ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

B. E. AGRICULTURE ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
   i) To train and educate students with general knowledge and skills in agricultural water
management, agricultural production process, farm machinery and farm management.
   ii) To provide a sound theoretical knowledge in engineering principles applied to agriculture
   iii) To prepare students for a successful agricultural engineering career integrating all aspects
of engineering in agriculture.
   iv) To develop innovative capacity of students for increasing agricultural production with
scarce water resources available.
   v) To impart positive and responsive out-reach attitudes, initiative and creative thinking in
their mission as engineers.
   vi) To understand ethical issues and responsibility of serving the society and the environment
at large.

PROGRAM OUTCOMES (POs)
Graduates of Agriculture Engineering will have
   a) Ability to apply the knowledge of mathematics, science and engineering in agriculture
   b) Ability to design and conduct experiments, analyze and interpret data to prepare farm
specific report
   c) Ability to design an irrigation system to meet the desired needs within realistic
Constraints such as economic, environmental, social, political, ethical, and sustainability
   d) Ability to think creatively, to formulate problem statements, to communicate effectively, to
synthesize information, and to evaluate agricultural systems
   e) Ability to function in interdisciplinary teams within the Institute and also with other
organizations at National/ International level while planning the research projects.
   f) Ability to use the techniques, skills and modern engineering tools necessary for Agricultural
engineering practice.
   g) Will develop competencies in computer and automatic control systems, information
systems, mechanical systems, natural resource systems to solve engineering problems
   h) Graduates will be able to express themselves clearly in oral and verbal communication
needs.
   i) Ability to devise a strategy or action plan to utilize the acquired knowledge in increasing
water- use efficiency, farm mechanization and Post harvest technology etc.
   j) Graduates will be capable of self-education in emerging problems and understand the
value of lifelong learning in Food Technology, Farm Machinery and Food Processing.
### PEOs and POs – Agriculture Engineering

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## ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
### B. E. AGRICULTURE ENGINEERING
### REGULATIONS– 2017
### CHOICE BASED CREDIT SYSTEM
### I TO VIII SEMESTERS CURRICULA & SYLLABI

### SEMESTER I

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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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**PROFESSIONAL ELECTIVE**

**SEMESTER V**

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**SEMESTER VI**

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading - short comprehension passages, practice in skimming-scanning and predicting-
Writing- completing sentences- developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information-
Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development-- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences. Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email-
Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one’s friend- Language development- Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs.

UNIT V EXTENDED WRITING 12


OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.
TEXT BOOKS:

REFERENCES

MA8151 ENGINEERING MATHEMATICS – I

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OBJECTIVES :
- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12

TOTAL : 60 PERIODS

OUTCOMES :
After completing this course, students should demonstrate competency in the following skills:
- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
• Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
• Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
• Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
• Apply various techniques in solving differential equations.

TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7\textsuperscript{th} Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH8151 ENGINEERING PHYSICS

L T P C
3 0 0 3

OBJECTIVES:
• To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER
9

UNIT II WAVES AND FIBER OPTICS
9

UNIT III THERMAL PHYSICS
9
UNIT IV  QUANTUM PHYSICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course,
- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TOTAL :45 PERIODS

TEXT BOOKS:

REFERENCES:

CY8151  ENGINEERING CHEMISTRY  L  T  P  C  3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
UNIT I  WATER AND ITS TREATMENT

UNIT II  SURFACE CHEMISTRY AND CATALYSIS

UNIT III  ALLOYS AND PHASE RULE

UNIT IV  FUELS AND COMBUSTION

UNIT V  ENERGY SOURCES AND STORAGE DEVICES
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  ALGORITHMIC PROBLEM SOLVING  9
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II  DATA, EXPRESSIONS, STATEMENTS  9
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III  CONTROL FLOW, FUNCTIONS  9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV  LISTS, TUPLES, DICTIONARIES  9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V  FILES, MODULES, PACKAGES  9
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

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

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TEXT BOOKS:

REFERENCES:

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

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 AND FREEHAND SKETCHING 7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.
UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• familiarize with the fundamentals and standards of Engineering graphics
• perform freehand sketching of basic geometrical constructions and multiple views of objects.
• project orthographic projections of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.
OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.
OUTCOMES:
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXTBOOKS:

HS8251 TECHNICAL ENGLISH L T P C 4 0 0 4

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.
UNIT I   INTRODUCTION TECHNICAL ENGLISH  

UNIT II   READING AND STUDY SKILLS  
Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragrapging- Writing- interpreting ogarts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III   TECHNICAL WRITING AND GRAMMAR  
Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV   REPORT WRITING  

UNIT V   GROUP DISCUSSION AND JOB APPLICATIONS  
Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading- reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL :60 PERIODS

OUTCOMES:
At the end of the course learners will be able to:
- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

REFERENCES:
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.
OBJECTIVES :
- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

UNIT II VECTOR CALCULUS 12
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS 12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{1}{z}, \frac{1}{z^2} \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORMS 12

TOTAL: 60 PERIODS

OUTCOMES :
After successfully completing the course, the student will have a good understanding of the following topics and their applications:
- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :
REFERENCES:

BE8251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C 3 0 0 3

OBJECTIVES:
- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 9

UNIT II ELECTRICAL MACHINES 9

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

UNIT IV DIGITAL ELECTRONICS 9

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9

TOTAL: 45 PERIODS
OUTCOMES:
- ability to identify the electrical components and explain the characteristics of electrical machines.
- ability to identify electronics components and understand the characteristics

TEXT BOOKS:

REFERENCES:

GE8292               ENGINEERING MECHANICS          L T P C
                        3 2 0 4

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   STATICS OF PARTICLES                        9+6

UNIT II   EQUILIBRIUM OF RIGID BODIES                9+6
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+6
UNIT IV   DYNAMICS OF PARTICLES  

UNIT V   FRICTION AND RIGID BODY DYNAMICS  
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.

OUTCOMES: 
On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TOTAL : (45+30)=75 PERIODS

TEXT BOOKS:

REFERENCES:

AI8201 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.
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

UNIT I   AGRICULTURE AND CROP PRODUCTION  
Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture; Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices

UNIT II   CROP SELECTION AND ESTABLISHMENT  
Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.
UNIT III CROP MANAGEMENT
Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.

UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS
Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, and fiber crops, and special purpose crops such as those grown for green manure and fodder.

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS
Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops; Cultivation practices of representatives of each group; Special features of production of horticultural crops - green house cultivation.

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

GE8261 ENGINEERING PRACTICES LABORATORY

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with
different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.

II  MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
   Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V-fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC
circuit.
5. Measurement of energy using single phase energy meter.

IV  ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding
   measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose
   PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints each 5
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

**MECHANICAL**
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

**ELECTRICAL**
1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

**ELECTRONICS**
1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

**OBJECTIVE:**
- To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
List of Experiments:
- Field preparation studies
- Seed selection and seed treatment procedures
- Seed bed and nursery preparation
- Sowing / Transplanting
- Biometric observation for crops
- Nutrient management studies
- Water management and irrigation scheduling
- Weed management studies
- Integrated Pest Management studies
- Harvesting
- Post harvesting

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS REQUIRED
- A wet land / garden land for a minimum of 5 cents area for each / group of students.
- An open / borewell as water source to support cultivation

MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
4 0 0 4

OBJECTIVES:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12
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 II FOURIER SERIES 12

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12
UNIT V  
Z - TRANSFORMS AND DIFFERENCE EQUATIONS


TOTAL : 60 PERIODS

OUTCOMES :
Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXTBOOKS :

REFERENCES :

AI8301  
SOIL SCIENCE AND ENGINEERING  
L T P C  
3 0 0 3

OBJECTIVE:
- 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
UNIT II   SOIL CLASSIFICATION AND SURVEY


UNIT III   PHASE RELATIONSHIP AND SOIL COMPACTION

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

UNIT IV   ENGINEERING PROPERTIES OF SOIL

Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability-Darcy’s law-field and lab methods - Assessment of seepage - Compressibility.

UNIT V   BEARING CAPACITY AND SLOPE STABILITY

Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations-Terzaghi”s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method- slope protection measures.

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

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

TEXTBOOKS:

REFERENCES:

AI8302   FLUID MECHANICS AND HYDRAULICS

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 an integrated understanding of the transport of mass, momentum and energy.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.
- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic pumps. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.
UNIT I  PROPERTIES OF FLUIDS

UNIT II  FLUID FLOW ANALYSIS

UNIT III  FLOW MEASUREMENT

UNIT IV  OPEN CHANNEL FLOW

UNIT V  DIMENSIONAL ANALYSIS & PUMPS

OUTCOMES:
• The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
• They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

TEXTBOOKS:
REFERENCES:

Web sites
2. www.it.iitb.ac.in/vweb/engr/civil/fluid_mech/course.html

<table>
<thead>
<tr>
<th>AI8303</th>
<th>THEORY OF MACHINES</th>
<th>L  T  P  C</th>
</tr>
</thead>
<tbody>
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<td>3 0 0 3</td>
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</table>

OBJECTIVE:
- To introduce the students the theory of machines pertaining to agricultural engineering.

UNIT I TERMINOLOGY
Definitions - Kinematic links - Pairs - Chain - Machines and mechanism - Types and uses – Kinematic inversion of four bar chain and slider crank mechanism. Velocity and acceleration in simple mechanisms - Vector polygon and instantaneous centre methods – Coriolis component of acceleration.

UNIT II FRICTION AND APPLICATIONS
Sliding and rolling friction –friction in screw threads-Bearing and lubrication- Friction clutches- Belt drives- Friction aspects in brakes.

UNIT III MOTION OF CAM AND FOLLOWER
Cam and follower - types - application – displacement diagrams - profile layout for uniform velocity - Uniform acceleration and retardation - simple harmonic and cycloidal motion.

UNIT IV GEARS AND GEAR TRAINS

UNIT V FLYWHEEL AND BALANCING

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the student will be able to
- Basic knowledge on the friction applications, gear and gear trains.
- Learn the fundamentals related to motion of cam and follower and fly wheel balancing.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- 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

UNIT III  THEODOLITE AND MODERN SURVEYING  9
Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments – Heights and distances- Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale’s table - Total Station- Global Positioning System (GPS).

UNIT IV  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 V  LEVELLING APPLICATIONS  9
Longitudinal and Cross-section-Plotting - Contouring - Methods – Characteristics and uses of contours- Plotting – Methods of interpolating contours – computation of cross sectional area and volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams

TOTAL: 45 PERIODS

OUTCOMES:
- Students are expected to use all surveying equipments, prepare LS & CS, contour maps and carryout surveying works related to land and civil engineering projects.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To understand the basic laws of thermodynamics and heat transfer.
- To understand the principle of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc.

UNIT I BASIC CONCEPTS OF THERMODYNAMICS 9+6

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS 9+6
First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes
Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility - Applications.

UNIT III HEAT ENGINES 9+6

UNIT IV GASES AND VAPOUR MIXTURES 9+6

UNIT V HEAT TRANSFER 9+6

TOTAL : 75 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to understand different gas power cycles and use of them in IC and R&AC applications.

TEXT BOOKS:


REFERENCES:

OBJECTIVE:
- To train the student to acquire skill in operation various surveying and levelling instruments

- **CHAIN SURVEYING**
  - Ranging, Chaining and Pacing
  - Chain traversing

- **COMPASS SURVEYING**
  - Triangulation Problem
  - Compass traversing

- **PLANE TABLE SURVEYING**
  - Radiation
  - Intersection - Triangulation problem
  - Plane table traversing

- **THEODOLITE SURVEYING**
  - Measurement of horizontal & vertical angles
  - Tangential & Stadia Tacheometry

- **LEVELLING**
  - Fly levelling using Dumpy level
  - Fly levelling using Tilting level
  - Check levelling
  - Block Levelling
  - Radial Contouring

- **DEMONSTRATION OF TOTAL STATION AND GPS**

OUTCOME:
- Students completing this course would have acquired practical knowledge on handling basic survey instruments including leveling and development of contour map of given area.

**TOTAL: 60 PERIODS**

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
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<tr>
<td>1.</td>
<td>Total Station</td>
<td>3 Nos</td>
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<tr>
<td>2.</td>
<td>Theodolites</td>
<td>Atleast 1 for every 5 students</td>
</tr>
<tr>
<td>3.</td>
<td>Dumpy level / Filling level</td>
<td>Atleast 1 for every 5 students</td>
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<tr>
<td>4.</td>
<td>Pocket stereoscope</td>
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<td>5.</td>
<td>Ranging rods</td>
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<td>6.</td>
<td>Levelling staff</td>
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</tr>
<tr>
<td>7.</td>
<td>Cross staff</td>
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</tr>
<tr>
<td>8.</td>
<td>Chains</td>
<td>1 for a set of 5 students</td>
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<tr>
<td>9.</td>
<td>Tapes</td>
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</tr>
<tr>
<td>10.</td>
<td>Arrows</td>
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<tr>
<td>11.</td>
<td>Prismatic Compass</td>
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</tr>
<tr>
<td>12.</td>
<td>Surveyor Compass</td>
<td>2 nos</td>
</tr>
<tr>
<td>13.</td>
<td>Survey grade or Hand held GPS</td>
<td>3 nos</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS
1. Flow Measurement
   - Calibration of Rotameter
   - Flow through Venturimeter
   - Flow through a circular Orifice
   - Determination of mean velocity by Pitot tube
   - Flow through a Triangular Notch
   - Flow through a Rectangular Notch

2. Losses in Pipes
   - Determination of friction coefficient in pipes
   - Determination of losses due to bends, fittings and elbows

3. Pumps
   - Characteristics of Centrifugal pump
   - Characteristics of Submersible pump
   - Characteristics of Reciprocating pump

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be able to measure flow in pipes and determine frictional losses.
- The students will be able to develop characteristics of pumps and turbines.

REFERENCES:

LIST OF EQUIPMENTS REQUIRED
- Rotameter – 1 no.
- Venturimeter – 1 no.
- Orificemeter – 1 no.
- Pitot tube – 1 no.
- Bernoulli’s theorem apparatus – 1 no.
- Triangular notch and Rectangular notch – 1 each (with a lined open channel setup)
- Coefficient of friction apparatus
- Pipe setup with bends, fittings and elbows for estimating minor losses
- Centrifugal pump, Reciprocating pump, Submersible pump, Jet pump – 1 each
- Collecting tank, Stop watch – 1 no. for each experiment
OBJECTIVES:
The Course will enable learners to:
• Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
• Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
• improve general and academic listening skills
• Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL :30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
• Listen and respond appropriately.
• Participate in group discussions
• Make effective presentations
• Participate confidently and appropriately in conversations both formal and informal

TEXTBOOKS:
REFERENCES:

MA8391 PROBABILITY AND STATISTICS

OBJECTIVES:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12
- Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

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

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

UNIT V STATISTICAL QUALITY CONTROL 12
- Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students will be able to:
- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
• Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
• Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXTBOOKS:

REFERENCES:

AI8401 UNIT OPERATIONS IN AGRICULTURAL PROCESSING L T P C 3 0 0 3

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

UNIT I EVAPORATION AND CONCENTRATION 9

UNIT II MECHANICAL SEPARATION 9

UNIT III SIZE REDUCTION 9
UNIT IV  CONTACT EQUILIBRIUM SEPARATION  9

UNIT V  CRYSTALLISATION AND DISTILLATION  9

OUTCOMES:
At the end of the study the student will have knowledge on
- Fundamentals of various unit operations of Agricultural Processing.
- Material handling equipments

TEXTBOOKS:

REFERENCES:

AI8402  FARM TRACTORS  L T P C
3 0 0 3

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

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

UNIT II  ENGINE SYSTEMS  9
UNIT III TRANSMISSION SYSTEMS

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

UNIT V POWER TILLER, BULLDOZER AND TRACTOR TESTING

OUTCOMES:
- The students will be able to understand the various equipments and mechanizations used in the farm.
- The students will have the knowledge on earth moving machinaries, tractor classification and tillage implements.

TEXTBOOK:

REFERENCES:

CE8091 HYDROLOGY AND WATER RESOURCES ENGINEERING
OBJECTIVE:
- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS
UNIT II  RUNOFF
Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III  FLOOD AND DROUGHT
Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

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

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments,
- ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
- ability to conduct Spatial analysis of rainfall data and design water storage reservoirs
- Understand the concept and methods of ground water management.

TEXTBOOKS:

REFERENCES:

CE8393  STRENGTH OF MATERIALS  L T P C
4 0 0 4

OBJECTIVE:
- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS
UNIT II  ANALYSIS OF PLANE TRUSSES  12
Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

UNIT III  TRANSVERSE LOADING AND STRESSES IN BEAM  12

UNIT IV  TORSION  12
Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

UNIT V  DEFLECTION OF BEAMS  12
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay”s method – Area moment method – Conjugate beam method.

TOTAL : 60 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behaviour of simple structures.
• Critically analyse problem and solve the problems related to structural elements and analyse the deformation behaviour for different types of loads.

TEXTBOOKS:

REFERENCES:

GE8291  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
• To study the nature and facts about environment.
• To finding and implementing scientific, technological, economic and political solutions to environmental problems.
• To study the interrelationship between living organism and environment.
• To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
• To study the dynamic processes and understand the features of the earth’s interior and surface.
• To study the integrated themes and biodiversity, natural resources, pollution control and waste management.
UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
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. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION
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. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS
OUTCOMES:
- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

REFERENCES:

OBJECTIVE:
- Students should be able to verify various quality aspects of soil and water studied in theory by performing experiments in lab.
  1. Identification of rocks and minerals
  2. Collection and processing of soil samples
  3. Determination of soil moisture, EC and pH
  4. Field density determination by Core Cutter and Sand Replacement method
  5. Specific gravity determination by Pycnometer
  6. Textural analysis of soil by International Pipette method
  7. Grain size analysis by using Mechanical shaker
  8. Determination of Organic carbon
  9. Estimation of Gypsum requirements

TOTAL : 30 PERIODS

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

REFERENCES:
OBJECTIVE:
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS
1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS

OUTCOME:
- The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

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<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
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<tr>
<td>1</td>
<td>UTM of minimum 400 kN capacity</td>
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<tr>
<td>2</td>
<td>Torsion testing machine</td>
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</tr>
<tr>
<td>3</td>
<td>Izod impact testing machine</td>
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</tr>
<tr>
<td>4</td>
<td>Hardness testing machine</td>
<td>1 each</td>
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<td></td>
<td>Rockwell</td>
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</tr>
<tr>
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<td>Vicker’s</td>
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</tr>
<tr>
<td></td>
<td>Brinell</td>
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</tr>
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<td>5</td>
<td>Beam deflection test apparatus</td>
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<tr>
<td>6</td>
<td>Extensometer</td>
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<tr>
<td>7</td>
<td>Compressometer</td>
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<tr>
<td>8</td>
<td>Dial gauges</td>
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<tr>
<td>9</td>
<td>Le Chatelier’s apparatus</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Vicat’s apparatus</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Mortar cube moulds</td>
<td>10</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students’ critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.
UNIT I
Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III
Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading- Genre and Organization of Ideas- Writing- Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V
Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
• Write different types of essays.
• Write winning job applications.
• Read and evaluate texts critically.
• Display critical thinking in various professional contexts.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  WATER RESOURCES AND IRRIGATION REQUIREMENT  9


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


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 - Excess irrigation and waterlogging problem - Command area - Concept, Components of CADP - On Farm Development works, Farmer” s committee - its role for water distribution and system operation - rotational irrigation system.

UNIT V  AGRICULTURAL DRAINAGE  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 PERIODS

OUTCOMES:

- The students will have knowledge and skills on Planning, design, operation and management of reservoir system.
- The student will gain knowledge on different methods of irrigation including canal irrigation.

TEXTBOOKS:


REFERENCES:

OBJECTIVES:

- To introduce the students to the working principles of farm equipments, tillage implements.
- To expose the students to farm mechanization benefits and constraints, identification of components of primary and secondary tillage implements.

UNIT I FARM MECHANIZATION

UNIT II PRIMARY AND SECONDARY TILLAGE IMPLEMENTS

UNIT III SOWING AND FERTILIZING EQUIPMENT

UNIT IV WEEDING AND PLANT PROTECTION EQUIPMENT
Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conowereder and rotary weeder – Engine operated and tractor weeder
Sprayers –types-classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control

UNIT V HARVESTING MACHINERY
Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses

TOTAL: 45 PERIODS

OUTCOME:

- The students will be able to understand the mechanization and various equipment used in the farm for different field operations.

TEXTBOOKS:

REFERENCES:

AI8503 DESIGN OF BASIC MACHINE ELEMENTS

OBJECTIVES:
- To introduce to the students to the basic concepts involved in the design of basic elements that are common to any agricultural machinery.
- To get through the detailed design & drawing of various components of agricultural machineries.

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

UNIT II DESIGN OF POWER TRANSMISSION SYSTEMS
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

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

UNIT V DESIGN OF GEARS AND BEARINGS
Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth.- Applications of different types of Gears - Types of bearings – sliding contact and rolling contact types. – Bearing selection based on application - Lubrication in journal bearings – calculation of bearing dimensions.

TOTAL :60 PERIODS
(Note: Use of PSG Design Data book is permitted in the university examination)

OUTCOME:
- At the end of the course the student will have the knowledge on detailed design and drawing of basic machine components.

TEXTBOOKS:
REFERENCES:

AI8504 POST HARVEST TECHNOLOGY

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

UNIT I FUNDAMENTALS OF POST HARVESTING

UNIT II PSYCHROMETRY AND DRYING

UNIT III CLEANING AND GRADING

UNIT IV SHELLING AND HANDLING

UNIT V CROP PROCESSING

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the study the student will have knowledge on
- Material handling equipments
- Different Post Harvest operations and processing methods of harvested crops.
- Fundamentals of various unit operations of Agricultural Processing.
TEXTBOOKS:

REFERENCES:

AI8511 OPERATION AND MAINTENANCE OF FARM MACHINERY LAB L T P C
0 0 4 2

OBJECTIVE:
- The students will be introduced to the practice of different farm machinery in the field on tillage, sowing, plant protection, harvesting and threshing; care and maintenance; lubrication; fits and tolerances and replacements; adjustments of farm machines; dismantling and reassembling of a disc harrow, seed-cum fertilizer drill and sprayer, engine pumps

LIST OF EXPERIMENTS
- Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.
- Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller.
- Field operation and adjustments of ploughs
- Field operation and adjustments of harrows
- Field operation and adjustments of cultivators
- Field operation of sowing and planting equipment and their adjustments
- Field operation of plant protection equipment
- Field operation on mowers and reapers
- Field operation of combine and determination of field losses
- Field operation of threshers and their performance evaluation
- Studies on methods of repair, maintenance and off-season storage of farm equipment
- Opening and reassembly of disc harrows, determination and adjustment of tilt and disc angles
- Hitching of agricultural implements and trailers
- Study and operation of bulldozer
- Visit to agro-manufacturers

TOTAL : 60 PERIODS

TEXTBOOKS:

REFERENCES:
LIST OF EQUIPMENT REQUIRED
- Tractor – 1 no.
- Power tiller – 1 no.
- Disc plough – 1 no.
- Disc harrow – 1 no.
- Multi tyne cultivator – 1 no.
- Paddy Transplanter – 1 no.
- Seed drill – 1 no.
- Sprayer – 1 no.
- Mower – 1 no.
- Weeder -1 no.
- Combine harvester -1 no. (optional) – can be had as demonstration

AI8512  POST HARVEST ENGINEERING LABORATORY  L T P C
0 0 4 2

OBJECTIVE:
- After the end of this lab, students will be able to determine various engineering properties of grains, test and evaluate different post harvesting machineries.

LIST OF EXPERIMENTS:
- Determination of moisture content of grains by oven method and moisture meter.
- Determination of porosity of grains.
- Determination of coefficient of friction and angle of repose of grains.
- Testing of paddy thresher & paddy winnower.
- Testing of groundnut decorticator & maize sheller
- Evaluation of thin layer drier
- Determining the efficiency of bucket elevator and screw conveyor
- Evaluation of shelling efficiency of rubber roll sheller
- Determining the oil content of oil seeds.
- Visit to modern rice mill
- Visit to pulse milling industry

TOTAL: 60 PERIODS

TEXTBOOKS:

REFERENCES:

LIST OF EQUIPMENTS REQUIRED:
- Hot air oven, Grain moisturemeter – 1 no. each
- Porosity apparatus – 1 no.
- Coefficient of friction apparatus – 1 no.
- Angle of repose – round type and L type – 1 no.each.
- Paddy thresher – 1 no.
- Groundnut decorticator and maize sheller – 1 no. each
- Thin layer dryer – 1 no.
- LSU dryer – 1 no.
- Bucket elevator and screw conveyor – 1 no. each
- Rubber roll sheller – 1 no.
- Oil expeller – 1 no.

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

**LIST OF EXPERIMENTS**
1. To study various instruments in the Meteorological Laboratory
2. Determination of infiltration rate using double ring and digital infiltrometer
3. Determination of soil moisture wetting pattern for irrigation scheduling
4. Design of Drip irrigation system
5. Design of sprinkler irrigation system
6. Measurement of flow properties in open irrigated channels (flumes, notches)
7. Evaluation of surface irrigation
8. Determination of uniformity coefficient for drip irrigation system
9. Determination of uniformity coefficient for sprinkler system (catch can method)
10. To conduct experiment on disc filter for micro irrigation systems

**TOTAL: 60 PERIODS**

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

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

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

UNIT II WELL HYDRAULICS  9

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

UNIT V SPECIAL TOPICS  9

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:


REFERENCES:

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 different methods of food processing

UNIT I  PROPERTIES AND PROCESSING OF MILK


UNIT II  DAIRY PRODUCTS


UNIT III  FOOD AND ITS PROPERTIES, REACTION AND KINETICS

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

UNIT IV  PROCESSING AND PRESERVATION OF FOODS

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

UNIT V  PACKAGING AND QUALITY CONTROL

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

OUTCOMES:

- The students will gain knowledge about Dairy and Food process engineering
- Understand the process of manufacturing of dairy products and thermal processing of food.
- Students will understand the importance of quality control and food preservation and packaging.

TEXTBOOKS:

REFERENCES:

OBJECTIVES:
- To impact knowledge on the protected cultivation of vegetables, fruits and flower crops.
- To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops.

UNIT I PROTECTED CULTIVATION AND ITS TYPES

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS
Protected cultivation technology for vegetable crops - Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS
Protected cultivation technology for flower crops - Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliages and fillers – integrated pest and disease management – postharvest handling.

UNIT IV PRECISION FARMING TECHNIQUES

UNIT V PRECISION FARMING OF HORTICULTURAL CROPS
Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

OUTCOMES:
- The students will be able to appreciate the different methods of protected cultivation practices available for vegetable crops and flowers
- A clear understanding of precision farming techniques and its application to horticultural crops is possible
TEXTBOOKS:

REFERENCES:
2. David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA.

AI8604 SOLAR AND WIND ENERGY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on solar energy systems, wind energy systems and its applications.

UNIT I SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS 9

UNIT II SOLAR CONCENTRATING COLLECTORS 9

UNIT III SOLAR PV TECHNOLOGY 9

UNIT IV WIND ENERGY 9

UNIT V WIND MILL TYPES AND APPLICATIONS 9

TOTAL: 45 PERIODS

OUTCOMES:
The student will be able to understand
- The concepts of solar and wind energy resources.
- The applications of solar and wind energy systems.
TEXTBOOKS:

REFERENCES:

AI8611 CAD FOR AGRICULTURAL ENGINEERING

OBJECTIVES:
- To draft the agricultural engineering related machineries and structures manually and also by computer aided methods.
  1. Design and Drawing of Underground pipeline system
  2. Design and Drawing of Check dam
  3. Design and Drawing of Mould board plough
  4. Design and Drawing of Disk plough
  5. Design and Drawing of Post harvest technology units (threshers and winnowers)
  6. Design and Drawing of Biogas plant.
  7. Introduction & demonstration on 3D modeling softwares like Pro/E, Creo, Solid works, Solid Edge etc.

OUTCOMES:
- The student will be able to understand the plan and layout of underground pipes, post harvesting units and check dams.
- The students also will be able to design and draw the components using computer aided methods

TOTAL: 60 PERIODS

REFERENCES:
OBJECTIVES:

- To conceive and design various farm structures related to agricultural engineering.
  1. Planning and Layout of farmstead
  2. Design of stall barn
  3. Design of loose housing and milk parlors
  4. Design of poultry house
  5. Design of a sheep/goat house
  6. Design of ventilation system for dairy and poultry house
  7. Design of silos—over ground and underground and hay storages
  8. Design of farm fencing system
  9. Design of machinery and equipment shed and workshops
  10. Design of septic tank and sanitary structures
  11. Design of rural/farm roads and culverts.

TOTAL: 60 PERIODS

OUTCOME:

- At the end of the course, the student will be able to design and draw all farm structures connected to agricultural engineering including animal housing, grain storage, small civil structures.

TEXTBOOKS:


OBJECTIVES:

- To get hands on experience on various aspects of food science and food process engineering.
- Determination of cooking properties of parboiled and raw rice.
- Estimation of microbial load in food materials.
- Determination of rehydration ratio of dehydrated foods.
- Experiment on osmotic dehydration of foods.
- Experiment of food extruder.
- Experiment on properties of food through microwave oven heating.
- Determination of properties of milk.
- Experiments on cream separator to determine the separation efficiency.
- Experiments on construction and operation of butter churn and butter working accessories.
- Experiments on detection of Food Adulteration.
• Experiments on estimation of protein in food.
• Experiment on expansion and Oil absorption characteristic of snacks on frying

The lab includes visit to food processing and dairy industry

TOTAL: 60 PERIODS

OUTCOME:
• On completion of the lab course, the students will be able to get experience on various aspects of food processing, preservation.

LIST OF EQUIPMENTS REQUIRED
1. Extruder -1no.
2. Pasteurizer – 1no.
3. Hot air oven-1no.
4. Hand refractometer-1 no.
5. Dessicator-1no.
6. Dean and Stark’s apparatus -1 no.
7. Cabinet dryer – 1 no.
8. Soxhlet flask -1no.
9. Distillation column – 1 no.
10. Kjeldahl flask – 1no.
11. Distillation apparatus – 1 no.
12. Microwave oven –1 no.
13. Cream separator -1 no.

Other basic requirements like weighing balance, physical balance, blotting papers, tracing sheets, burette, vernier calipers, pipette, conical flask, test tubes, beakers, spatula and other glasswares, food samples, chemicals should be available.

TEXTBOOKS:

REFERENCES:
4. Charm, S.E.1971. The fundamentals of Food engineering, AVI pub.Co.,Inc,

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 related to soil and water management.
UNIT I  SOIL EROSION PRINCIPLES

UNIT II  ESTIMATION OF SOIL EROSION

UNIT III  EROSION CONTROL MEASURES

UNIT IV  WATER CONSERVATION MEASURES

UNIT V  SEDIMENTATION

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to gain fundamental knowledge on the concepts of erosion and sedimentation.
- They will have sufficient knowledge on soil and water conservation measures.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To introduce the principles and basic concepts of Remote Sensing and GIS
- To introduce the remote sensing systems, data products and analysis
- To introduce the spatial data models, analysis and presentation techniques
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

UNIT I  CONCEPTS OF REMOTE SENSING AND SATELLITES  9
Definition - Historical background - Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing - Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation. - Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT, SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution - Recent satellites with its applications

UNIT II  DATA PRODUCTS AND IMAGE ANALYSIS  9

UNIT III  CONCEPTS OF GIS  9
Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.

UNIT IV  DATA INPUT AND ANALYSIS  9

UNIT V  APPLICATION OF RS AND GIS  9

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXTBOOKS:

REFERENCES:

AI8703 BIO - ENERGY RESOURCE TECHNOLOGY

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

UNIT I BIO RESOURCE - AN INTRODUCTION

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

UNIT III BIO REACTORS AND FERMENTORS

UNIT IV ALCOHOL PRODUCTION

UNIT V ENERGY AND ENVIRONMENT

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

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

OBJECTIVES:
- To introduce the principles and basic concepts of Remote Sensing and GIS through hands on training
1. Measurement of relief displacement using parallax bar
2. Stereoscopic vision test
3. Aerial photo interpretation - visual
4. Satellite images interpretation – visual
5. Introduction to QGIS
6. Geo-referencing of images
7. Image enhancement practice
8. Supervised classification practice
9. Unsupervised classification practice
10. Database Management Systems
11. Spatial data input and editing - Digitising
12. Raster analysis problems – Database query
13. GIS applications in DEM and its analysis
14. GIS application in watershed analysis
15. GIS application in rainfall-runoff modelling
16. GIS application in soil erosion modelling

OUTCOME:
- On completion of the lab course, the students will have adequate knowledge in application of RS and GIS in various fields of agricultural engineering.

TEXTBOOKS:

REFERENCES:

OBJECTIVE:
- To gain the practical knowledge on various renewable energy gadgets.

EXPERIMENTS:
1. Characterization of biomass – proximate analysis
2. Determination of caloric value of fuels – solids and gases
3. Design of KVIC / Deenbandhu model biogas plant
4. Study of UASB biomethanation plant
5. Purification of biogas – CO_2 and H_2S removal
6. Performance evaluation of agro based gasifier
7. Study on pyrolysis unit – Biochar, Charcoal and Tar making process
8. Testing of biogas/producer gas engines
9. Study on briquetting and Stoichiometric calculations
10. Automatic weather station – Analysis of wind data and prediction
11. Testing of solar water heater
12. Testing of natural convection solar dryer
13. Study on Solar power and I-V Characteristics
14. Testing of solar photovoltaic water pumping system

The lab includes visit to biomass power plant and wind farms.

TOTAL: 60 PERIODS

OUTCOME:
On completion of the lab course, the students will

- Be exposed to renewable energy sources and their applications.

REFERENCES:

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

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

AI8713                  ICT IN AGRICULTURAL ENGINEERING LAB EXERCISES                L  T  P  C
0  0  2  1

OBJECTIVES:
- To gain practical knowledge on various technologies in information and communication for agriculture.
EXPERIMENTS:
1. Configuring timers for automatic switching “on and off” of irrigation systems
2. Experience with solenoid valves for pressurized irrigation
3. Using sensors for Agro meteorological measurements
4. Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5. Use of mobile apps for controlling or triggering an agricultural system
6. Construction of crop growth functions (best fit) for crop yields simulations
7. Image processing as tool for biotic and abiotic stress identification
8. Experience with existing open source crop simulation models
9. Exposing cloud resources for agricultural applications
10. Developing automated agro advisory systems

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

TOTAL: 30 PERIODS

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.

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.

OBJECTIVE:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.
OUTCOME:
- On completion of the project work, students will be in a position to take up any challenging practical problem and find solution by formulating proper methodology.

AI8001 SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING

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
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

UNIT III SIMULATION

UNIT IV NEURAL NETWORKS

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM
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

OUTCOME:
- Upon completion of the course, the student will have the knowledge on system concepts and will be able to apply the optimization techniques like LP, DP, ANN, FL and GA for problems in agriculture.

TEXTBOOKS:
REFERENCES:
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

AI8002 IT IN AGRICULTURAL SYSTEMS

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
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
Artificial light systems, management of crop growth in greenhouses, simulation of CO₂ 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
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
Importance of climate variability and seasonal forecasting, Understanding and predicting world’s climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS
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

OUTCOME:
- The students shall be able to understand the IT applications in environmental control systems, precision farming, agricultural systems management and weather prediction models.

TEXTBOOKS:
REFERENCES:

AI8003 CLIMATE CHANGE AND ADAPTATION L T P C 3 0 0 3

OBJECTIVES:
- To know the basics, importance of global warming
- To know the concept of mitigation measures against global warming
- To learn about the global warming and climate change.

UNIT I EARTH’S CLIMATE SYSTEM 9

UNIT II ATMOSPHERE AND ITS COMPONENTS 9

UNIT III IMPACTS OF CLIMATE CHANGE 9

UNIT IV OBSERVED CHANGES AND ITS CAUSES 9

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES 9

TOTAL: 45 PERIODS

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

REFERENCES:

GE8071 DISASTER MANAGEMENT

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I INTRODUCTION TO DISASTERS
- Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
- Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
- Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

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

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

REFERENCES:
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE8074 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVE:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V
Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and
State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL: 45 PERIODS

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

AI8004 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 CONCEPTS OF AGRICULTURAL BUSINESS 9
Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.

UNIT II AGRI – BUSINESS ORGANIZATION 9

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

UNIT V MARKET PROMOTION AND HUMAN RESOURCES 9

TOTAL: 45 PERIODS
OUTCOME:
- The students shall be exposed to various trends in agricultural business management.

TEXTBOOKS:

REFERENCES:

AI8005 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
- 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

UNIT III COST CURVES 9
UNIT IV MANAGEMENT OF RESOURCES
Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.

UNIT V FARM MANAGEMENT AND FINANCIAL ANALYSIS
Farm management- need and analysis – Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles – Farm planning – Elements of farm planning – Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting.

TOTAL: 45 PERIODS

OUTCOME:
• Students are able to plan the financial aspects related to farm management in a cost effective manner.

TEXTBOOKS:
2. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani

REFERENCES:

UNIT I COMMUNICATION AND PROGRAMME PLANNING

UNIT II EXTENSION TEACHING METHODS

UNIT III MODERN COMMUNICATION GADGETS
Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

OBJECTIVE:
• To expose the students to different extension methods for communication to take the work from lab to field
UNIT IV DIFFUSION AND ADOPTION
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
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

OUTCOME:
- After completion of this course, the students will be familiar with various extension methods, communication gadgets. Be trained in capacity building techniques

TEXT BOOKS:

REFERENCES:

MA8491 NUMERICAL METHODS

OBJECTIVES:
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT II INTERPOLATION AND APPROXIMATION
Interpolation with unequal intervals - Lagrange's interpolation – Newton’s divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton’s forward and backward difference formulae.
UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS
12

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS
12
Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

OUTCOMES:
Upon successful completion of the course, students should be able to:
• Understand the basic concepts and techniques of solving algebraic and transcendental equations.
• Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
• Apply the numerical techniques of differentiation and integration for engineering problems.
• Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
• Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS:

REFERENCES:

GE8075 INTELLECTUAL PROPERTY RIGHTS
L T P C
3 0 0 3

OBJECTIVE:
• To give an idea about IPR, registration and its enforcement.
UNIT I  INTRODUCTION  9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs  10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS  10

UNIT IV  DIGITAL PRODUCTS AND LAW  9

UNIT V  ENFORCEMENT OF IPRs  7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:
• Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

REFERENCES:

AI8007  AGRICULTURAL WASTE MANAGEMENT  L T P C
3 0 0 3

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

UNIT I  INTRODUCTION  7
Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.

UNIT II  COMPOSTING  10
UNIT III  BIOMASS BRIQUETTING
Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes.

UNIT IV  BIOCHAR PRODUCTION
Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.

UNIT V  BIOGAS AND BIO ETHANOL PRODUCTION

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course student will be able to understand
- Nutritive value and energy production potential of agro wastes.

TEXT BOOKS:

REFERENCES:
3. Biochar production from agricultural wastes via low-temperature microwave carbonization

AI8008  SUSTAINABLE AGRICULTURE AND FOOD SECURITY

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 & ORGANIC FARMING  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 – organic farming – principles and practices.

UNIT IV  FOOD PRODUCTION AND FOOD SECURITY  9

UNIT V  POLICIES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY  9

TOTAL: 45 PERIODS

OUTCOMES:
• 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.

TEXTBOOKS:

REFERENCES:
3. Gangadhar Banerjee and Srijit Banerji, Economics of sustainable agriculture and alternate production systems, Ane Books Pvt Ltd., 2017
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  8

UNIT II  REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING  9

UNIT III  PSYCHROMETRY  10
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

TOTAL: 45 PERIODS

OUTCOME:
- The students will have a clear understanding of psychrometry, refrigeration and air conditioning and their applications to agriculture

TEXTBOOKS:

REFERENCES:

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**  
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**  
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**  

UNIT IV  
**Food packaging materials and testing**  

UNIT V  
**Special packaging techniques**  

TOTAL: 45 PERIODS

OUTCOME:
- The students will have a clear understanding of various methods of storage and different packaging techniques for food

TEXTBOOKS:

REFERENCES:

AI8011  
**Seed processing technology**  
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 of production of good quality seed using specific examples.
- To familiarize them with planning, development and organization of seed programmes.

UNIT I  
**Seed characters**  
Definition and characteristics of seed and how it differs from grain; Propagation of crop plants through true seed and vegetative means; Features of good quality seed; Importance of seed in successful crop production; Floral biology: self and cross pollination; Methods of genetic improvement of crop plants such as selection, hybridization, mutation and polyploidy; Seed legislations promulgated in India from 1966 to date and the purpose of each of these legislations.
UNIT II  SEED PRODUCTION AND CERTIFICATION
Multiplication of seed and seed material: systems of seed multiplication, classes of seed, multiplication models, multiplication ratio, field selection, planting ratio, isolation needs and rouging; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process: legal basis, pre-requisites for applicability, detailed description of the specific steps of the certification process (with particular emphasis on field inspection).

UNIT III  SEED PROCESSING AND TESTING
Components of seed processing in a broader sense; Steps in seed processing in its narrower sense: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps; Seed treatment; Seed drying; Seed sampling; Seed testing: details of specific tests conducted for different purposes (service, certification and seed law enforcement); Standards prescribed for different crops.

UNIT IV  DEVELOPING SEED PROGRAMMES
Types of organizations involved in seed production (public, quasi-governmental, private and cooperative), and their objectives and features; Organizational set up of a seed company; Steps involved in planning and developing a seed programme; Seed marketing activities, and analysis of seed demand and supply; Costing and pricing strategies; Economics of production of different crop seed; Seed packaging; Opportunities for Indian seed companies to have a greater share of world seed market; Visit to seed organizations; Preparing seed projects to obtain credit; Export procedures and formalities; Seed/plant quarantine methods.

UNIT V  SEED PRODUCTION IN SPECIFIC CROPS
Principles and special techniques used for seed production in important horticultural crops by selecting representatives of vegetable / flower / fruit / spice / condiment / plantation crops.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to appreciate the different methods of seed production, processing and testing
- They will also have the knowledge on different seed programmes

TEXTBOOKS:

REFERENCES:

AI8012  HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERS

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  

UNIT II  CONVECTION  

UNIT III  PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS  

UNIT IV  RADIATION  

UNIT V  MASS TRANSFER  
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 :45 PERIODS

TEXT BOOKS:

REFERENCES:

AI8013  PROCESS ENGINEERING OF FRUITS AND VEGETABLES  

OBJECTIVES:
- To understand the basics of Post Harvest Technology of fruits and vegetables through their structure and composition
- To study the different methods of processing and preservation of fruits and vegetables including drying and dehydration
- To learn the latest methods of storage of fruits and vegetables
UNIT I STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE

UNIT II CLEANING, GRADING AND ON-FARM PROCESSING

UNIT III PRESERVATION OF FRUITS AND VEGETABLES
Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques.

UNIT IV DRYING AND DEHYDRATION
Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.

UNIT V STORAGE

OUTCOME:
- At the end of this course, the student will be thorough in various methods of processing, preservation and storage of fruits and vegetables using latest technologies.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I  INTRODUCTION  9

UNIT II  TQM PRINCIPLES  9
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III  TQM TOOLS AND TECHNIQUES I  9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV  TQM TOOLS AND TECHNIQUES II  9
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V  QUALITY MANAGEMENT SYSTEM  9

TOTAL: 45 PERIODS

OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXTBOOK:

REFERENCES:
4. ISO9001-2015 standards
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

OUTCOME:

- After completion of the course, the students will have a thorough knowledge on watershed planning, development and management strategies through different soil and water conservation approaches.

TEXT BOOKS:


REFERENCES:

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  8

UNIT II  PUMP VALVES  7
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  10

UNIT IV  DRIPL IRRIGATION DESIGN  10
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  10
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

OUTCOME:
- After completion of the course, the students will have a thorough knowledge on micro irrigation, its concepts and design of a sprinkler and drip system

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I DESIGN OF IRRIGATION CHANNELS
Design of Erodible and Non-Erodible, Alluvial channels- Kennedy’s and Lacey’s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods

UNIT II COMMAND AREA

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER
Availability of water - Rainfall, canal supply and groundwater – Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix

UNIT IV WATER BALANCE

UNIT V SPECIAL TOPICS
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

OUTCOME:

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

TEXTBOOK:


REFERENCES:

OBJECTIVES:
- To expose the students to the concept of Irrigation Automation
- To introduce the concepts of Automatic Systems and IoT applications
- To train the students to explore and use new technologies in Irrigation

UNIT I  INTRODUCTION TO AUTOMATION  9

UNIT II  SYSTEMS OF AUTOMATION  7

UNIT III  IoT IN IRRIGATION  10

UNIT IV  SURFACE AND MICRO-IRRIGATION AUTOMATION  11

UNIT V  ASSESSMENT OF PARAMETERS IN IRRIGATION  8

TOTAL: 45 PERIODS

OUTCOMES:
- Student will understand the technologies available for automation
- Students can design conventional methods as automated system to be more efficient

TEXTBOOK:

REFERENCES:
1. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, American Society of Civil Engineers, 2014
2. Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers, 1987
OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I        HUMAN VALUES
10

UNIT II        ENGINEERING ETHICS
9

UNIT III       ENGINEERING AS SOCIAL EXPERIMENTATION
9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV        SAFETY, RESPONSIBILITIES AND RIGHTS
9

UNIT V        GLOBAL ISSUES
8

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:


REFERENCES:

OBJECTIVES:
- To understand the productivity of farm machines, their maintenance processes and evaluation for right selection and management
- To provide sufficient knowledge of mechanization status in the country and management techniques for future requirements.

UNIT I  INTRODUCTION TO FARM POWER AND DESIGN CRITERIA
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
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  SYSTEM APPROACH
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
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
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

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

TEXTBOOKS:
2. Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M. 1989. Tractor and its Power Units. Van Nostrand Reinhold
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

OUTCOME:
- After completion of the course, the students will be able to understand the concepts of mechanics, dynamics and traction of implements and their applications.

TEXTBOOKS:

REFERENCES:
2. S. C. Jain, Farm Machinery- An Approach

AI8020  SPECIAL FARM EQUIPMENT  L T P C  3 0 0 3

OBJECTIVE:
- To study the special machineries used for agricultural applications

UNIT I  MOWERS AND WEEDING EQUIPMENT  9
UNIT II  SPRAYERS AND DUSTERS  9

UNIT III  THRESHERS AND HARVESTERS  9

UNIT IV  THRESHERS AND OTHER MACHINERIES  9
Thresher – construction and working of multi crop thresher. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter- flail mowers - lawn mowers – tree pruners

UNIT V  SPECIALIZED FARM EQUIPMENT  9

TOTAL: 45 PERIODS

OUTCOME:
- After completion of the course, the students will have a thorough knowledge on special farm equipment required for various agricultural operations.

TEXTBOOKS:

REFERENCES:

AI8021  ENERGY AUDITING AND MANAGEMENT  L T P C
3 0 0 3

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

UNIT I  ENERGY CONSERVATION CONCEPTS  9

UNIT II  ENERGY AUDITING AND ECONOMICS  9
UNIT III  THERMAL ENERGY AUDIT  

UNIT IV  ELECTRICAL ENERGY AUDIT – I  

UNIT V  ELECTRICAL ENERGY AUDIT - II  
HVAC and refrigeration system – fans and blowers – fan performance – pumps - lighting system - energy auditing and reporting in industries – replacement of renewable energy technology option – case study in agro-industries

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

AI8022  ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING  

OBJECTIVE:
• To study the physical work load, equipment/work place design, safety and occupational health hazards in farm operations.

UNIT I  ERGONOMICS  
Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metabolism- energy requirements at work - acceptable work load.

UNIT II  PHYSIOLOGICAL FUNCTIONS  
Human Skeletal system – muscle, structure and function - Physiological stress - Efficiency of work - Physical functions - Age and individual differences in physical functions- Physiological and operational criteria of physical activity.
UNIT III ENERGY EXPENDITURE
Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of Spraying-Weeding operations - Movements of body members- Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time.

UNIT IV ANTHROPOMETRY

UNIT V HUMAN ENGINEERING IN TRACTOR DESIGN

OUTCOME:
• The student will gain knowledge to improve the performance of the farm systems by improving the human - machine interaction with safety measures.

TEXT BOOKS:

REFERENCE:

GE8073 FUNDAMENTALS OF NANOSCIENCE

OBJECTIVE:
• To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS
Nanofoms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT) - methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionallization and applications-Quantum wires, Quantum dots-preparation, properties and applications.
UNIT IV  CHARACTERIZATION TECHNIQUES

UNIT V  APPLICATIONS

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

REFERENCES: