr. V.A.Sathgurunath’s “A Guide for Campus Recruitment”, Sagarikka Publications, Thiruchirapalli, 3rd Edition, (2011).
3. Nishit K.Sinha “Quantitative Aptitude for CAT”, Pearson Publication, New Delhi, 2nd Edition, (2009).

15UAG407	SURVEYING LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To train the student to acquire skill in operation various surveying and leveling instruments

LIST OF EXPERIMENTS

I CHAIN SURVEYING

a. Ranging, Chaining and Pacing
b. Chain traversing

II COMPASS SURVEYING

c. Triangulation Problem
d. Compass traversing

III PLANE TABLE SURVEYING

5. Radiation
6. Intersection – Two point problem
7. Triangulation problem – Bessel's Method

IV THEODOLITE SURVEYING

8. Measurement of horizontal & vertical angles
9. Tangential & Stadia Tacheometry

V LEVELLING

10. Fly levelling using Dumpy level
11. Fly levelling using Tilting level
12. Check levelling

VI DEMONSTRATION OF TOTAL STATION AND GPS

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Calculate the area based on the principle of chain surveying
- Calculate the area based on the principle of compass surveying
- Calculate the area based on the principle of plane table surveying
- Calculate the area based on the principle of theodolite surveying
- Work out the problems based on the principle of leveling

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	QUANTITY REQUIRED
1.	Chain link	10
2.	Compass	10
3.	Theodolite	10
4.	Dumpy Level	10
5.	Plane Table	10
6.	Ranging rods	10
7.	Leveling Staff	10
8.	Measuring tape – 30 m	10
9.	Other accessories required for	10

15UAG408	TRACTOR AND FARM ENGINES LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To make the student knowledgeable in dismantling and assembling of different systems of tractor

LIST OF EXPERIMENTS

1. Introduction and selection of farm tractors
2. Hand tools used in garage
3. Dismantling of Engine from Tractor
4. Piston and cylinder and cranking system - Disassembling and assembling cylinder head and valves
5. Fuel System dismantling and assembly
6. Lubricating and Cooling System - Dismantling & Reassembly
7. Dismantling and assembling of a tractor clutch system
8. Front Axle, Gears – Dismantling and Assembling
9. Tractor Rear Axle, Gears - Disassembling & Assembling
10. Brake Linkages, Operation, Assembly and Disassembly of Axle
11. Tractor Power Steering - Disassembling and Assembling
12. Determination of centre of gravity of tractors

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Gain Knowledge in dismantling and assembly of IC engine of a farm tractor
- Understand the concept of tractor actuation system
- Gain Knowledge in dismantling and assembly of different systems of a farm tractor
- Assembling and dismantling of the fuel and cooling systems of a farm tractor
- Selection of tractors for area specific cultivation

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Quantity
1.	Tractor	**1 Nos**

15UAG501	IRRIGATION AND DRAINAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the necessity ofplanning 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 9

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

UNIT II METHODS OF IRRIGATION 9

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 9

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

UNIT IV CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes – Lining and maintenance of canals - 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 9

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

TOTAL : 45

COURSE OUTCOMES

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

- Understand the water resources available in Tamil Nadu and India
- Gain knowledge on different methods of irrigation including canal irrigation.
- Determine water requirements of crops and the irrigation schedule for different c
- Possess a good understanding of the different irrigation methods
- Design and construct irrigation structures for landscaping

TEXT BOOKS

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

REFERENCE BOOKS

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

15UAG501 - ASSESSMENT QUESTIONS

UNIT I

1.	Gross command area includes a) Cultivable area b) wet land c) empty plot d) cultivable and uncultivable area	**[Remember]**
2.	Write short note on water resource survey	**[Understand]**
3.	Explain in detail about the methods to estimate consumptive use of water	**[Remember]**
4.	A stream of 130 l/s was delivered from a canal and 100 l/s were delivered to field, an area of 1.6 ha was irrigated in 8 h. The effective depth of the root zone was 1.7 m .the runoff loss in the field was 420m^2.The depth of water penetration varied linearly from 1.7 m at the head end of the field to 1.1 m at the tail end. Available moisture content is 20 cm/m depth of soil. Determine water conveyance efficiency, water application efficiency, water storage efficiency, water distribution efficiency	**[Apply]**

UNIT II

1.	Sprinkler irrigation method was started in a)1900 b)1990 c)1982 d)1920	**[Remember]**
2.	Define regime channel	**[Understand]**
3.	Write in detail about surface and subsurface method of irrigation	**[Remember]**
4.	Explain erodible and non erodible canal design theories	**[Remember]**

UNIT III

1.	Whichof the following forcw act on gravity dam a)water pressure b)silt pressure c)wind pressure d)all the above	**[Remember]**
2.	Explain any three factors affecting location of dam	**[Understand]**
3.	Explain the design procedure for gravity and arch dam	**[Remember]**
4.	Write in detail about diversion headworks	**[Remember]**

UNIT IV

1. For a given discharge in a horizontal frictionless channel two depths may have the same specific force. These two depths are known as
   a.) Specific depths b.) Sequent depths
   c.)Alternate depths d.) Normal depth and critical depth **[Remember]**
2. Explain the necessity of canal drop **[Understand]**
3. Explain in detail about CADP-Command Area Development Programme **[Remember]**
4. Explain the classification of canals **[Remember]**

UNIT V

1. Potential evapo-transpiration was suggested by
   a)Thomthwait b)Harrige c)Darcy d)Gorge **[Remember]**
2. State infiltration theory **[Understand]**
3. Write in detail about surface and subsurface drainage system **[Remember]**
4. Explain about recycling of water for irrigation **[Remember]**

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG502 - ASSESSMENT QUESTIONS

UNIT I		
1.	What is primary and secondary tillage?	**[Remember]**
2.	Define Field Capacity	**[Understand]**
3.	Discuss about the various primary and secondary tillage implements	**[Understand]**
4.	Explain about the various trailed and mounted farm implements in detail with the help of suitable illustrations	**[Remember]**
UNIT II		
1.	What are the benefits of ploughing	**[Remember]**
2.	List the various types of ploughs	**[Remember]**
3.	Discuss about mould board plough attachments, its shapes and types	**[Understand]**
4.	Explain about Disc plough, types and force representation on disc with illustrations	**[Understand]**
UNIT III		
1.	Enumerate the various secondary tillage implements	**[Remember]**
2.	What is a bund former?	**[Understand]**
3.	Discuss about cultivators, its construction and types with neat sketches	**[Remember]**
4.	Explain about the implements utilized for the preparation of wetlands	**[Understand]**
UNIT IV		
1.	What is broadcasting?	**[Remember]**
2.	Define transplanting	**[Understand]**
3.	Discuss about the types of seed drills and planters with suitable illustrations	**[Remember]**
4.	Explain about the devices for metering mechanisms	**[Understand]**
UNIT V		
1.	What is FYM	**[Understand]**
2.	Define Fertigation	**[Remember]**
3.	How do you calibrate a seed drill?	**[Analyze]**
4.	Explain about seed cum fertilizer drill with suitable illustrations	**[Understand]**

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	9	25
Understand	16	9	9	25
Apply	16	20	20	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG502	TILLAGE AND SOWING **IMPLEMENTS**	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about the different types of primary and secondary tillage implements, farm equipment and different ploughing methods
- To know about the tools and techniques used for a wide variety of different types of farming operations and landscaping
- To utilize the power tools and mounted implements with the tractor

UNIT I FARM POWER AND MECHANIZATION 9

Farm power – Sources – Mobile power and Stationary power – Merits and demerits of different forms of power – Status of farm power in India. Farm mechanization – concepts – Benefits - Scope – limitation - Mechanization indicator – Mechanization in different farming operation - Status of farm Mechanization in India.

UNIT II PRIMARY TILLAGE IMPLEMENTS 9

Tillage- Classification – Primary tillage - objectives – Types - Mould board plough- Components – Types of share and Mouldboard – Plough accessories - Adjustment of MB Plough. Animal drawn MB plough – One way, Two way and Turn wrest plough - Problems. Disc plough –Advantages – Types - Adjustment and Repair – Others plough – Chisel plough – Subsoiler – Rotary plough. Ploughing of land – Important terminology – Ploughing methods – casting and Gathering – Continuous plough and Round and round plough.

UNIT III SECONDARY TILLAGE IMPLEMENTS 9

Secondary tillage - Harrowing – types – Components of disc harrow – Penetration and Care and Maintenance. Others Harrow – Spike tooth – Spring tooth- Acme – Triangular – Zig Zag – Guntaka –Bodela and Bindha – Animal drawn disc harrow - Problems. Cultivators - types – Tractor drawn cultivator – Trailed and Mounted – types Spring loaded tines and Rigid tines – Animal drawn cultivator with seeding attachment – Problems.

UNIT IV SOWING AND PLANTING EQUIPMENT 9

Seeding – Methods – Seed drill – Components – Seed metering mechanism – types- types of furrow openers – Calibration of seed cum fertilizer drill. Test for seed uniformity – Sticky belt method and Sand bed method - Animal drawn cotton seed drill. Planter – Function – Seed metering device.Potato planters – Automatic and Semi-automatic – Sugarcane planter – Zero till drill - Fertilizer distributer – Spreader – Problems.

UNIT V INTERCULTURAL AND OTHERS IMPLEMENTS 9

Intercultural Implements – Sweep –Junior hoe – Duck foot cultivator – Engine operated weeder - Rotary tiller.Other implements – Puddler – Bund former – Ridger – Soil scoop – Green Manure trampler – paddy weeder. Centre of power - Resistance –Line of pull -Pull – Draft – Unit draft – Side draft - TFC – AFC – Soil Inversion and Pulverization - Problems

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Understand the importance of farm mechanization and its objectives
- Design and construct the primary tillage implements
- Design and construct the secondary tillage implements
- Apply the theory and working principles of different drills and planters
- Learn the different types of intercultural implements and field performance

TEXT BOOKS

- Jagdishwar Sahay. 2006. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.
- Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

REFERENCE BOOKS

1. Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.
2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.

15UAG503	PLANT PROTECTION AND HARVESTING EQUIPMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts of plant protection and different methods adopted
- To know the mechanization requirements of each operation in agricultural production
- To know and differentiate between the different types of machinery and labour saving devices used in agricultural production

UNIT I WEEDING EQUIPMENT **9**

Weeding and Intercultural equipment. Junior hoe - guntaka - blade harrow - dry land weeders - tractor mounted and engine operated sweeps. Engine operated and rotary weeders for upland and low land - selection, constructional features and adjustments.

UNIT II SPRAYERS AND DUSTERS **9**

Sprayers – classifications - parts and accessories - atomizers - agitators - determination of particle size and distribution. Number Median Diameter (NMD) and Volume Median Diameter (VMD). Sprayer operation – boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers - Arial spraying- Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

UNIT III HARVESTERS **9**

Principles and types of cutting mechanisms. Harvesters - types - mower – mower mechanism construction and adjustments - registration and alignment. Mowers, windrowers, reapers, reaper binders and forage harvesters. Combine harvester – types - parts - construction and working. Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters.

UNIT IV THRESHERS AND OTHER MACHINERIES **9**

Thresher – construction and working of multi crop thresher. Fruit pluckers - tree shakers fruit harvesting machinery. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter.

UNIT V SPECIALIZED FARM EQUIPMENT **9**

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.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Explain different types of weeding equipments available in agricultural operation and its working principle.
- Elaborate the working principle of different sprayers and their importance.
- Detail the different types of dusters and their principle operation.
- Identify the different mechanism adopted for harvesting different crops.
- Detail the working principle of threshers and fruit harvesters

TEXT BOOKS

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

2. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.

REFERENCE BOOKS

1. Sanjay Kumar *et al*. 2013. Fundamentals of Agricultural Engineering. Kalyani publishers, Ludhiana-141 008.
2. Surendarsingh, 2011. Farm Machinery Principles and Applications. Indian Council of Agricultural Research, New Delhi-12.

15UAG503 - ASSESSMENT QUESTIONS

UNIT I

1.	Explain about the long and short handled weeders in detail with illustrations	**[Understand]**
2.	What are disc, rotary and tine cultivators? Write about tractor drawn cultivator	**[Remember]**
3.	Describe about the working of the different types of hand operated weeding equipments with neat sketch	**[Analyze]**
4.	How to set blades in a cultivator? Discuss in detail	**[Evaluate]**

UNIT II

1.	A 0.95 m^3 round bottom sprayer tank is 1.5m long and has a depth of 0.9 m. Mechanical agitation is to be provided with four paddles 280 mm long (tip diameter) and 200 mm wide mounted on a shaft 150 mm above the bottom of the tank. a) calculate the minimum rpm for agitating a mixture of 10% of oil and 90% water, b) if the mechanical efficiency of the power transmission system is 90%, what iput power would b needed for agitation. Under the conditions what recirculation rates would be required for hydraulic agitation at 400kPa and 2.75MPa? If the pump efficiency is 50% what pump input power would be needed for hydraulic agitation at each pressure? Prepare a table to summarize and compare the results. Note that the degrees recirculation rate and increased power requirement when the hydraulic agitation pressure increased.	**[Analyze]**
2.	A field sprayer is equipped with nozzle having a rated delivery of 0.42 lpm of water at 275kPa. The nozzle spacing in the boom is 51 cm. Each kg of active ingredient (2,4 - D) is mixed with 80 L of water and the decide application rate is 0.9kg of chemical/ha. What ids the correct forward speed for a nozzle pressure of 200kPa.	**[Analyze]**
3.	To apply a herbicide on 12” bands on rows 36” apart. The herbicide label recommends 3lbs/acre on broadcast basics. The sprayer has 300 gallon tank and the application to measured with calibration method for band application is 15GPA. Determine the amount chemical needed per tank.	**[Remember]**
4.	A field Sprayer having a horizontal boom with 20 nozzles spaced 40cm apart is to be designed for a maximum application rate of a 750 L/ha at 520 kPa and 6.5 km/h	**[Apply]**

(a) Determine the required pump capacity in LPM, assuming 10 percentage of the flow is bypassed under the above max conditions

(b) If mechanical Agitation requires 375 input watts and the pump efficiency is 50%. What should be the engine rating if the engine is to be loaded to not more than 80% of its rated power?

(c) What discharge rate per nozzle (LPM) is required under above conditions?

(d) If the nozzle have 70° Spray angles and the pattern is such that 50 percentage overlap is needed for uniform coverage (i.e. spray pattern 50% wide than nozzle spacing at what height above the tops of the plant should boom be operated)

UNIT III

1. The maximum yield of sugarcane is obtained for a population of 40,000 buds/ha. The pits are formed by a power hole digger, rows are 120cm apart and average emergence of 90% is expected. Determine **[Apply]**

   1) No of pits per hour if 20sec is taken per pit,

   2) How many buds per pits should planted if pits are 150cm apart.

2. A bullock drawn mower has drive wheel 90cm in dia. The power to drive the knife is transmitted to the crank wheel through a transmission gear train. The first step consists of 120 tooth gear on main axle, driving 20 tooth gear on counter shaft. The second step consists of a 60 tooth bevel pinion on the crankshaft; the guards are spaced 8cm apart with knife stroke 8cm. **[Create]**

   Calculate

   a) The number of stroke, the knife will make per minute when the mower is pulled at 4 km per hour speed and driven gear= 15 tooth

   b) The total length of knife stroke per minute

3. What are theprinciples and types of cutting mechanisms **[Remember]**
4. Discuss elaborately about the Combine harvester types, its construction and working **[Analyze]**

UNIT IV

1. What is a Chaff cutter? **[Remember]**
2. Enumerate the types of forest machineries **[Understand]**
3. What is a Thresher? Explain about the construction and working of multi crop thresher **[Remember]**
4. Infer the significance of Fruit pluckers, tree shakers and other fruit harvesting machinery **[Analyze]**

UNIT V

1. What are specialized farm equipment **[Understand]**
2. Discuss elaborately about tractor operated hoist, tractor operated rhizome planter. **[Analyze]**
3. Explain Pneumatic planters **[Understand]**
4. Discuss elaborately about thedirect paddy seeders, direct paddy cum daincha seeder. **[Analyze]**

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	10	25
Understand	16	9	10	25
Apply	16	20	18	34
Analyze		12	12	16
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG504	HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES

- The course is intended to build up necessary background for the understanding of the physical behavior of the various modes of heat transfer, like, conduction, convection and radiation.
- To understand the application of various experimental heat transfer correlations in engineering calculations.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

UNIT I CONDUCTION 12

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – one dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction – Lumped analysis – Use of Heislers chart.

UNIT II CONVECTION 12

Basic concepts – Convective heat transfer coefficients – Boundary Layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, Cylinders and spheres – Internal flow – Laminar and turbulent flow – Combined Laminar and turbulent flow – Flow over bank of tubes – Free convection - Dimensional analysis – Flow over vertical plates, horizontal plate.

UNIT III RADIATION 12

Basic concepts, law of radiation – Stefan Boltsmann law, Kirchoff law – Block body radiation – Grey body radiation shape factor algebra – Electrical analogy – Radiation shields – introduction to gas radiation.

UNIT IV HEAT EXCHANGERS 12

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.

UNIT V MASS TRANSFER 12

Basic concepts – Diffusion mass transfer – Fick‟s Law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

TOTAL : 60 PERIODS

COURSE OUTCOMES

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

- Understand conduction, convection and radiation problems for different geometries
- Analyze the performance of heat exchangers and evaporators.
- Impart the importance of different heat exchangers.
- Apply the different forms of radiations in a real system.
- Understand the various modes of mass transfer and apply them in engineering problems

TEXT BOOKS

1. Sachdeva, R.C., “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, New Delhi, 1995.
2. Yadav, R., “Heat and Mass Transfer”, Central Publishing House, New Delhi, 1995.

REFERENCE BOOKS

1. Ozisik, M.H., “Heat Transfer”, McGraw Hill Book Co., New York, 1994.
2. Nag, P.K., “Heat Transfer”, Tata McGraw Hill Book Co., New Delhi, 2002.
3. Holman, J.P., Heat and Mass transfer, Tata McGraw Hill Book Co., New York, 2002.
4. Kothandaraman, C.P., “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, New Delhi, 1998.

15UAG504 - ASSESSMENT QUESTIONS

UNIT I

1.	Define the following (i) conduction (ii) convection (iii) radiation (iv) fin efficiency	**[Remember]**
2.	Derive general heat conduction equation in Cartesian coordinates.	**[Understand]**
3.	A fin 5mm thick and 45 mm long has its base on a plane plate which is maintained at 125^0C. The ambient temperature is 25^0C. The conductivity of fin material is 55 W/m^{0}C and the heat transfer coefficient is 145 W/m^2 ^{o}C. Determine (i) temperature at the end of the fin (ii) temperature at the middle of the fin (iii) heat dissipated by the fin.	**[Apply]**
4.	Compare the temperature distributions in a spine having a diameter of 2 cm and length 10 cm and exposed to a convection environment with h = 25 W/ m^{2}K for three fin materials: copper, stainless steel, and glass. Also compare the relative heat flows and fin efficiencies with respect to the copper fin.	**[Analyze]**

UNIT II

1.	Define the following (i) free and force convection (ii) Reynolds's number and Nussle number.	**[Remember]**
2.	Explain for fluid flow along a flat plate: (i) velocity distribution in hydrodynamic boundary layer (ii) temperature distribution in thermal boundary layer (iii) variation of local heat transfer coefficient along the flow.	**[Understand]**
3.	A thin 80 cm long and 8cm wide horizontal plate is maintained at a temperature of 130^0C in large tank full of water at 70^0C. Estimate the rate of heat input into the plate necessary to maintain the temperature of 130^0C.	**[Analyze]**
4.	Air at 30^0C is flowing across a tube with a velocity of 25 m/s. The tube could be either a square with a side of 5cm or a circular cylinder of diameter 5cm. Compare the rate of heat transfer in each case if the tube surface temperature is 124^0C.	**[Apply]**

UNIT III

1.	Define the following (i) black body (ii) white body (iii) grey body (iv) opaque body	**[Remember]**
2.	Describe the phenomenon of radiation from real surfaces.	**[Understand]**
3.	Calculate the following for an industrial furnace in the form of a black body and emitting radiation at 25000 °C. (i) Monochromatic emissive power at 1.2µm length. (ii) Wavelength at which the emission is maximum (iii) maximum emissive power (iv) total emissive power (v) total emissive power of the furnace if it is assumed a real surface with emissivity equal to 0.9.	**[Apply]**
4.	Two black discs each of diameter 500 mm are placed directly opposite at a distance 1m apart. The discs are maintained at 1000 K and 500 K respectively. Compare the heat flow between the discs: (i) when no other surfaces are present. (ii) when the discs are connected by right cylindrical block no flux surface	**[Apply]**

UNIT IV

1. Define the Heat Exchanger and its types **[Remember]**
2. Derive the LMTD for a parallel flow heat exchanger starting the assumptions. **[Understand]**
3. In a certain double pipe heat exchanger hot water flows at a rate of 5000kh/hr and gets cooled from 95^0C to 65^0C. At the same time 50000kg/hr of cooling water at enters the heat exchanger. The flow conditions are such that over all heat transfer coefficient remains constant at 2270 W/m^2K. Determine the heat transfer area. **[Apply]**
4. Hot oil with a capacity rate of 2500 W/K flows through a double pipe heat exchanger. It enters at 360^0C and leaves at 300^0C. Cold fluid enters at 30^0C and leaves at 200^0C. If the overall heat transfer coefficient is 800 W/m^2K, Compare the heat exchanger area required for (i) Parallel Flow (ii) Counter Flow **[Apply]**

UNIT V

1. Define the following (i) molar concentration (ii) mass fraction **[Remember]**
2. Explain briefly the following (i) Fick's law of diffusion (ii) Equimolar counter diffusion (iii) Evaporation process in the atmosphere **[Understand]**
3. Air at 25°C and atmospheric pressure flows with a velocity of 300 cm/s inside a 10 mm diameter tube of 1 m length. The inside surface of the tube contains deposit of naphthalene. Determine the average mass transfer coefficient. Take for Naphthalene air, D = 0.62 X 10^{-5} m^2/s. **[Apply]**
4. Dry air at 20 °C flows over a flat plate of length 50 cm which is covered with a thin layer of water at a velocity of 1 m/s. Compare the total mass transfer coefficient at a distance of 10cm from the leading edge and the average mass transfer coefficient. **[Apply]**

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	18	9	10	25
Understand	16	9	10	25
Apply	16	20	20	30
Analyze		12	10	20
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG507	TILLAGE AND SOWING EQUIPMENTS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To expose the students to different tillage operation in the field
- To conduct field experiments with different sowing equipments

LIST OF EXPERIMENTS

1. Operation of an animal drawn plough, measuring the draft
2. Adjustment of mould board plough and measurement of field capacity
3. Hitching of mounted implement to the tractor - mounted and trailed implements
4. Dismantling and assembling the tractor drawn disc plough operation adjustment - Determination of field capacity
5. Methods of Ploughing with mounted implements – Comparison of field capacity - calculation
6. Operation of tractor drawn cultivator - Adjustments – Calculations
7. Operation of Sub Soiler, Soiler- Chisel Plough – Mole Plough – Adjustments
8. Identifications of parts in Cube Feet and fluted roller and seed mechanism
9. Calibration of a seed dill
10. Practical Problems on primary tillage implements Problems on seed drills and planters
11. Practical Problems on seed drill
12. Practical Problems on seed drill planter
13. Cost Economics of Farm Implements – Determination of Operating Cost

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Learn about the tools and techniques used for a wide variety of different types of farming operations and landscaping.
- Utilize the power tools and mounted implements with the tractor.
- Possess skills on safe and efficient use of tractors and seed drills.
- Run an Agro Service Centre for Farm Machinery.
- Work out the cost economics of farm implements.

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	QUANTITY REQUIRED
1.	Tractor	1 No
2.	Mould board plough	1 No
3.	Disc Plough	1 No
4.	Seed drill	1 No
5.	Sub soiler	1 No
6.	Puddler and trampler	1 Each
7.	Paddy drum seeder	1 No
8.	Fluted roller and Cub feed Metering device	1 Each

15UAG508	PLANT PROTECTION AND HARVESTING EQUIPMENTS LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To learn about the different types of weeders and their operation.
- To know about the different types of sprayers and their working principle.
- To study about the combine harvesters and their working principle.

LIST OF EXPERIMENTS

1. Operation and evaluation of dry land weeders
2. Operation and evaluation of Cono weeder
3. Operation and evaluation of power operated weeders
4. Dismantling, parts identification and assembly of knapsack sprayer
5. Field-testing of rocker arm sprayer
6. Nozzles and Spray Pattern Study
7. Calibration, field testing and handling techniques of power sprayer
8. Practice problems on sprayers
9. Practice problems on Hydraulic energy sprayers
10. Study and testing of different types of dusters
11. Digging holes with power tiller operated digger
12. Side mounted mower - adjustment and operation
13. To study the combine harvester

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Understand the operating principle of different weeders.
- Operate the different sprayers in the field and identify different components and their use.
- Dismantle and reassemble the power sprayer
- Elaborate the working principle of mower, reaper and digger.
- Calculate the different losses in the combine harvester.

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Quantity
1.	Dry land weeders	1No
2.	Conoweeder	1No
3.	Power operated weeder	1No
4.	Power operated sprayer	1No
5.	Rocker arm sprayer	1No
6.	Nozzles	1No
8.	Foot Sprayer	1No
9.	Hand Compression Sprayer	1No
10.	Mist Sprayer/duster	1No
11.	Reaper	1No
12.	Combine harvester(Optional)	

15UGS531	SOFTSKILLS AND COMMUNICATION LABORATORY (**Common to MECH., Civil, EIE, Chemical & Agri)**	L	T	P	C
		0	0	2	1

OBJECTIVES

- To develop a requisite knowledge in communication skills and soft skills .
- To enhance the students' acumen in sharpening the skills to meet the global challenges and industrial needs.

UNIT I COMMUNICATION SKILL **10**

Listening to the Conversation - Introducing Oneself Before Audience - Group Discussion - Formal Letter writing - E Mail Etiquettes - power point presentation.

UNIT II PREPARATION FOR INTERVIEWS **10**

Preparation of Resume - Difference between Bio-data and CV- Visiting Company Web site - Gathering Information about Company - Mode of Selection - Different types of Selection Methods – Pre-Placement Talk - Attitude Before Interview.

UNIT III INTERVIEW SKILL **10**

Body Language - Types of Interview – Attending to Telephonic Interview – Do's and Don'ts during and after the Interview - Expectations of the Interviewer - Mock Interview.

TOTAL : 30 PERIODS

15UAG601	SOLAR AND WIND ENERGY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about the fundamental aspects of solar energy availability, solar thermal energy conversion technologies and solar PV power generation technology
- To understand about the fundamental aspects of wind energy availability and wind power generators
- To acquire the knowledge on the alternate sources of energy such as geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and energy storage

UNIT I SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS 9

Solar radiation availability - 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.

UNIT II SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY 9

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.

UNIT III WINDCHARACTERISTICS 9

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.

UNIT IV WIND MILL DESIGN AND APPLICATIONS 9

Turbines - Wind mill – classification– power curve. Upwind and downwind systems - transmission rotors – pumps - generators - standalone system - grid system – batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.

UNIT V ALTERNATE ENERGY SOURCES 9

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 – thermal.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Possess the knowledge on the fundamental aspects of solar energy.
- Gain the knowledge on the fundamental aspects of wind energy availability and wind power generators
- Understand the wind mill design and its characteristics.
- Gain the knowledge of working principle of fuel cells.
- Possess the knowledge on the different alternate sources

TEXT BOOKS

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

REFERENCE BOOKS

1. Mathew Buresch, Photovoltaics Energy Systems. McGraw-Hill Book Company, London, 1986.
2. Jui Sheng Hsieh. Solar Energy Engineering, Prentice Hall, London, 1986.
3. TanyBurtar, Hand book of wind energy. John Wiley and Sons, 2001,

15UAG602	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquire knowledge about the fundamentals of groundwater occurrence and their Exploitation.
- To understand the well hydraulics so as to locate wells for the extraction of ground water.
- To choose appropriate pumps for a given well and their maintenance

UNIT I PRECIPITATION AND ABSTRACTIONS **10**

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

UNIT II RUNOFF **9**

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

UNIT III FLOOD AND DROUGHT **8**

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).

UNIT IV RESERVOIRS **8**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

UNIT V GROUNDWATER AND MANAGEMENT **10**

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Possess the knowledge on hydrologic cycle and runoff loss and will be able to draw hydrographs.
- Know about different types of aquifers and ground water flow.
- Draw water table contour maps.
- Calculate the well losses.
- Design open well as wells as bore wells.

TEXT BOOKS

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

REFERENCE BOOKS

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

15UAG602 – ASSESSMENT QUESTIONS

UNIT I

1. Lysimeter is used to measure:
   a) Evaporation
   b) Humidity
   c) Rainfall
   a) Evapotranspiration

   [Remember]

2. Define hydrologic cycle. **[Understand]**

3. What are rain gauges? Explain the different types of rain gauges with neat sketch. **[Evaluate]**

4. Write the procedure for estimating the consistency of a rain gauge station using Double Mass Curve Technique. **[Create]**

UNIT II

1. The ratio of total channel length to the drainage area:

   a) Stream Density

   b) Drainage Density **[Remember]**

   c) Length of the watershed

   d) Relief

2. Define IUH. **[Understand]**

3. Discussabout the different methods of stream flow measurement. **[Create]**

4. The ordinates of a 6-h unit hydrograph of a catchment are given below: **[Apply]**

Time (h)	0	3	6	9	12	15	18	24	30
Ordinates of a 6-h UH	0	25	50	85	125	160	185	160	110

Time (h)	36	42	48	54	60	69
Ordinates of a 6-h UH	60	36	25	16	8	0

Derive the flood hydrograph of a catchment due to the storm given below:

Time from start of storm (h)	0	6	12	18
Accumulated rainfall (cm)	0	3.5	11	16.5

The φ- index for the catchment is estimated as 0.25 cm/h. The base flow can be assumed to be 15 m^3/s at the beginning and increasing by 2 m^3/s for every 12 hours till the end of the direct runoff hydrograph.

UNIT III

1. DPAP stands for:
    a) Drought Predicted Area Programme
    b) Drought Prone Area Programme **[Remember]**
    c) Drought Prone Area Prediction
    d) None of the above
2. Summarise the different kinds of droughts. **[Understand]**
3. Discussabout the different methods to control flood. **[Create]**
4. Evaluate the importance of DPAP. **[Evaluate]**

UNIT IV

1. Period through which deposited sediment does not impact on the intended purpose of the reservoir:
    a) Design life
    b) Useful life **[Remember]**
    c) Economic life
    d) None of these
2. Define spillways. **[Understand]**
3. Define reservoir sedimentation. Examine its impacts and explain the different methods to control the reservoir sedimentation. **[Analyze]**
4. a) Define reservoirs. Explain the classification of reservoirs **[Analyze]**
    b) Define life of reservoirs. Explain the different types of life.

UNIT V

1. Define aquifers. **[Understand]**
2. The geological formations which neither stores nor transmits water are known as:
    a) Aquifers
    b) Aquicludes **[Remember]**
    c) Aquifuges
    d) Aquitards
3. Explain the various artificial recharge technique. **[Analyze]**

4. Derive the equations for steady state flow into an unconfined aquifer. **[Create]**

ASSESSMENT PATTERN

Cognitive Level	**Periodical Test – I (as marks)**	**Periodical Test – II (as marks)**	**Periodical Test – III (as marks)**	**End semester examination**
Remember	12	16	9	25
Understand	20	10	9	25
Apply	16	20	20	40
Analyze	2	4	12	10
Evaluate				
Create				
Total (50)	50	50	50	100

15UAG603	DESIGN OF AGRICULTURAL MACHINERY	L	T	P	C
		4	0	0	4

OBJECTIVES

- To introduce to the students to the basic concepts of design of agricultural machineries.
- To get through the detailed design & drawing of various components of agricultural machineries.

UNIT I STRESSES IN MACHINE MEMBERS 12

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

UNIT II DESIGN OF POWER TRANSMISSION SYSTEMS 12

Selection of V-Belts and pulleys- selection of flat belts and pulleys- wire ropes and pulleys- selection of transmission chains and sprockets. Design of pulleys and sprockets.

UNIT III DESIGN OF SHAFTS AND COUPLINGS 12

Design of solid and hollow shafts based on strength and rigidity- Design of keys, keyways and splines- Design of rigid and flexible couplings. Design of bolts and nuts - knuckle and cotter joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 12

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs.

UNIT V DESIGN OF GEARS AND BEARINGS 12

Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth. Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions.

TOTAL : 60 PERIODS

(**Note:** Use of PSG Design Data book is permitted in the university examination)

COURSE OUTCOMES

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

- Identify and compute the type of stresses and strains induced in machine components.
- Select suitable power transmission systems for engineering application.
- Design the machine components for engineering applications.
- Design energy storing elements for high loads.
- Select suitable springs and bearings to satisfy the functional requirements of machine element.

TEXT BOOKS

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

REFERENCE BOOKS

1. Norton R.L, Machine Design – An Integrated Approach, Pearson Publications, 3rd Edition, 2006.
2. Srivastava A.K., Goering.C.E. andRohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.
3. Gary Krutz, Lester Thompson and Paul Clear., “Design of Agricultural Machinery”, John Wiley and Sons, New York, 1984.

15UAG607	CAD FOR AGRICULTURAL ENGINEERING	L	T	P	C
		0	0	3	2

OBJECTIVES

- To draft the agricultural engineering implements/tools using Computer Aided Design

LIST OF EXPERIMENTS

1. Introduction to AUTOCAD Software – To Study the application of all the tools
2. Draw the simple tractor components and mark dimensions
3. Draw an isometric component of simple gear
4. Create an isometric component drawing of piston
5. Create a two dimensional sketch diagram of connecting rod
6. Create an isometric component drawing of crankshaft
7. Create an isometric component drawing of cylinder
8. Create an isometric component drawing of crankcase
9. Create an isometric component drawing of cam shaft
10. Create an isometric component drawing of a valve
11. Create a 3D drawing of IC engine assembly
12. Create a two dimensional sketch diagrams of KVIC Model Biogas Plant

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- To Study and understand different tools of AutoCAD package
- Visualize different views of tractor engine components
- Develop a three dimensional assembly model consisting of many components of tractor engine
- Apply CAD to draw a two dimensional view of KVIC model biogas plant

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LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Quantity
1.	Computer	30 Nos
2.	Software – AutoCAD	1 Nos

15UAG608	INNOVATIVE AND CREATIVE PROJECT	L	T	P	C
		0	0	3	2

OBJECTIVES

- To use the knowledge acquired in agricultural engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

STRATEGY

Identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication.Demonstrate the novelty of the project through the results and outputs.

TOTAL : 45 PERIODS

COURSE OUTCOMES

- Carry out mini project involving design and fabrication
- Develop prototype machine
- Create novel ideas

15UAG701	BIO-ENERGY RESOURCE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.
- To acquire knowledge about the fundamentals of renewable energy resources.
- To understand the concepts and conversion systems in harnessing them.
- To apply the above concepts in meeting the energy needs in Agriculture.

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

Biomass – types – source of energy- energy plantation. Biomass energy conversion routes – wet and dry processes.

UNIT II BIOCHEMICAL CONVERSION 9

Biodegradability – raw material for biogas production and their characteristics – conversion principles – factors affecting biogas production. Types of biogas plants – floating drum and fixed dome types – comparison of biogas plants – utilization of biogas – bio digested slurry - landfills. High rate anaerobic reactors – types. Ethanol production from biomass.

UNIT III THERMO CHEMICAL CONVERSION BY COMBUSTION 9

Combustion principles – furnaces – utilization of thermal energy – fixed bed and fluidized bed systems – emissions – scrubbing – flue gas treatment system.

UNIT IV THERMO CHEMICAL CONVERSION BY GASIFICATION AND 9

Biomass gasification – chemistry of gasification – types of gasifier. Composition of producer gas – application and problems of gasifiers. Gasifier system – storing, feeding, blowers and burners. Engine adaptation and operation with producer gas. Biomass power generation – co-firing. Pyrolysis – product recovery – types - further thermo-chemical processes.

UNIT V ENERGY CONSERVATION 9

Principles and energy audit – energy conservation technologies – cogeneration – waste heat utilization – combined cycle power generation – heat recuperators – heat regenerators – heat pipe- stirling engine – heat pumps – energy storage

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Know about the energy scenario and status of renewable energy sources and production in India.
- Possess the knowledge on different renewable energy sources and energy conversion technologies.
- Able to use renewable energy technologies to meet the energy requirements of farms.
- Classify the gasification and pyrolysis process.
- Elaborate energy conservation technologies.

TEXT BOOKS

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 BOOKS

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

15UAG702	DAIRY AND FOOD ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products , sanitation and effluent treatment in dairy industry
- To expose the students to the fundamental knowledge of food, its properties and differentmethods of food processing.

UNIT I PROPERTIES AND PROCESSING OF MILK 9

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

UNIT II DAIRY PRODUCTS 9

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

UNIT III FOOD AND ITS PROPERTIES, REACTION AND KINETICS 9

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.

UNIT IV PROCESSING AND PRESERVATION OF FOODS 9

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

UNIT V QUALITY CONTROL 9

Quality control of processed food products - Factors affecting quality - Food packaging, importance, flexible pouches - restorable pouches - aseptic packaging, granules, powder and liquid packaging machines - nanotechnology – principles - applications in food processing – food plant location.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Gain knowledge about milk processing
- Understand the process of manufacturing of dairy products and thermal processing of food.
- Specify the kinetics of foods
- Elaborate food preservation methods
- Learn the importance of quality control and packaging methods

TEXT BOOKS

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

REFERENCE BOOKS

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

2. Toledo, R.T., “Fundamentals of Food Process Engineering”, CBS Publishers and Distribution, New Delhi, 1997.

15UAG703	FARM MANAGEMENT AND FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management
- To understand the types of resources and Investment analysis in agriculture sector
- Farm financial analysis, Investment and Budgeting for farms

UNIT I FARM MANAGEMENT **9**

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.

UNIT II LAWS OF ECONOMICS **9**

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.

UNIT III COST CURVES **9**

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.

UNIT IV MANAGEMENT OF RESOURCES **9**

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.

UNIT V FARM MANAGEMENT AND FINANCIAL ANALYSIS **9**

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.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Understand the basic concepts of farm management
- Solve the problems in farm with different laws of economics
- Work out breakeven point for different machineries in farm
- Manage the resources in farm with different methods
- Elaborate different elements of farm planning

TEXT BOOKS

1. Johl, S.S., and Kapur, T.R., „Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani
3. Devi, I., „Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

REFERENCE BOOKS

1. Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Subba Reddy, S., and Raghu Ram, P. „ Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

15UAG706	BIO-ENERGY LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To introduce the various applications of bio energy

LIST OF EXPERIMENTS

1. Characterization of biomass
2. Design of KVIC model / Deenbandhu mode biogas plant
3. Purification of biogas – CO_2 and H_2S removal
4. Study on biogas appliances and utilization of biogas for engine running.
5. Estimation of manurial value of biodigested slurry
6. Calculation on Stoichiometric calculations
7. Performance evaluation of briquetting machine
8. Performance evaluation of agro residue gasifier
9. Study on utilization of producer gas for engine running
10. Study on pyrolysis plant
11. Waste heat recovery calculation.
12. Testing of solar water heater
13. Design of rotor blade for horizontal axis wind mill

The lab includes visit to biomass power plant

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Explain the different applications of biomass and their performance evaluation.
- Possess knowledge on non conventional energy sources and their applications.
- Evaluate performance the types of gasifier
- Test the solar water heater
- Design rotor blade for horizontal axis wind mill

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	QUANTITY REQUIRED
1.	Biogas plants	1 No
2.	Gasifiers	1 No
3.	Briquetting machine	1 No
4.	Pyrolysis plant	1 No
5.	Solar water heater	1 No
6.	Wind mill	1 Each
7.	Water Scrubbing unit	1 Unit

15UAG707	POST HARVEST AND FOOD PROCESS ENGINEERING LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To get hands on experience on various aspects of food science and food process engineering

LIST OF EXPERIMENTS

2 Determination of moisture content of grains by oven method and moisture meter.
3 Determination of porosity of grains.
4 Determination of coefficient of friction and angle of repose of grains.
5 Determining the efficiency of bucket elevator and screw conveyor
6 Evaluation of groundnut decorticator
7 Determination of cooking properties of parboiled and raw rice
8 Experiment on properties of food through microwave oven heating
9 Experiments on cream separator to determine the separation efficiency
10 Determination of properties of milk
11 Experiments on detection of Food Adulteration
12 Experiments on construction and operation of butter churn and butter

NOTES: The lab includes visit to food processing and dairy industry

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Determine the engineering properties of food grains
- Analyze the parboiling characteristics of paddy
- Determine the efficiency of bucket elevator
- Calculate cream separation efficiency
- Detect food adulteration

LIST OF EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Quantity
1.	Porosity apparatus	1 Nos
2.	Coefficient of friction apparatus	1 Nos
3.	Angle of repose – round type and L type	1No
4.	Groundnut decorticator and maize Sheller	I each
5.	Thin layer dryer	1No
6.	Bucket elevator and screw conveyor	I each
7.	Parboiling drum	I No
8.	Hot air oven	1No
9.	Desiccator	1No
10.	Cabinet dryer	1 No
11.	Microwave oven	1 No
12.	Cream separator	1 No

15UAG708	INDUSTRIAL TRAINING (4 WEEKS)	L	T	P	C
		0	0	0	2

OBJECTIVES

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

STRATEGY

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

OUTPUTS

After the successful completion of this training, the student will be able to

- Learn more about yourself and your skills, identifying areas for improvement.
- Propose and analyze the knowledge gained through academic learning in the classroom to the work environment.
- Identify the career development opportunity for a position in order to pursue a particular interest or career option.
- Identify the technical skills, best practices and knowledge required in the workplace.
- Identification of Problem for final year Project

15UME801	PROFESSIONAL ETHICS (Common to ALL Branches)	L 2	T 0	P 0	C 2

OBJECTIVES :

- To impart knowledge on a values-based approach and provide a method of thinking about and dealing with ethical issues in the work place.
- To explain what a profession is and what it means to act professionally.

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 10

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Assessment of safety and risk – Risk Benefit analysis – Professional Rights – Employee rights – Intellectual Property Rights

UNIT III GLOBAL ISSUES 11

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Engineers as Managers – Consulting Engineers – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

1. Illustrate the basic perception of profession, professional ethics and various m issues.(Understand)
2. Describe the code of ethics and role of professional ethics in engineering field. (Understand)
3. Apply ethical principles to resolve global and cross cultural issues that arise in professic career.(Apply)

TEXT BOOKS:

1. Subramanian. R , "Professional Ethics", Oxford University press India, New Delhi First edition, 2013.
2. Dhinesh Babu.S, "Professional Ethics and Human Values", Laxmi Publications, New Delhi, Reprint, 2016.

REFERENCE BOOKS

1. Jayakumar.V, "Professional Ethics in Engineering", Lakshmi Publications, Chennai.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G Seebauer, Robert L Barry "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. David Ermann, Michele S Shauf "Computers, Ethics and Society", Oxford University Press, 2003.

Assessment Questions

CO 1:

1. Explain the levels of moral development proposed by Kohlberg and Gilligan. Also bring out the drawbacks of Kohlberg theory? (**Understand)**
2. Describe the professional roles played by an engineer? (**Understand)**
3. What is meant by Moral Autonomy? Discuss the factors influencing person concern and the skills required to improve more Autonomy? **(Remember)**
4. Where and how do moral problems arise in engineering practice? Give the safety and other obligations of professional engineers for appropriate problems. (**Apply)**

CO 2:

1. How can an engineer become a responsible experimenter? Explain in detail? **(Remembering)**
2. Discuss on the roles played by the codes of ethics set by professional societies? (**Understanding)**
3. In the challenger disaster, Examine if and how the principal actors behaved as responsible experimenters? **(Analyze)**
4. Make use of codes of ethics in engineering practice? **(Apply)**

CO 3:

1. List out some most common conflicts that may arise for an engineering project manager? **(Remember)**
2. Construct the sequence of events which lead to the Bhopal disaster **(Apply)**
3. Compare ethical relativism and descriptive relativism with some examples. **(Analyze)**
4. Explain engineers as Expert witness and Advisors **(Understand)**

Assessment Pattern

Cognitive Level	Periodical Test – I (as marks)	Periodical Test – II (as marks)	Periodical Test – III (as marks)	End semester Examination (as marks)
Remember	18	18	10	40
Understand	32	32	16	44
Apply	-	-	16	8
Analyze	-	-	8	8
Evaluate	-	-	-	-
Create	-	-	-	-
Total (50)	**50**	**50**	**50**	**100**

15UAG804	PROJECT WORK	L	T	P	C
		0	0	12	6

OBJECTIVES

- 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.

STRATEGY

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.

TOTAL: 180 PERIODS

OUTPUTS

After the successful completion of this project work the student will be able to

- The students will be in a position to take up any challenging practical problem
- To find solution by formulating proper methodology.

15UAG901	REFRIGERATION AND AIR-CONDTIONING FOR AGRICULTURE ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the underlying principles of operation in different refrigeration & Air conditioning systems and components.
- To provide knowledge on basic design aspects of Refrigeration & Air conditioning systems

UNIT I REFRIGERATION CYCLE **9**

Review of thermodynamic principles of refrigeration. Concept of Air refrigeration system. Vapour compression refrigeration cycle – use of P.H charts – multistage and multiple evaporator systems – cascade system – COP comparison

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING **9**

Compressors – reciprocating & rotary (elementary treatment) – condensers – evaporators cooling towers. Refrigerants – Properties – selection of refrigerants, Alternative refrigerants, cycle controls

UNIT III PSYCHROMETRY **9**

Psychrometric processes use of psychrometric charts – grand and room sensible heat factors – bypass factors – air washers, requirements of comfort air conditioning, summer and winter air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS **9**

Cooling load calculation working principles of – centralized Air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV systems. Duct design by equal friction method, indoor air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES **9**

Vapor absorption systems – Ejector jet, steam jet refrigeration, thermo electric refrigeration. Applications: ice – plant – food storage plants – milk chilling plants.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Indicate the refrigeration process on P-h and T-S diagrams
- Identify the components of refrigeration systems and describe their functioning
- A clear understanding of psychrometry, refrigeration and air conditioning and their applications to agriculture
- Working out the problems on VAV and VRV system
- Analyze the refrigeration cycle and calculate the COP of the system.

TEXT BOOKS

1. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., New Delhi, 1983.
2. Arora, C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1988.

REFERENCE BOOKS

1. Dossat, R.J., “Principles of Refrigeration and Air Conditioning”, Pearson Education Pvt. Ltd., New Delhi, 1997.
2. Jordon and Priester, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt. Ltd., New Delhi, 1985.
3. Stoecker, N.F., and Jones, “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1981.

15UAG902	STORAGE AND PACKAGING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the underlying principles of spoilage and storage
- To provide knowledge on different storage methods and packaging techniques.

UNIT I SPOILAGE AND STORAGE **9**

Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.

UNIT II STORAGE METHODS **9**

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.

UNIT III FUNCTIONS OF PACKAGING MATERIALS **9**

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

UNIT IV FOOD PACKAGING MATERIALS AND TESTING **9**

Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.

UNIT V SPECIAL PACKAGING TECHNIQUES **9**

Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understanding of various methods of spoilage and storage of different crops
- Understand the different structures of CAP and CA
- Knowledge in packaging materials
- Understand the testing methods and reports preparation
- Analysis the special packing technique

TEXT BOOKS

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

REFERENCE BOOKS

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing &Co.Pvt.Ltd. New Delhi.

15UAG903	SEED TECHNOLOGY APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To expose the students to scope and importance of good quality seed production
- To acquaint them with the principles and special techniques used in the process production of good quality seed using specific examples.
- To familiarize them with planning, development and organization of seed programmes

UNIT I SEED QUALITY AND SEED HANDLING BASICS 9

Seed - definition- seed structure - seed quality characteristics – Physical, physiological , genet health quality – causes of deterioration of variety - seed maturity – physiological and harve maturity – seed harvest and threshing – Post harvest handling – seed drying - seed proces stages - cleaning, grading, upgrading- seed quality enhancement – priming- coating- pelleting- storage- factors affecting seed storage – storage godown- cold storage

UNIT II SEED HARVESTING, THRESHING AND DRYING MACHINES 9

Combined harvester – threshers - seed extractors - tomato, chilli and brinjal – cleaning and maintenance of equipment‟s- Acid delinting – Gas delinting – machineries - Seed driers- bin driers- modern driers – continuous flow driers - different types – adjustments - cleaning and maintenance of equipments

UNIT III SEED DRYING AND PROCESSING MACHINES 9

Debearding – precleaning machines – different types – adjustments – Air screen cleaner – sieve size specification – processing adjustments – specific gravity separator – adjustments-precision grading – intended cylinder separator – adjustments – needle separator – adjustments – magnetic separator – adjustments – cleaning and maintenance of equipment‟s. Mechanical damage – detection of mechanical injury and implications on seed quality – SEM and X – ray techniques to detect mechanical injury – seed hardness test.

UNIT IV SEED QUALITY ENHANCEMENT MACHINES 9

Seed coating machine – types - functioning – parts – adjustments – Seed priming – machinery – seed pelleting machinery – types functioning – parts adjustments - cleaning and maintenance of equipments

UNIT V SEED PACKAGING, STORAGE STRUCTURES, SEED QUALITY 9

Seed packers – types - Online seed packing machine - parts - adjustments - cleaning and maintenance of equipments- storage godown – cold storage unit- parts- maintenance – seed quality testing – seed purity – seed germination – ODV – seed moisture – seed health – quick viability test

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the seed quality and Handling methods
- Discuss the principles of threshing and Harvesting of different seeds
- Describe the principle of drying and crop processing machineries
- Develop seed quality enhancement machines
- Ability to appreciate the different methods of seed packing, storage structures and testing

TEXT BOOKS

1. Agrawal, R.L. 1996. Seed Technology, Oxford & IBH Publishing Co., New Delhi.
2. Bhaskaran, M. *et al.,* 2004. Principles of seed production. Scientific Publishers, Ludhiana.
3. Copeland, L.O. 1988. Principles of seed science and technology. Surjeet Publications, New Delhi.
4. Sahay, K.M. and K.K.Sing.1994. Unit operations in Agricultural Processing. Vikas Publishing House Pvt. Ltd., New Delhi

REFERENCE BOOKS

1. Gregg, B.G., A.G. Law., S.S. Virdi and J.S. Balis. 1970. *Seed Processing*. National Seed Corp., New Delhi.
2. Umarani, R., R. Jerlin., N. Natarajan., P. Masilamani and A.S. Ponnuswamy. 2006. *Experimental Seed Science and Technology.* Agrobios (India), Jodhpur.
3. Vanangamudi, K., K. Natarajan., T. Saravanan., R. Renuka., N. Natarajan and R. Umarani. 2006. *Seed hardenig, pelleting, and coating. Principles and practices.* Sathish serial publishing house, New Delhi.
4. Agrawal, P.K., 1993. *Handbook of seed testing.*National Seed Corp., New Delhi.
5. Desai, B.B. 2007. *Seed Handbook: Biology, Production, Processing and Storage*. Marcel Dekker.

15UAG904	WATERSHED MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives

- To provide the technical know-how of analyzing the degradation of soil and water resources and implementation of the measures for soil and water conservation.
- To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.

UNIT I INTRODUCTION **9**

Watershed – Definition - concept - Objectives – Land capability classification - priority watersheds - land resource regions in India

UNIT II WATERSHED PLANNING **9**

Planning principles – collection of data – present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system.

UNIT III WATERSHED MANAGEMENT **9**

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

UNIT IV WATER CONSERVATION PRACTICES **9**

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

UNIT V WATERSHED DEVELOPMENT PROGRAMME **9**

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

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Study watershed characteristics
- Identify watershed management problems and land use planning
- Understand the principles of hydrologic and hydraulic structures.
- Discuss water conservation technologies
- Evaluate watershed Development programmes

TEXT BOOKS

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

REFERENCE BOOKS

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

15UAG905	MICRO IRRIGATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To expose the students to the fundamental knowledge in Pumps for Irrigation use
- To introduce the concept of micro-irrigation and design a Sprinkler & Drip irrigation system

UNIT I WATER LIFTS AND PUMPS **9**

Pump classification Variable displacement pumps–Centrifugal pump- Submersible pump- Vertical Turbine pumps mixed flow – Jet and Airlift pumps-Pump selection and installation- Pump troubles and Remedies.

UNIT II PUMP VALVES **9**

Types of valves- Pressure relief valve- Gate valve-Isolated valve- Non return valve- Butterfly valve-Solenoid valves- Automated control valve- selection, repair and maintenance.

UNIT III MICRO IRRIGATION CONCEPT AND APPLICATIONS **9**

Micro irrigation- Comparison between Traditional and Micro irrigation methods -Merits and demerits of micro-irrigation system, Types and components of micro irrigation system- Scope and potential problem of micro irrigation - Low cost Micro irrigation Technologies- Gravity fed micro irrigation - Care and maintenance of micro-irrigation System- Economics of micro-irrigation system

UNIT IV DRIP IRRIGATION DESIGN **9**

Drip irrigation - Components - Dripper- types and equations governing flow through drippers- Wetting pattern- Chemigation application- Pump capacity-Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation.

UNIT V SPRINKLER IRRIGATION DESIGN **9**

Sprinkler irrigation- Components and accessories - Hydraulic design - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Sprinkler discharge- Water distribution pattern- Droplet size, filtering unit, fertigation - System maintenance.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the characteristics of different pumps
- Study the working principles of different valves
- Understand types and components of micro-irrigation system
- study the design parameters of drip irrigation system design
- study the design parameters of sprinkler irrigation system design

TEXT BOOKS

1. Suresh, R., “Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors, New Delhi, 2010.
2. Michael, A.M., “Irrigation Theory and Practice”, Vikas Publishers, New Delhi, 2002.

REFERENCE BOOKS

1. Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 1991.
2. Jack Keller and RondBelisher., “Sprinkler and Trickle Irrigation”, Vannistrand Reinhold, New York, 1990.
3. Sivanappan R.K., “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi, 1987.
4. Keller.J and D. Karmeli, “Trickle Irrigation Design”, Rainbird Sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.

15UAG906	ON FARM WATER MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives

- To understand the fundamentals of minor irrigation, its types, operation and maintenance and peoples participation
- Command Area Development, On farm structures, policy, operation and maintenance

UNIT I DESIGN OF IRRIGATION CHANNELS **9**

Design of Erodible and Non-Erodible, Alluvial channels- Kennedys and Laceys Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods

UNIT II COMMAND AREA **9**

Command area - Concept - – CADA Programmes in Tamil Nadu - Duty of water - expression - and relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System – case studies.

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER **9**

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

UNIT IV WATER BALANCE **9**

Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency

UNIT V SPECIAL TOPICS **9**

National water policy - Institutional aspects - Socio-economic perspective- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts- Water productivity – Water pricing.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Design of Erodible and Non-Erodible using Kennedys and Laceys Theories
- Understand the basic concepts of command area
- Distinguish surface and ground water
- Working out the water balance problems
- Discuss the national water policy

TEXT BOOKS

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

REFERENCE BOOKS

1. Keller, .J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York.
2. Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.
3. Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.
4. Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.

15UAG907	FARM POWER AND MACHINERY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint and equip with the latest design procedures of farm power and machinery systems.
- To provide sufficient knowledge of mechanization status in the country and management techniques for future requirements.

UNIT I INTRODUCTION **9**

Modern trends, principles, procedures, fundamentals and economic considerations for design and development of farm power and machinery systems - Reliability criteria in design and its application.

UNIT II MACHINERY MANAGEMENT **9**

Maintenance and scheduling of operations. Replacement of old machines, repair and maintenance of agricultural machinery, inventory control of spare parts, work study, productivity, method study. First order Markov chains and their applications in sales forecasting and in problems of inventory control and modeling of workshop processes and quality control.

UNIT III SYSTEMS APPROACH **9**

System approach in farm machinery management and application of programming techniques to the problems of farm power and machinery selection.

UNIT IV PLANNING OF MACHINERY **9**

Time and motion study. Man-machine task system in farm operations, planning of work system in agriculture. Computer application in selection of power units and to optimize mechanization system.

UNIT V ECONOMIC ANALYSIS **9**

Energy conservation - performance and power analysis - cost analysis of machinery - fixed cost and variable costs, effect of inflation on cost; selection of optimum machinery and replacement criteria- Break-even analysis, reliability and cash flow problems; mechanization planning.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Study about design and development of agricultural tractor
- Discuss the tractor maintenance procedure
- Working out the problems of farm power using system approach
- Understand planning of machinery
- Ability to understand the concepts of bio energy sources and its applications

TEXT BOOKS

1. Bainer, R. Kepner, R.A. and Barger, E.L. 1978. Principles of farm machinery. John Wiley and Sons. New York.
2. Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M. 1989. Tractor and its Power Units. Van Nostrand Reinhold
3. Culpin, C. 1978. Farm Machinery. Granada Publishing Ltd., London.
4. Kepner, R.A., Bainer, R. and Barger, E.L. 1987. Principles of Farm Machinery. C.S.B. Publishers and distributors, New Delhi.
5. Smith, H.P. and Wilkes, L.H. 1979. Farm Machinery and Equipment. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

15UAG908	MECHANICS OF TILLAGE AND TRACTION	L	T	P	C
		3	0	0	3

Objectives

- To impart the fundamental knowledge of mechanics and dynamics in various tillage implements
- To study the tyres, traction and its applications

UNIT I MECHANICS OF TILLAGE **9**

Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship

UNIT II DYNAMICSOF TILLAGE **9**

Design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics performance of tillage tools.

UNIT III TRACTION **9**

Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction

UNIT IV TYRES **9**

Tyre size, tyre lug geometry and their effects, tyre testing

UNIT V APPLICATIONS **9**

Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand mechanics of tillage tools.
- Apply in designing of tillage tools
- Understand concepts of traction
- Discuss the types of tyre and its testing
- Study the application of GIS in soil dynamics.

TEXT BOOKS

1. Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub. Co. NewYork
2. J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki , 1996. Tractors and their power units. Fourth ed. American Society of Agricultural Engineers, ASAE
3. Kepner, R. A., Roy Bainer and E. L. Barger. 1978. Principles of farm machinery. Third edition; AVI Publishing Company Inc: Westport, Connecticut.

REFERENCE BOOKS

1. Ralph Alcock.1986. Tractor Implements System. AVI Publ.
2. S. C. Jain, Farm Machinery- An Approach

15UAG909	FRUITS AND VEGETABLES PROCESSING	L	T	P	C
		3	0	0	3

Objectives

- The students would be exposed to fundamental knowledge in fruits and vegetables processing methods

UNIT I STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE 9

Importance of post harvest technology of horticultural crops – post harvest losses –factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishablecommodities – mechanism and factors causing spoilage.

UNIT II CLEANING, GRADING AND ON-FARM PROCESSING 9

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

UNIT III PRESERVATION OF HORTICULTURAL CROPS 9

Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques

UNIT IV DRYING AND DEHYDRATION 9

Dehydration of horticultural crops– types of dryers, construction and working - methods – fluidized bed dryer, spouted bed dryer, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages

UNIT V STORAGE 9

Storage of horticultural commodities – storage under ambient conditions, low temperature storage, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage – concept and methods –modified atmosphere packaging – gas composition, quality of storage – waxing of fruits – types of wax, equipment and advantages.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand about various types of structures and ripening offruits and vegetables processing methods
- Classify cleaning and grading methods
- Understand the preservation methods of horticultural crops
- Gain the knowledge in drying and dehydration of fruits and vegetables
- Acquire knowledge on storage techniques

TEXT BOOKS

1. Srivastava,R.P. and Sanjeev Kumar. 1998. Fruit and vegetable preservation. International Book Distributing Co., Lucknow.
2. Sudheer K. P. and V. Indra. 2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi

REFERENCE BOOKS

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

15UAG910	SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Objectives

- To introduce the students to the application of systems concept to agricultural engineering problems, planning and management.
- Soft computing techniques for modeling different problems in the field agricultural engineering

UNIT I SYSTEM CONCEPTS **9**

Definition, classification, and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.

UNIT II LINEAR PROGRAMMING & DYNAMIC PROGRAMMING **9**

Introduction to operations research – Linear programming, problem formulation, graphical solution, solution by simplex method – Sensitivity analysis – application - Bellmans optimality criteria, problem formulation and solutions – application.

UNIT III SIMULATION **9**

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

UNIT IV NEURAL NETWORKS **9**

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.

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM **9**

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

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Discuss the system concepts
- Apply the linear programming & dynamic programming
- Study principles and concepts of simulation
- Discuss the concepts of neural networks
- Ability to apply the optimization techniques like LP, DP, ANN, FL and GA for problems in agriculture

TEXT BOOKS

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2. Gupta, P.K., and Man Mohan, “Problems in Operations Research”, (Methods and
3. Solutions), Sultan Chand and Sons, New Delhi, 1995.
4. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

REFERENCE BOOKS

1. Chaturvedi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi, 1997.
2. Taha, H.A., “Operations Research”, McMillan Publication Co., New York, 1995.
3. Hiller, F.S., and Liebermann, G.J., “Operations Research”, CBS Publications and Distributions, New Delhi, 1992.
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.

15UAG911	AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management
- To understand the types of resources and Investment analysis in agriculture sector

UNIT I FARM MANAGEMENT **9**

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.

UNIT II LAWS OF ECONOMICS **9**

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.

UNIT III COST CURVES **9**

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.

UNIT IV MANAGEMENT OF RESOURCES **9**

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.

UNIT V FARM MANAGEMENT AND FINANCIAL ANALYSIS **9**

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.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the concepts in farm management
- Discuss the laws of economics
- Apply the principle of cost curve
- Study the Management of resources
- Plan the financial aspects related to farm management cost effective manner.

TEXT BOOKS

1. Johl, S.S., and Kapur, T.R., „Fundamentals of Farm Business Management‟, Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani
3. Devi, I., „Agricultural Economics‟ Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006

REFERENCE BOOKS

1. Raju, V.T., “Essentials of Farm Management”, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Subba Reddy, S., and Raghu Ram, P. „ Agricultural Finance and Management‟, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

15UAG912	AGRICULTURAL EXTENSION	L	T	P	C
		3	0	0	3

Objectives

- To expose the students to different extension methods for communication to take the work from lab to field

UNIT I COMMUNICATION AND PROGRAMME PLANNING **9**

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

UNIT II EXTENSION TEACHING METHODS **9**

Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

UNIT III MODERN COMMUNICATION GADGETS **9**

Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone.

UNIT IV DIFFUSION AND ADOPTION **9**

Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.

UNIT V CAPACITY BUILDING **9**

Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Discuss communication and programme planning characteristics
- Study the types of extension teaching methods
- Ability to use the modern communication gadgets
- Understand the diffusion and adoption
- Describe capacity building

TEXT BOOKS

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd,

REFERENCE BOOKS

1. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork
2. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford &IBH Publishing Co. Pvt. Ltd, New Delhi.

15UAG913	IT IN AGRICULTURAL SYSTEMS	L	T	P	C
		3	0	0	3

Objectives

- To introduce the students to areas of agricultural systems in which IT and computers play a major role.
- To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.

UNIT I PRECISION FARMING **9**

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

UNIT II ENVIRONMENT CONTROL SYSTEMS **9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT **9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

UNIT IV WEATHER PREDICTION MODELS **9**

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

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS **9**

Expert systems, decision support systems, Agricultural and biological databases, e- commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the Precision agriculture and agricultural management
- Application in environment control system
- Describe the agricultural management system
- Study the concepts of weather prediction model
- Ability to understand e-governance system

TEXT BOOKS

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

REFERENCE BOOKS

1. Peart, R.M., and Shoup, W. D., “Agricultural Systems Management”, Marcel Dekker, New York, 2004.
2. Hammer, G.L., Nicholls, N., and Mitchell, C., “Applications of Seasonal Climate”, Springer, Germany, 2000.

15UAG914	SOIL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

Objectives

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

UNIT I INTRODUCTION AND SOIL PHYSICS **9**

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 **9**

Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping - mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.

UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION **9**

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

UNIT IV ENGINEERING PROPERTIES OF SOIL **9**

Shear strength of cohesive and cohesionless - 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 BEARING CAPACITY AND SLOPE STABILITY **9**

Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations-Terzaghi‟s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method-slope protection measures.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- 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.

TEXT BOOKS

1. Nyle C. Brady, “The Nature and Properties of Soil”, Macmillan Publishing Company, 10th Edition, New York, 2008.
2. Punmia, B.C., “Soil Mechanics and Foundation “Laxmi Publishers, New Delhi, 2007.

REFERENCE BOOKS

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.

15UAG915	DESIGN OF FOOD PROCESSING EQUIPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint and equip the students with the design features of different food processing equipments being used in the industries

UNIT I DESIGN OF PULPER, CRUSHER AND STORAGE TANKS **9**

Application of engineering principles related to design and selection of food processing equipment - design consideration of pumps - design of pressure vessels and pipe lines - design aspects of storage tanks, design of sterilizers and process vats - design of pulper and crushers – design considerations – materials of construction – installation and operation.

UNIT II DESIGN OF FILTERS, HEAT EXCHANGERS AND EVAPORATORS **9**

Design of filtration process - installation and operation - design consideration of membrane separation process - ultra filtration - reverse osmosis - design of heat exchangers – plate heat exchanger, shell and tube heat exchangers - design of finned type heat exchanger – materials of construction – installation and operation - design of single effect evaporators – applications - multiple effect evaporators- Installation and maintenance..

UNIT III DESIGN OF DRYERS AND EXTRUDERS **9**

Design of dryers – cabinet / tray dryer, fluidized bed dryer, vacuum dryer, spray dryer, heat pump dryer, foam mat dryer and freeze dryer – design considerations, installation, operation and maintenance - design considerations of food extruders – single and twin screw extruders – installation, operation and maintenance of food extruders.

UNIT IV DESIGN OF COLD STORAGE AND FREEZERS **9**

Design of cold storage – factors to be considered – estimation of cooling load – construction and operation-construction, installation and maintenance of cold storage -design consideration for controlled atmospheric storage and modified atmospheric storage of perishables-design of freezers – types of freezers – design considerations – construction and operation-design of frozen storage – installation and operation..

UNIT V DESIGN OF MIXING, SIZE REDUCTION AND CONVEYING EQUIPMENTS **9**

Design consideration of mixing and blending equipments – design of agitators and scale up – operation and maintenance - design consideration of size reduction equipments- installation and maintenance-design consideration of material conveying equipments- belt conveyor-pneumatic conveyor- screw conveyor – installation and maintenance- design of plant lay out for a food industry-design of wiring, water supply, drainage-sanitation plan for a food industry.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Design and evaluate the crushers and storage tanks
- Apply the design principles of heat exchangers and Evaporators
- Design and study the performance of dryer
- Understand the concept of cold storage design
- Apply the knowledge to design material handling equipments

TEXT BOOKS

1. Joshi, M.V and V.V.Mahajani. 2004 Process Equipment Design (3rd edition). New India Publishing Agency, New Delhi.
2. Phirke, P.S. 2004. Processing and conveying equipment design. Jain Brothers, New Delhi

REFERENCE BOOKS

1. Farrell, A.W. 1983. Engineering for dairy and food products. John Wiley and Sons, New York.
2. George D.Saravacos and Athanasios E.Kostaropouos. 2002. Hand Book of Food Processing Equipment. Kluwer Academic/Plenum Publishers, 233 Spring Street, New York.
3. Hall, C.W and T.J. Hedrick. 1971. Drying of milk and milk products. AVI Publishing Co., West Port, Connecticut.
4. Jowitt, R.(Ed.), 1980. Hygienic Design and operation of food plant. Ellis Horwood, Chichester.
5. Leniger and Beverloo. 1975. Food process engineering. Reidal Publishing Co. Holland.
6. Perry, R.H and C.H.Chilton.1998. Chemical engineering handbook. McGraw Hill, Tokyo.

15UAG916	MANUFACTURING PROCESSES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart the knowledge on the concepts of basic manufacturing processes and fabricationtechniques, such as metal casting, metal joining, metal forming and plastics componentmanufacture.
- To expose the various manufacturing methods employed in industries

UNIT I PROPERTIES OF METALS 9

Engineering materials - Property definitions– Iron-carbon equilibrium diagram- Ferrous metals and alloys, Non Ferrous metals and alloys – manufacturing processes and properties. Heat treatment of steels – purpose and method of heat treatment. Annealing, normalizing- hardening- tempering- surface hardening.

UNIT II FORMING AND WELDING PROCESS 9

Mechanical working of metals - hot working processes – hot rolling- hot forging- spinning extrusion- drawing-piercing. Cold working processes -Cold rolling- shot peening. Smithy and forging operations- types. Welding process - arc welding – Polarity – Types- electrodes. Gas welding –gas flames- gas welding technique –gas cutting of metals. Sheet metal work – tools.

UNIT III MOULDING AND CASTING PROCESS 9

Pattern making – pattern materials- Types of pattern – core boxes- core prints Foundry – moulding tools - moulding sand- Properties- Moulding- moulding materials- types of moulds- methods of moulding. Special casting process – permanent moulding- slush casting- die casting- centrifugal casting investment casting- shell moulding – continuous casting.

UNIT IV MACHINING PROCESS 9

Lathe - principal parts – types – working principles -basic operations – lathe accessories- .Drilling machine, shaper, planer- principal parts-working principle- operations-. Grinding machine, milling machine, principal parts – types - basic operations

UNIT V ADVANCED MANUFACTURING PROCESS 9

Manufacturing process for plastics -compression moulding- transfer moulding- injectionmoulding -jet moulding and blow moulding- Calendaring-casting- slush casting- laminating-. Joining. Modern machining methods, Electro discharge machining (EDM), wire cut Electro discharge machining (WEDM), advantages and limitations. Advanced manufacturing technologies.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

1. Study the properties of different metal
2. Apply the appropriate welding process for different joining.
3. Discuss the various casting processes.
4. Study the principles of lathe, Grinding and milling machine
5. Gain knowledge advanced manufacturing process

TEXT BOOKS

1. Khurmi, R.S. and J.K. Kupta. 2000. A Textbook of workshop Technology. Publication division of NIRJA construction and development Co. (P) Ltd. Ramnagar, New Delhi-110055.
2. Sharma, P.C. 2004. A textbook of Production Technology. S. Chand & Company Ltd. Ram Nagar, New Delhi-110055.

REFERENCE BOOKS

1. Khanna, O.P. 1990. A textbook on welding technology. Dhanpat Rai. New Delhi.
2. HajraChowdry, S.K.1986. Elements of Workshop Technology, Vol.I& II. Manufacturing Process.Asian Book Co., New Delhi.
3. Adithan, M. and A.D.Gupta. 2001. Manufacturing technology. New Age International (p) Ltd. Publishers, Chennai.

15UAG917	TESTING AND MANAGEMENT OF FARM MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint and equip with the tests and procedures for performance evaluation of farm power and machinery as per test standards and interpretation of results.

UNIT I MACHINERYMANAGEMENT **9**

Field machinery system – Machine capacities-Time efficiency-Machine maneuverability-Field pattern-Field shape-System limitations- operational constrains - power constrains - working day – operation specific machinery management problems.

UNIT II MACHINERY PERFORMANCE **9**

Power performance-Tractor power - Draw bar power performance - PTO power performance - Hydraulic power performance - Rolling Resistance - Power measurement-Tractor engine performance - power requirements - Cost Analysis-Machine life-Depreciation methods.

UNIT III TESTING OF TRACTOR AND POWER TILLER **9**

Testing and evaluation systems in India - General Guide lines on the use of test codes. Testing and Evaluation of agricultural tractors - Indian standards. Performance of agricultural tractors - analysis of results - Nebraska tractor test and test reports. Testing and evaluation of power tiller and power tiller attached implements.

UNIT IV TESTING OF TILLAGE AND SOWING EQUIPMENT **9**

Testing and evaluation Primary tillage implements mould board plough, disc plough , chisel plough and sub soiler. Secondary tillage implemets – different types of harrows and cultivators - different types of weeders. Sowing equipments – Animal drawn implements and tractor drawn implements - seed cum fertilizer drill –- Rice transplanter.

UNIT V TESTING OF PLANT PROTECTION AND HARVESTING MACHINERY **9**

Testing and evaluation of different types of sprayer – hand compression , knapsack , rock arm and foot operated, power sprayer and manually operated sprayer and duster – different types of harvesters - Combine harvester – thresher - potato harvester

TOTAL : 45 PERIODS

COURSE OUTCOME

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

1. Study the machinery management
2. Analysis machine and power performance
3. Understand the procedure for testing the tractor and power tiller
4. Understand the testing standard for tillage and sowing equipments
5. Gain the knowledge about testing plant production and harvesting equipments

TEXT BOOKS

1. Metha M.L. *et al,* 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana-141001.RNAM test codes and procedure for farm machinery, 1983
2. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
3. Indian standard test codes related to tractors, power tillers and agricultural implements.

REFERENCE BOOKS

1. Barger E.L.et.al. 1958. Tractors and their power units. John Wile3y and sons inc.
2. Kepner, R.A. et.al.1987. Principles of farm machinery. CBS publishers and distributors, Delhi.
3. Claude Culpin (198) Profitable farm mechanization Crosby Lockwood & Sons Ltd., 26, Old Brompton Road, SW.7.
4. Donnell R. Hunt 1986. Engineering models for Agricultural production. The AVI publishing co.INC, Connecticut-06881.

15UAG918	DESIGN AND CONSTRUCTION OF GREEN HOUSE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint and equip the students with green house design and construction techniques.

UNIT I INTRODUCTION **9**

Introduction, Importance and scope of Green house, Types-Single span – multi span – Tunnels – Shade houses-Naturally ventilated Green house, Site selection – orientation, and layout.

UNIT II GREEN HOUSE DESIGN **9**

Construction of Green house, Fastening and stretching the film, Standards, Load calculations, Construction – Foundations, Floors, Frame, Structural components. Erection procedure, Cover materials- types – properties

UNIT III GREEN HOUSE MATERIAL AND SOLAR RADIATION **9**

Solar radiation – Diffused radiation – Inside and Outside green house radiation– Thermal analysis of green house – Steady and unsteady state analysis. Air changes – Cooling – Negative and Positive pressure system – pad material – desired properties – pad area and Fan to pad distance – Fans – Airflow rate – Water flow rate – Bleed off ratio

UNIT IV DESIGN OF IRRIGATION SYSTEM **9**

Introduction to instrumentation and automation in green house. Measurement of, temperature, photosynthesis, relative humidity, leaf area index. Design of irrigation system Drip irrigation - Components - Dripper- types Pump capacity-Installation- Operation and maintenance of Drip irrigation system.

UNIT V DESIGN OF DRAINAGE SYSTEM **9**

Root media for soil and soil less culture, Design of drainage system for soil less culture. Properties of root medium. Estimation of irrigation water requirement of Green house crops, Installation and calibration of Tensiometers in green houses. Economic analysis of green house

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the characteristics of different pumps
- Study the working principles of different valves
- Understand types and components of micro-irrigation system
- study the design parameters of drip irrigation system design
- study the design parameters of sprinkler irrigation system design

TEXT BOOKS

1. Barre H.J. and Sammet L.L. 1990 Farm Structures, McGraw Hill Book Co., New York.
2. Christian Von Zabeltitz and W. O. Baudoin. 1999. Green houses and shelter structures fortropical regions, FAO Plant Protection paper, Rome.
3. Tiwari G.N. and Goyal R.K. 1998 Green house Technology – Fundamentals, Design, Modelling and applications, Narosa Publishing House, New Delhi.

15UAG919	FARM STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint and equip the students with farm structures design and construction techniques.

UNIT I FARMSTEAD PLANNING AND GRAIN STORAGE **9**

Different types of farm buildings- farm site selection- building arrangement- indigenous food grain storage structures- need for good storage- modern grain storage and concrete bins- threshing and drying floors.

UNIT II HOUSING OF DAIRY CATTLE AND POULTRY **9**

Planning and designing dairy barns- stall barns and loose houses- milking parlor-waste management -poultry housing requirements- common types of poultry houses and their planning- introduction to aquacultural systems

UNIT III FARM FEED STORAGE STRUCTURES AND MACHINERY SHED **9**

Silo-requirement- Types of silo, over ground, underground and others- Design of silos- covered an open spaces -Machinery sheds- Site selection-Types and shapes of building- Space requirements- Farm shops, building requirement and space requirement- Fencing, types of fences-fence posts

UNIT IV RURAL ROADS, FARM WATER SUPPLY AND SEWAGE DISPOSAL **9**

Survey and planning- Geometrical design- Pavement design- Construction and maintenance- Typical rural culverts of different sizes, their hydraulic and structural design and construction- Sources of water supply- Estimation of quantity for different consumption-Capacity requirements of storage tanks- distribution systems- Design of septic tanks and sanitary structures

UNIT V GREEN HOUSES **9**

Types- Functional design-Structural material and design-Orientation, ventilation, cooling and types of cladding material – Type design - Water management in green houses

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Identify and design the grain storage structures
- Understand the design procedures of different housing system
- Study the layout concepts of machinery shed
- Analysis and locate the drainage and farm road
- Design the different components of green house

TEXT BOOKS

1. Ojha, T.P. and Michael, A. M. (2012). "Principles of Agricultural Engineering", Vol.-I (Sixth Edition), Jain Brothers, New Delhi.
2. Sharaf, S. (2012). "Green House Management of Horticultural Crops", Oxford Book Company, New Delhi.

REFERENCE BOOKS

1. Van Lier, H.N. (1999). "CIGR Handbook of Agricultural Engineering, Vol. I- Land and Water Management Engineering", ASAE, USA.
2. Bartali, E. H. and Frederick, W. (1999). "CIGR Handbook of Agricultural Engineering, Vol. II- Animal Production and Aquacultural Engineering", ASAE, USA.

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15UAG920	ENERGY AUDITING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives

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

UNIT I ENERGY SCENARIO **9**

Energy scenario – classifications – global Primary energy reserves – energy needs of growing economy – energy pricing – energy sector reforms – energy security – energy conservation – future strategy – energy conservation acts – global environment issues – ozone layer depletion – global warming – loss of bio diversity – climate change problem and response – the conference of the parties – Prototype Carbon Fund – sustainable development.

UNIT II ENERGY MANAGEMENT **9**

Objectives of energy management – principles – energy audit strategy - types – detailed energy audit –steps. Energy performance - bench marking – fuel substitutions – energy audit instruments – material and energy balance – energy conversion – energy index – cost index – financial management – financing options

UNIT III ENERGY MANAGEMENT IN BOILERS **9**

Energy efficiency in thermal utilities – methodology – stoichiometric analysis– performance evaluation – boiler losses - analysis – feed water treatment – energy conservation opportunities in boilers– furnaces – insulation– cogeneration – principles of operation - waste heat recovery systems – case study – analysis.

UNIT IV ENERGY MANAGEMENT IN ELECTRICAL SYSTEM **9**

Electrical systems – introduction – electricity billing – load management – power factor – improvements and benefits – energy audit in electrical utilities methodology – energy conservation opportunities in motors – efficiency – energy efficient motors – motor losses – analysis –compressed air system.HVAC and refrigeration system – load estimation- fans and blowers – fan performance – centrifugal pumps – energy conservation in lighting systems.

UNIT V ENERGY AUDITING IN INDUSTRIES AND REPORTING **9**

Energy auditing case studies. Industrial energy auditing and conservation measures - Policy recommendations. Energy auditing report preparation - Production process and energy conservation opportunities in Aluminium, Automobile, Chemical and Agro based industries. Waste heat recovery – classification – advantages- applications - saving potential. Clean Development Mechanism – principles and project format. Renewable energy gadgets – performance – energy efficiencies.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Gaining knowledge in energy scenario
- Understand the concept of conservation of energy
- Apply the energy management principles in boilers.
- Analysis the energy management concept in electrical system
- Prepare and Evaluate the energy audit report

TEXT BOOKS

1. Craig B. Smith, 1981. Energy Management Principles, Applications, benefits and savings. Pergamon Press Inc.
2. Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1 – 4, 2005 Bureau Energy Efficiency, New Delhi.

REFERENCE BOOKS

1. Guide book for National Certification Examination for Energy Managers and Energy Auditors, Book 1. General aspects of Energy Management and Energy Audit, Bureau of Energy Efficiency.
2. Handbook of refractories by D.N. Nadhi, Tata McGraw, New Delhi, 1987.

		L	T	P	C
15UAG921	BIO AND THERMOCHEMICAL CONVERSION OF BIOMASS	3	0	0	3

OBJECTIVES

- Toacquaintandequipthestudentswiththeprinciplesofbiogastechnologiesfor recyclingwaste and to protect the environment
- To acquaint and equip the students with the principles of thermochemical routes of biomass into fuel and end products

UNIT I BIOMASS CHARACTERIZATION **9**

Biomass – types –Biodegradability – raw material - Biomass characterization – physical, chemical and thermal - fuels from biomass - energy plantation. greenhouse gas mitigation – forest carbon sinks.

UNIT II BIOCHEMICAL CONVERSION **9**

Biomass Conversion principles –– wet and dry processes. Factors affecting biogas production. Types of biogas plants – floating drum and fixed dome types – comparison of biogas plants – utilization of biogas – bio digested slurry - landfills. High rate anaerobic reactors – types. Ethanol production from biomass

UNIT III THERMOCHEMICAL CONVERSION **9**

Stoichiometric analysis–typesof biomasscombustion systems–comparative study of the parameters of combustion,gasificationandpyrolytic technologiesforenergy generationfrombiomass. Co-combustion and cofiringof biomass–slagging and fouling issueswithagriculturalbiomass.Torrefaction–biological,physicaland chemicalchanges during torrefaction–products. TorrifiedBiomass-properties–advantagesand disadvantages.

UNIT IV GASIFICATION **9**

Biomass gasification – chemistry of gasification – types of gasifier. Composition of producer gas – application and problems of gasifiers. Gasifier system – storing, feeding, blowers and burners. Engine adaptation and operation with producer gas. Biomass power generation – co-firing. Pyrolysis – product recovery – types - further thermo-chemical processes.

UNIT V BY PRODUCTS **9**

Bio-oil – characterization processes – upgradation methods .Biochar production – uses – activated carbon production – applications. Biomass sustainability issues and environmental impact. Syngas cleaning –conversion of syngas to liquid fuels.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Study about biomass properties
- Understand the concept of biochemical conversion process
- Understand the principle of thermochemical conversion process
- Study the principles of different types of gasification
- Ability to utilize the by - product of biomass

TEXT BOOKS

1. James L Waish, Jr., P.E. et al. 1988. Handbook on biogas utilization. The Environment, Health and Safety Division, Georgia Tech Research Institute, Atlanta, Georgia
2. Khandelwal K.C and S.S. Mahdi 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi
3. Mathur,A.N and N.S.Rathore 1993. Biogas production management and utilization. Himanshu Publication. New Delhi
4. Horlock JH, 1987. Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford Press.
5. Rao. S and B.B.Parulekar. 2000. Energy Technology – Non conventional, Renewable andConventional. New Nirman Printing Press, Delhi.
6. Sergio C. Capareda, 2014, Introduction to Biomass Energy Conversions, CRC Press

15UAG922 **GROUND AND WELL WATER ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the concepts of groundwater, its availability, assessment and utilization
- To understand the theory behind well design, construction and management of wells.

UNIT I HYDROGEOLOGIC PARAMETERS 9

Water Balance – Distribution of subsurface water – Water bearing properties of Rocks – Types of Aquifers – Aquifer properties Estimation – Pumping test :– Permeability, Specific yield, transmissivity and Storage coefficient – Methods of Estimation – Ground water table fluctuation method – GEC Norms – Ground water development and potential in India - Groundwater prospectives - Geophysical techniques – Electrical resistivity survey

UNIT II WELL HYDRAULICS 9

Darcy"s law – Groundwater Flow Equation – Steady state flow – Dupuit Forcheimer Assumption – Theim"s Equation - unsteady flow – Theis method and Jacob method – Image well theory – Partial penetration of wells.

UNIT III WELL DESIGN 9

Design characteristics – Design of wells - Well diameter, depth and Well screen design – Materials for well screens – Well casing – Design of collector wells and Infiltration gallery – Dug wells versus tube wells

UNIT IV WELL CONSTRUCTION AND MAINTENANCE 9

Types of wells – 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 loss – Pumping equipment.

UNIT V SPECIAL TOPICS 9

Artificial Recharge Techniques – Sea water Intrusion – Ground water modeling Techniques – Ground water pollution and legislation - Ground water development and potential in India – Hazardous substances – Hazard identification – Dose response assessment – Risk analysis

TOTAL: 45 PERIODS

OUTCOMES:

- Students know the technical aspects of groundwater, its availability, assessment and utilization
- Familiarized with the theory behind well design, construction and management of wells.

TEXTBOOKS:

1. Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.
2. Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.

REFERENCES:

1. Rastogi,A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008.
2. David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007
3. Fletcher.G.Driscoll, “Groundwater and Wells”, Johnson Revision, New York, 1987.

15UAG971	PRINCIPLES OF AGRONOMY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study about agro ecology and cultivation aspects.
- To learn the management of crops including soil management and to control the diseases to increase the food production

UNIT I AGRICULTURE-EVOLUTION AND DEVELOPMENT 9

Agriculture – Definition – Importance and scope - Agriculture as Art, Science and Business – Branches of agriculture - Evolution of man and agriculture – Development of scientific Agriculture - National and International Agricultural Research Institutes

UNIT II HISTORY OF AGRICULTURE 9

History of agricultural development in the world and India. Agriculture heritage – Agriculture in ancient India – Stages of agriculture development - Era of civilization-Importance of Neolithic civilization - Chronological agricultural technology development in India- Kautilya‟s Arthasasthra- Sangam literature - Indigenous Technical Knowledge (ITK)-Tamil Almanac and rainfall prediction.

UNIT III AGRO ECOLOGY 9

Agronomy – Definition – Meaning and scope - Agro-climatic zones of India and Tamil Nadu – Agro ecological zones of India and Tamil Nadu - Crops and their classification – Economic and agricultural importance - Major crops of India, Tamil Nadu - Major soils of India, Tamil Nadu – Basic elements of crop production - Factors affecting crop production – climatic - edaphic- biotic - physiographic and socio economic factors. Economic ecology

UNIT IV TILLAGE, SOWING AND WEEDING 9

Tillage – Definition - Types- Objectives - Modern concepts of tillage – Main field preparations - Seeds - seed rate- sowing methods - Germination – Factors affecting germination - Crop stand establishment - Planting geometry and its effect on growth and yield - After cultivation – Thinning - Gap filling – Weeds – Definition – Effects of weeds and management of weeds - IWM - Inter cultural operations.

UNIT V NUTRIENTS, IRRIGATION AND TYPES OF FARMING 9

Manures and fertilizers – Agronomic interventions for enhancing FUE – Irrigation - Time and methods of irrigation - Modern techniques of irrigation - Drainage and its importance -Cropping patterns and cropping systems - intensive cropping - Crop rotation - Sustainable agriculture- integrated farming systems - Farm enterprises - Organic / eco- friendly agriculture -Concepts and principles – Irrigated farming and Dry farming- Concepts and principles .

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Describe agriculture-evolution and development
- Understand the importance of ecology system
- Explain the types of tillage and methods adopted for sowing
- Outline the cropping system and nutrient management

TEXT BOOKS

1. George Acquaah. 2002. Horticulture-principles and practices. Prentice-Half of India Pvt. Ltd., New Delhi.
2. Kumar, N.2010. Introduction to Horticulture, Oxford and IBH Publication, New Delhi.

REFERENCE BOOKS

1. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
2. Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi.

15UAG972	AGRICULTURAL BUSINESS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the importance of Agri-business management, its characteristics and principles
- To impart knowledge on the functional areas of Agri-business like Marketing management, Product pricing methods and Market potential assessment

UNIT I AGRIBUSINESS MANAGEMENT **9**

Concept – components of agribusiness – forms of agribusiness firms. Management - concept – functions of management – managerial roles and skill (Mintzbergs) required atvarious levels of management.

UNIT II MANAGEMENT FUNCTIONS **9**

Planning – steps and types of plans. Organizing – basis for Departmentation. Staffing – human resource planning process. Directing –techniques of direction. Coordination and control - types.

UNIT III AGRICULTURAL MARKETING **9**

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

UNIT IV AGRICULTURAL BUSINESS FINANCE **9**

Forms of agri-business organizations - Role of lead bank in agribusiness finance – Financial management. Acquiring capital-Budget analysis. Concepts and determinants- Business project scheduling of raw material procurement - production management – launchingproducts (branding, placement) - Input marketing promotion activities.

UNIT V MARKET PROMOTION AND HUMAN RESOURCES **9**

Agricultural products - marketing promotion activities - product pricing methods. District Industries Centre - Consumer survey - Agricultural inputs retailing - Market potential assessment- types of distribution channels - Return on Investment - Personnel management. Recruitment, selection and training - Technology in Agri Business

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand management concepts and principles.
- Study the concept and application of management in agribusiness.
- Analyze production, consumption and marketing of products.
- Study the Importance of agri-business organization and banks.
- Promote agri-products in market with distribution channels.

TEXT BOOKS

1. Koontz.H and Weihrich.H, 2013, „Principles of Management‟, Tata McGraw Hill, New Delhi.
2. Howard H Fredrick and Donald F Kuratko, 2010, „Entrepreneurship – Theory, Process, Practice‟, Cengage Learning Publishers, Melbourne
3. Rao, V.S.B, and P.S. Narayana, 2004, „Principles and Practices of Management‟, Konark Publishing Pvt. Ltd. New Delhi.
4. Himanshu, “Agri Business Management – Problems and prospects”, Ritu Publications,

REFERENCE BOOKS

1. Chandra Prasanna, “Projects: Preparation, Appraisal, Budgeting and Implementation”, Tata McGraw Hill Publications, New Delhi, 2001.
2. Kotler, P., “Marketing Management. Analysis, Planning and Control”, Prentice Hall Inc., New York, 2001.

15UAG973	FUNDAMENTALS OF HORTICULTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To teach the basic and fundamental aspects of horticulture

UNIT I BASIC CONCEPTS OF HORTICULTURE 9

Scope and importance – Global scenario of horticultural crops- Divisions of horticulture - area and production – export and import - classification of horticultural crops – Nutritive value of horticultural crops – horticultural therapy – Horticulture Zones of India and Tamil Nadu – Horticultural developmental agencies

UNIT II SOIL AND CLIMATIC FACTORS 9

Influence of soil – physical and chemical properties and climatic factors – light, temperature, photoperiod, relative humidity, rainfall, micro climate, pollution – influence of biotic and abiotic stresses on crop production

UNIT III NURSERY TECHNIQUES AND CROPPING SYSTEMS 9

Nursery techniques – vegetable garden – Nutrition garden, kitchen garden and other types of gardens - planting systems – planning, layout and management of an orchard- wind breaks - after-cultural practices – clonal orchards- use of growth regulators – water management – drip and fertigation - weed management - nutrient management - soil fertility management - cropping systems - intercropping - multi-tier cropping

UNIT IV GROWTH AND DEVELOPMENT 9

Important phases of growth and development - bearing habits - Principles and methods of pruning and training of horticultural crops– rejuvenation of old and senile orchards- factors influencing fruitfulness and unfruitfulness – special horticultural practices

UNIT V POST HARVEST HANDLING 9

Post harvest handling – processing, value addition, storage and marketing of horticultural produce. material handling equipments – belt conveyor, screw conveyer and bucket elevator - working principles – advantages and disadvantages

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the basic concepts of horticulture crops
- Study the external factors for different horticultural crops
- Apply the nursery technique and cropping system for better crop production
- Analysis the different technique to increase growth and developments
- Study the post harvest technique for different crops

TEXT BOOKS

1. Adams,C.R.andM.P.Early.2004. Principlesofhorticulture. Butterworth– Heinemam, Oxford University Press.
2. Bansil.P.C.2008.HorticultureinIndia.CBSPublishersandDistributors,New Delhi.
3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

REFERENCE BOOKS

1. Bhattacharjee.S.K. 2006. Amenity Horticulture, Biotechnology and Post harvest technology. Pointer publishers. Jaipur
2. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
3. Chandra, R. and M. Mishra. 2003. Micro propagation of horticultural crops. International Book Distributing Co., Lucknow.

15UAG974	ORGANIC FARMING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study about organic cultivation aspects of different crops
- To impart the students about importance of agricultural farming in recent trend.

UNIT I INTRODUCTION AND TYPES **9**

Ecology and Principles of ecology. Biodiversity: importance and measure to preservebiodiversity. Organic farming: - History of organicfarming - global scenario –pre requisites for Organic farming - organic carbon: status and improvement strategies – conservation tillage.

UNIT II CONCEPTS AND PRINCIPLES **9**

Farming system - Definition - Scope - principles and concepts - classification – Collective and cultivation – Advantages and disadvantages– Problems of agriculture - Types of farming – organic and integrated farming system - Importance and advantages. Impacts of green revolution farming –Fate of chemicals in agro ecosystem

UNIT III NUTRIENT SOURCES **9**

Organic sources of nutrients – on farm and off farm sources – organic waste recycling-methods - Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers. Panchagavya and other organic solutions – Preparation and usage

UNIT IV PEST AND DISEASE MANAGEMENT **9**

Bio intensive pest and diseases management - physical, cultural, mechanical and biological methods – non-chemical weed management methods: preventive, physical, cultural, mechanical and biological control measures - good crop husbandry practices

UNIT V CERTIFICATION, EXPORTS AND ITK **9**

Organic certification – NPOP guidelines - Certification agencies in India – crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities. Indigenous Technical Knowledge (ITK) in organic agriculture – rationale and principles – soil, nutrient, weed, water, pest and disease management – benefits and problems in organic farming: promotional activities – economic evaluation of organic production systems

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the types of farming and impacts of green revolution farming
- Elaborate the concepts of organic farming and its principles
- Explain about nutrient sources in organic farming.
- Outline the pest and disease management in organic farming.
- Gain knowledge about certification, exports and ITK.

TEXT BOOKS

1. Nicholas lampkin 1994. Organic farming. Farming press London.
2. Arunkumarsharma 2008. A Hand book of organic farming. Agrobios Publishers.

REFERENCE BOOKS

1. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.
2. Veeresh, G.K. 2010. Organic farming, Cambridge university press.
3. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.

		L	T	P	C
15UAG975	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	3	0	0	3

OBJECTIVES

- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.
- Importance of science, food security and ecological balance

UNIT I LAND RESOURCE AND ITS SUSTAINABILITY 9

Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation.

UNIT II WATER RESOURCE AND ITS SUSTAINABILITY 9

Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water)

UNIT III SUSTAINABLE AGRICULTURE 9

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 farming principles – Sustainability in rainfed farming

UNIT IV FOOD PRODUCTION AND FOOD SECURITY 9

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.

UNIT V POLICES AND PROGRAMMES 9

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.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- 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.

TEXT BOOKS

1. M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.
2. B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India
3. Publishing Agency, New Delhi, 2007.

REFERENCE BOOKS

1. Swarna S.Vepa etal., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.
2. Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.

15UAG976	SEED PRODUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study about seed production methods
- To impart the students about importance of quality and certification of the seed

UNIT I INTRODUCTION **9**

Seed - definition – importance – quality characteristics – history of seed industry- classes of seed - generation system - multiplication ratio - seed replacement rate –varietal deterioration - causes – maintenance.

UNIT II PRINCIPLES OF SEED PRODUCTION **9**

Methods and tools of seed production in variety and hybrid – seed crop management - land requirement-isolation – pre-sowing seed treatment – dormancy - spacing – nutrient- irrigation - contaminants - roguing – plant protection – physiological maturation – pre-harvest sanitation spray - harvest and postharvest techniques-extraction – methods - drying – processing - seed treatment - pre-storage – packing – storage – mid- storage treatment.

UNIT III SEED QUALITY **9**

Seed certification – phases – procedures - general and specific standards – field inspection – field counts –contaminants - post harvest inspection – seed standards - bagging – tagging – blending of seed lots – grow out test.

UNIT IV SEED TESTING **9**

Seed testing - importance – seed lot – seed sample - sampling methods – purity analysis – moisture estimation – germination tests – viability test – seed vigour tests - seed health test

UNIT V SEED LEGISLATION **9**

Seed Act and Rules –Central Seed Committee - Central Seed Certification Board, State Seed Certification Agency - Central and State Seed Testing Laboratories - Seed Inspector - duties and responsibilities – offences and penalties - Seed Control Order1983 – New policy on seed development / New Seed Policy 1988– National Seed Policy2002 - Seed Bill 2004.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Study the seed production industry
- Elaborate the concepts of seed production and storage technique
- Gain knowledge about quality control of the seed
- Study the pest and disease management in horticultural crops.
- Gain knowledge about seed certification

TEXT BOOKS

1. P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.
2. S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
3. Raymond A.T. George. 1985. Vegetable seed production. Longman and Londen, New York.

REFERENCE BOOKS

1. K.Vanangamudi et al., 2006. Advances in Seed Science and Technology. Vol. 2. Quality seed production in vegetables. Agrobios (India), Jodhpur. Agrobiosindia.com
2. R.Umarani, R.Jerlin, N.Natarajan, P.Masilamani and A.S.Ponnuswamy (2006) Experimental Seed Science and Technology, Agrobios, Jodhpur.
3. T.S.Verma and S.C.Sharma (2000) Producing Seeds of Biennial Vegetables in Temperate Regions. ICAR, New Delhi.
4. P.S.Arya. 1999. Vegetable seed production in hills. M.D. Publication Pvt. Ltd

15UAG977	SERICULTURE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- Sericulture technologies would strengthen theknowledge base of the students for establishing commercial sericultural enterprise

UNIT I INTRODUCTION **9**

Importance and history of sericulture – organizations involved in sericulture – silkworm types- mulberry cultivation – varieties - morphology of mulberry plant – identification of popular mulberry genotypes.

UNIT II PROPAGATION METHODS **9**

Methods of propagation – nursery and main field preparation.Planting methods – identification of nutrient deficiency symptoms – identification of weeds – herbicide application methods – irrigation methods and management practices Pruning and harvesting – pests, diseases and nematodes of mulberry and their management.

UNIT III SILKWORM **9**

Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – pure races –multivoltine, bivoltine - cross breeds – bivoltine hybrids – double hybrids - morphology and biology of silkworm – mouth parts of larva –sex limited characters – anatomy and physiology of digestive and excretory systems of larva – structure and function of silk glands.

UNIT IV HOUSING SYSTEM **9**

Rearing house – types – disinfection – room and bed disinfectants – egg incubation methods – chawki rearing – feeding, cleaning and spacing – rearing of late age worms – feeding, cleaning, spacing and moulting care different stages – spinning – mountages – harvesting. Visit to sericulture farms – interaction with sericulturists- visit to grainage and cocoon market- economics of mulberry silkworm rearing.

UNIT V BY PRODUCTS **9**

Pests and diseases of silkworm and their management – post cocoon technology – stifling to weaving. Byproducts of sericulture - non –mulberry silkworms – eri, tasar and muga silkworms.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Study the sericulture concepts
- Gain the knowledge about propagation methods of mulberry
- Analysis the characteristics of silkworm
- Understand the different rearing housing system
- Understand the post cocoon technologies and value addition of sericulture

TEXT BOOKS

1. Dandin, S.B., J.Jayaswal and K. Giridhar.2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore, 287 p.
2. Jolly, M.S., S.K. Sen, T.N. Sonwalkar and G.K. Prasad 1980. Non – mulberry Silks. FAO Agicultural Services Bulletin 29. Food and Agriculture Organisation of the United Nations, Rome,178 p.

REFERENCE BOOKS

1. CSB. 2003. Seri Business Manual- Vol. III Farm & Industry Sectors, Central Silk Board, Bangalore.
2. Krishnaswami,S., M.N. Narasimhanna, S.K Suryanarayan and S.Kumararaj. 1978. Seiculture Manual 2 and 3 – Silkworm Rearing . FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organisation of the United Nations, Rome,131 p.
3. Rangaswami, G.,M.N.Narasimhanna, K.Kasiviswanathan, C.R.Sastry and M.S.Jolly. 1978. Sericulture Manual 1 – Mulberry Cultivation. FAO Agricultural Services Bulletin 15/1. Food and Agriculture Organization of the United Nations, Rome, 150 p.

15UAG978	BASICS OF LANDSCAPE GARDENING	L	T	P	C
		3	0	0	3

BJECTIVES

- To expertise the students in applied gardening concepts and to develop entrepreneurship skills in landscape gardening

UNIT I CONTEMPORARY AND FUTURISTIC LANDSCAPE GARDENING 9

Understanding contemporary and futuristic attitudes to open space garden designs in India – Mughal influence, European influence, Japanese influence, British influence. Latest trend in landscape design – Landscape industry – Landscape profession – India and World.

UNIT II PLANTS AND PURPOSE 9

Plants specific to ecological considerations – Indigenous, native and exotic plant species for sustainable greening – Plants for container growing – Plants for instant gardens – Plants for spring, summer, winter and autumn

UNIT III PLANTS AND DESIGN 9

Functional uses of plant material – Architectural uses of plant material – Visual plant characteristics – Aesthetic uses of plant material – Planting design process and principles – master plan and design development – planting program.

UNIT IV SPECIAL TYPES OF GARDEN AND PRACTICES 9

Vertical garden – roof garden – Terrace garden – Skyrise garden – Burlapping – Scenic gardens and roadways – Garden with water features and water conservation – Garden for residential and Corporate, civil bodies and urban extensions

UNIT V TURFING AND COMPUTER AIDED DESIGNING (CAD) 9

Turfing - Turf grasses - Types, species, varieties, hybrids - Selection of grasses for different locations - Advances in turf establishment - Turf management - Irrigation, nutrition, special practices, aerating, rolling, soil top dressing, use of turf growth regulators (TGRs) and micronutrients, turf mowing - Applications of CAD in landscape garden designing.

TOTAL : 45 PERIODS

COURSE OUTCOME

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

- Understand the concepts of garden landscaping
- Study the characteristics of different plants
- Study the function of design materials
- Gain the knowledge of different types of gardening and their practices
- Study the turf characteristics and apply the CAD in gardening.

TEXT BOOKS

1. Booth, N.K. 1983.Basicelements of landscapearchitecturedesigns
2. Randhawa, G.S. andA.Mukhopadhay. FloricultureinIndia, Allied publication
3. Woodrow M.G,.1999. GardeninginIndia.Biotech book

REFERENCE BOOKS

1. Bose, T.K., R.G. Maiti, R.S. Dhua and P. Das. 1999. Floriculture and Landscaping. NayaProkash.
2. Christine Wein-Ping Yu .1987. Computer-aided Design: Application to Conceptual Thinking in Landscape Architecture Floriculture Today.

15UAG861	INTRODUCTION TO RENEWABLE ENERGY	L	T	P	C
		1	0	0	1

OBJECTIVES

- To impart knowledge in mushroom production methods

Historical development and importance of cultivated, medicinal and poisonous mushroom. General morphology of different mushrooms.Methods of isolation and purification of mushroom for development of mother culture.Methods for preparation of spawn.Methods of cultivation of Volvariella, Pleuratus and milky mushroom. Care of mushroom beds. Study of contaminantsand diseases limiting mushroom production.Mushroom processing and preservation.Development of small unit model for mushroom cultivation.

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Understand the cultivation practices of different types of mushroom production
- become an efficient agricultural entrepreneur

TEXTBOOKS

1. Mushroom Cultivation in India - B.C.Suman and V.P.Sharma
2. Mushroom Growing for Everyone - G. Roy
3. Mushroom Production and Processing - V.N.Pathak, N.Yadav and M.Gaur

REFERENCES

1. Aneja, K. R. 1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation Mushroom (2nd Edition). WishwaPrakashan, New Delhi.
2. Bahl, N. 2000. Handbook on Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Chadha, K.L. and S.R. Sharma. 1995. Mushroom Bio-technology - Advances in Horticulture. vol. 13. Malhotra Publishing House, New Delhi

15UAG862	MUSHROOM CULTIVATION	L	T	P	C
		1	0	0	1

OBJECTIVES

- To gain knowledge in all types of renewable energy

Energy sources, Introduction, classification, energy from biomass, types of biogas plants, constructional details, biogas production and its utilization, agricultural wastes, Principles of combustion, pyrolysis and gasification, types of gasifiers, producer gas and its utilization. Briquettes and uses of Briquettes, solar energy, solar flat plate and focussing plate collectors, solar air heaters, solar space heating and cooling, solar energy applications / solar energy gadgets, solar cookers, solar water heating systems, solar grain dryers, solar refrigeration system, solar ponds, solar photovoltaic systems, solar lantern, solar street lights, solar fencing, solar pumping systems. Wind energy: types of wind mills, constructional details & application of wind mills. Hydraulic ram. Liquid Bio fuels, bio diesel and Ethanol from agricultural produce, its production & uses

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Design and development of renewable energy equipments and instruments

TEXTBOOKS

1. Rai., G.D. 2002 “Solar Energy Utilization” Khanna publishers, New Delhi.
2. More, H.S and R.C. Maheshwari, 1982 “ Wind Energy Utilization in India” CIAE

REFERENCES

1. Mathew Buresch, 1986. Photovoltaics Energy Systems. McGraw-Hill Book Company, London.
2. Jui Sheng Hsieh. 1986. Solar Energy Engineering, Prentice Hall, London.

15UAG863	VERMICOMPOST TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES

- To gain knowledge in vermicomposting for bio conservation of biodegradable waste

Identification of raw materials, availability, types and segregation of wastes – Characterization – Preparation of Coimbatore method of composting – Windrow compost making – Vermicomposting – Acceleration of composting and enrichment of compost with bio-inoculants- Instrumentation techniques in compost analysis – Monitoring the changes during composting – Compost maturity analysis – Physical, Chemical and biological maturity tests – Quality standards – Economics of compost making and marketing – Field visit to small scale compost units – Agro-industrial composting sites and municipal waste composting – Preparation of large scale composting project.

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Learn to design vermicomposting systems for recycling of all types of waste

TEXTBOOKS

1. Balakrishnamoorty 2005. Environmental Management .Prentice- Hall of India Private Ltd. New Delhi.
2. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerat, India

15UAG864	GREEN HOUSE TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES

- To impart knowledge about Greenhouse control environment
- Planning and design of greenhouses

Classification of greenhouse - Components of green house - Orientation Of Greenhouse / Polyhouse - Plant growing structures/containers in green house production - Environmental factors influencing greenhouse cultivation - Media preparation and fumigation - Drip irrigation and fertigation systems greenhouse cultivation - Designs - Cost estimation for green/polyhouse- Problem management in greenhouse cultivation - Special horticultural practices in greenhouse production

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Design the greenhouse structures for the production of vegetable crops
- Knowing the growing of various crops in different regions controlling the various environmental factors such as temperature, humidity, irrigation, wind speed etc. and increasing the productivity

TEXTBOOKS

1. Salaokhe V.M. and Sharma, A.K. Greenhouse: Technology and Applications, Agrotech Publishing Academy, Udaipur 2006.
2. Nelson, Paul V. Greenhouse: Operation and Management, Fifth Edition, Prentice Hall, Upper Saddle River, New Jersey, USA 1998.
3. Aldrich, R.A. and Bartok Jr. J.W.. Greenhouse Engineering. Natural Resource, Agriculture and Engineering Service, Cooperative extension, 152 Riley-Robb Hall, Ithaca, NY 14853-570, 1994

15UAG865	WATER HARVESTING TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES

- To learn the different types of water harvesting techniques and its maintenance

Site and technique selection - Negarim microcatchments Contour bunds for trees - Semi-circular bunds - Contour ridges for crops - Trapezoidal bunds - Contour stone bunds - Permeable rock dams and Water spreading bunds - Layout and construction Maintenance

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Design varies water harvesting system for crop production improvement

TEXTBOOKS

1. Watershed Management - V.V. Narayan, G. Shastry and U.S. Pattanaik
2. Soil Erosion and conservation - R.P. Tripathi and H.P. Singh
3. Watershed Management for dryland agriculture – M.C. Oswal

15UAG866	ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES

- To Gain knowledge about entrepreneurship , Globalisation and production Inventory management

Concept of entrepreneurship; entrepreneurial and managerial characteristics; Assessing overall business environment in the Indian economy. Globalisation and the emerging business / entrepreneurial environment. Overview of Indian social, political and economic systems and their implications on agricultural entrepreneurs.

Principles of Management (Definition, functions of management viz planning, organisation, coordination and control,Operational Aspects of Production Inventory Management,Basic principles of financial management,Marketing Techniques, Personnel Management,Importance of Communication in business

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Learn to become an efficient agricultural entrepreneur.

TEXTBOOKS

3. Balakrishnamoorty 2005. Environmental Management .Prentice- Hall of India Private Ltd. New Delhi.
4. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerat, India

15UAG867	ENERGY AUDIT AND MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES

- To develop understanding approaches of auditing and energy management systems

Definition, Energy audit-need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing systemefficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

Facility as an energy system Methods for preparing process flow, Material and energy balance diagrams.

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- To design the diagrams of various energy system methods .

TEXTBOOKS

1. Craig B. Smith, 1981. Energy Management Principles, Applications, benefits and savings. Pergamon Press Inc.
2. Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1 – 4, 2005 Bureau Energy Efficiency, New Delhi.

15UAG868	FARM MACHINERY,MANAGEMENT AND COST ECONOMICS	L	T	P	C
		1	0	0	1

OBJECTIVES

- To gain the knowledge of various farm management techniques for planning and budgeting .

Farm Management: Definition, scope, functions of farm management science, nature and characteristics of farm management science, various farm management decisions, farm planning and budgeting partial and complete budget, steps in farm planning and budgeting, types and system of farming. Linear programming: assumptions, advantages and limitations of linear programming.

Farm business income, family labour income, net income using farm management data, preparation of farm plans.

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- To apply linear programming techniques in farm management and prepare various farm plans.

15UAG869	LIQUID BIOFUELS	L	T	P	C
		1	0	0	1

OBJECTIVES

- To study the production and application of liquid biofuel from biomass

Introduction – importance - fuel properties - Sources of biofuel –vegetables oils - Jatropha oil - Properties biodiesel –- Chemistry of biodiesel production – biodiesel production plant –properties – blending - advantages and Disadvantages. Bioethanol - Raw materials for bioethanol production - Properties of ethanol - Ethanol Production – Sources - sugar materials - starch materials - cellulosic materials – flowchart of ethanol production – Extraction methods - Separate Hydrolysis and Fermentation (SHF) - Simultaneous Saccharification and Fermentation (SSF). Fermentation - Batch Fermentation - Continuous Fermentation – Uses of ethanol – blending - Advantages and disadvantages

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Understand the concept of biodiesel production and its application
- Study the principles of various methods in bio ethanol production

TEXTBOOKS

3. Francis D. K. Chingand, Ian M. Shapiro. 2004. Green Building.John Wiley and Sons, Inc., Hoboken, New Jersey.

15UAG870	SOLAR PV SYSTEM	L	T	P	C
		1	0	0	1

OBJECTIVES

- Tostudyphotovoltaicpowergeneration technologies

Solar photovoltaic (PV) systems - Components of Solar PV system - Working principle of solar cell - Types of solar cell – efficiency - Applications of solar PV system - home lighting system - Solar Pump – Types - Advantages - Solar Street Light - Solar Lantern - Solar PV power plants - Solar PV fencing and other advanced application - Advantages. DesignofPV systems

TOTAL : 15 PERIODS

COURSE OUTCOME

After completion of this course, the students will able to

- Understand the concept of solar PV system
- Design a PV powered system for domestic and industrial applications

TEXTBOOKS

1. Chetan Singh Solanki. 2011. Solar Photovoltaics: Fundamentals, technologies and Applications. ISBN: 978-81-203-4386-3, PHI Learning Pvt. Limited, New Delhi