

# **B.Tech. - AGRICULTURAL ENGINEERING**

## **Syllabus**

### **I Year I – Semester**

<b>(HS103) ENGINEERING MATHEMATICS – I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	3	1	-	4	4

#### **UNIT – I**

**Matrices :** Matrices, Rank of a matrix, Solutions of system of linear equations, Gauss-Jordan, Gauss Elimination, Eigen values, Eigen vectors, Cayley-Hamilton theorem - Applications, Diagonalisation of a matrix.

#### **UNIT - II**

**Ordinary Differential Equations:** Revision of integral formulae, Formation of ordinary differential equations, Differential equations of first order and first degree – linear, Bernoulli and exact. Applications to Newton's Law of cooling, Law of natural growth and decay, Orthogonal trajectories. Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type  $e$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ , method of variation of parameters

#### **UNIT – III**

**Frobenius Series Solution:** Frobenius series solution of differential equations (constant and variable coefficients)

#### **UNIT – IV**

**Laplace Transformations :** Definitions and properties, Laplace transform of standard functions, Inverse transform, first shifting Theorem, Transforms of derivatives and integrals, Unit step function, second shifting theorem, Dirac's delta function, Convolution theorem, Differentiation and integration of transforms, Application of Laplace transforms to ordinary differential equations.

#### **UNIT - V**

##### **Numerical Methods:**

**Solutions of Algebraic and Transcendental equations:** Bisection method, Regula-Falsi method, Newton-Raphson method, Numerical solutions of algebraic system of equations by Gauss-Siedel method. Interpolation: Errors in polynomial interpolation, Finite differences, Forward, backward and central differences, Newton's formulae for interpolation, Central difference interpolation formulae, Gauss and Bessel central difference formulae, interpolation with unevenly spaced points, Lagrange's interpolation formula. Curve fitting by least squares method, solving differential equations by numerical methods – Euler's, Modified Eulers, RK method.

#### **TEXT BOOKS :**

1. K.V. Iyengar et al, "A Textbook of Engineering Mathematics", 9<sup>th</sup> ed., S. Chand & Co, 2010.
2. T.K.V. Iyengar et al, "Mathematical Methods", S. Chand & Co, 2009.
3. B. V. Ramana, "Engineering Mathematics-I", 3<sup>rd</sup> ed., Tata McGraw-Hill Publishing Co., 2008
4. B. V. Ramana, "Mathematical Methods", 3<sup>rd</sup> ed., Tata McGraw-Hill Publishing Co., 2008

## REFERENCE BOOKS :

1. E. Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> ed., John Wiley Sons, 2008.
2. R K Jain and S R K Iyengar, "Advanced Engineering Mathematics", 2<sup>nd</sup> ed., Narosa Publishing House, 2006.
3. Dr.B.S. Grewal, "Higher Engineering Mathematics", 40<sup>th</sup> ed., Khanna Publishers, 2009.
4. B.V. Ramana, "Higher Engineering Mathematics", 3<sup>rd</sup> ed., Tata McGraw-Hill Publishing Co, 2008.

## (HS107) ENGINEERING PHYSICS

L	T	P	To	C
3	1	-	4	4

### UNIT – I

**Waves & Oscillations and Physical Optics:** Waves & Oscillations: Damped Oscillation – Forced oscillations – Resonance. Physical Optics : Interference - Types of interference – Young's Double Slit experiment – Diffraction – Fraunhofer diffraction at single slit – Polarization – Production of plane polarized light.

### UNIT- II

**Crystal Structures and X-Ray Diffraction:** Introduction -Space lattice - Basis - Unit cell - Lattice parameter - Bravais lattices – Crystal systems - Structure and packing fractions of Simple cubic, Body centered cubic and Face centered cubic crystals - Directions and planes in crystals – Miller indices - Separation between successive (hkl) planes - Diffraction of X-rays by crystal planes - Bragg's law - Powder method.

### UNIT – III

**Modern Physics:** Matter waves – deBroglie's concept of matter waves –Davisson and Germer experiment – Schroedinger's time independent wave equation - Physical significance of the wave function - Particle in one dimensional potential box – Heisenberg's uncertainty principle.

### UNIT – IV

#### **Semiconductors & Superconductors:**

**Semiconductors:** Introduction - Intrinsic semiconductor and carrier concentrations – Equation for conductivity – Direct and Indirect band gap semiconductors - Drift and diffusion - Einstein's equation. **Superconductors:** General properties - Meissner effect - Type I and Type II superconductors – High  $T_c$  superconductors - Applications of superconductors.

### UNIT – V

**Lasers and Fiber Optics & Holography:** Lasers: Characteristics of Laser light – Spontaneous and Stimulated emission of radiation – He-Ne Laser – CO<sub>2</sub> Laser – Applications of lasers in industry, science and medicine. **Fiber Optics & Holography:** Principle of optical fiber – Numerical Aperture – Types of fibers – Dispersion and Attenuation in optical fibers – Optical sensors – Optical fiber communication.

## TEXT BOOKS:

1. Halliday, Resnick and Walker, "Fundamentals of Physics", 6<sup>th</sup> ed., John Wiley publishers, 2003.
2. R.K.Gaur & S.L.Gupta, "Engineering Physics", 8<sup>th</sup> ed., Dhanpat Rai publishers, Pvt., (Ltd), 2001.
3. M.R.Srinivasan, "Engineering Physics" 3<sup>rd</sup> ed., New Age International, 2002.

4. M.N. Avadhanulu & P.G. Kshirasagar, "Engineering Physics", 1<sup>st</sup> ed., S. Chand & Company Ltd, 1992.

#### REFERENCE BOOKS:

1. Grawfor F.S., Berkley Physics courses, "Waves and Oscillations", Vol. III, McGraw Hill, 1992.
2. V. Raghavan, "Materials Science and Engineering", 5<sup>th</sup> ed., Prentice-Hall India, 2004.
3. S.O.Pillai, "Solid State Physics" Revised 6<sup>th</sup> ed., New Age International Publications, 2005.
4. V.Rajendran, "Engineering Physics", 1<sup>st</sup> ed., TMH Publications, 2010.

#### (HS109) ENGINEERING CHEMISTRY

L	T	P	To	C
3	1	-	4	4

#### UNIT - I

**Water technology:** Introduction-Hardness of water-Determination of hardness by EDTA-Disadvantages of hard water-Scales & Sludges-Caustic embrittlement-Boiler corrosion-Priming & Foaming-Softening Methods-Desalination of brackish water-Chemical analysis of water.

#### UNIT - II

**Science of Corrosion:** Introduction-Dry corrosion (chemical)-Wet corrosion(electro chemical )-Mechanism of wet corrosion-Bimetallic corrosion-Concentration cell corrosion-Factors influencing corrosion-Corrosion control methods & Protective coatings.

#### UNIT - III

##### Engineering materials:

- a). Nature of bonding, differences between molecules and materials, covalent, noncovalent supra molecular interactions.
- b). Properties and engineering applications of Ceramics, Refractories, Glasses, Pottery, Abrasives, Lubricants.

#### UNIT - IV

##### Polymers:

- (a) Introduction –Types of polymerization-Preparation, properties & applications of Silicones, Plastics, Rubber, Vulcanization and Engineering plastics.
- (b) Elementary Treatment of Membranes.

#### UNIT - V

**NANOCHEMISTRY:** Introduction- Carbon nanotubes- Structure, synthesis, properties & potential applications of carbon nanotubes-Nano engineering devices-Fabrication, properties & applications of LOC-Micromachinery-Nanomotor-Nanopore-Nanosensor.

#### TEXTBOOKS:

1. P.C Jain and Monica Jain, "Engineering Chemistry", 15<sup>th</sup> ed., Dhanpat Rai Publications 2009.
2. M.R. Senapati, "Advanced Engineering Chemistry" 2<sup>nd</sup> ed., Lakshmi Publications, 2006.

## REFERENCE BOOKS:

1. S.S.Dara, "Text book of Engineering Chemistry" 1<sup>st</sup> ed., S. Chand Publications, 2009.
2. V.R Gowrikar, N.V.Viswanathan and J.Sridhar; "Ploymer Science", 1<sup>st</sup> ed., New Age Publications, 2006.
3. C.V. Agarwal, C.P. Murthy and A.Naidu, "Chemistry of Engineering materials", 9<sup>th</sup> ed., BSP Publications, 2008.
4. Phani Kumar,"Principles of Nano technology material, tools and process at nanoscale" 1<sup>st</sup> ed., Scitech Publications, 2008.

## (EE101) BASIC ELECTRICAL & ELECTRONICS ENGINEERING

L	T	P	To	C
2	2	-	4	4

### UNIT - I

**Electric Circuits:** Representation of sources and network elements - Ohms Law – series, parallel circuits - Kirchoffs Laws – mesh and nodal analysis of simple resistive circuits.

**Magnetic Circuits** Magnetomotive force, reluctance, flux and flux density – calculations in a ring shaped iron specimen with an air gap – self and mutual inductances.

### UNIT - II

**A.C. Circuits:** Generation of A.C. voltages- frequency – crest value – average value and form factor – R.M.S. value of alternating wave forms – phasor representation of alternating quantities.

Analysis of A.C. circuits – series and parallel – series resonance and parallel resonance.

Three phase systems – relation between phase and line quantities of voltages and currents in star and delta connected systems – analysis of balanced three phase circuits – power consumed in a three phase balanced load.

### UNIT - III

**D.C. Machines :** Principle of operation of D.C. machines-EMF equation – types of D.C. generators types of D.C. motors – characteristics. Transformers : Principle of operation of single phase transformer – constructional features – EMF equation –transformation ratio of voltages and currents.

### UNIT - IV

**A.C. Machines :** Principle of operation of three phase induction motors – slip ring and squirrel cage motors – torque slip characteristics –Principle of operation of single phase induction motors – Capacitors start, capacitor run, split phase and shade pole motors.

Introduction to synchronous machines, applications.

### UNIT - V

**Semiconductor Devices:** Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction -

V I characteristic of PN junction diode - Zener diode - Zener diode characteristics - Half wave and full wave rectifiers - Voltage regulation.Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits – Amplifier operation of transistor

## TEXT BOOKS:

1. Mittle, V.N., Basic Electrical Engineering, TMH ed., New - Delhi, 1990

2. U.Bakshi & A.Bakshi, “Basic Electrical Engineering”, 1<sup>st</sup> ed., Technical Publications, Pune, 2005.

#### REFERENCE BOOKS:

1. Del Taro, “Electrical Engineering Fundamentals”, 2<sup>nd</sup> ed., Prentice Hall of India Pvt. Ltd., New Delhi.
2. Millman & Halkias, “Integrated Electronics”, McGraw Hill, 1979.
3. A.K. Thereja & B.L. Thereja, “Electrical Technology”, Vol. – II, S.Chand Publications, 2007.

(HS101) TECHNICAL ENGLISH COMMUNICATION	L	T	P	To	C
	3	1	-	4	4

#### UNIT – I: Reading : Skimming and Scanning

- **Gift of The Magi** – O Henry
- **IF** - Rudyard Kipling
- **A Nation’s Strength** - Dr. Karan Singh
- **Is Science a religion** - Richard Dawking

#### UNIT – II: Mechanics of Writing

- Phrase, Clause
- Sentence construction and synthesis
- Sentence Improvement
- Correction of Sentences

#### UNIT – III: Study Skills

**A.P.J.Abdul Kalam, Ignited Minds, 1<sup>st</sup> Edition, Penguin Publishers, 2003**

- Reading comprehension
- Note making
- Precis Writing
- Summarizing

#### UNIT-IV: Vocabulary

- Academic Word list
- 500 words – Frequently Used Scientific, Technical and Business Terminology
- Idioms and Phrasal Verbs
- One Word substitutes
- Indianisms

#### UNIT – V: Writing Skills

##### *Paragraph Writing*

- Descriptive Writing
- People
- Places
- Processes
- Objects

### ***Letter Writing***

- Formal Letter
- Informal Letter
- Business Letter

### **REFERENCE BOOKS:**

1. V. R. Narayana Swamy, "Strengthen Your Writing", 1<sup>st</sup> ed., Orient Longman, 2003.
2. John Seely, "The Oxford Guide to Writing & Speaking" 2<sup>nd</sup> ed., Oxfordup, 2008.
3. K R Narayana Swamy, "Success with Grammar and Composition" 1<sup>st</sup> ed., Orient Longman, 2002.
4. Thomas Elliott Berry, "The Most Common Mistakes in English usage", 1<sup>st</sup> ed., Tata McGraw Hill, 2004.
5. Yedugiri, Viva Books, "Making Sense of English".
6. Michael Swan, "Practical English usage", 3<sup>rd</sup> ed., Oxford University Press, 2001.
7. AR Thorat, B.S.Valke, SB Gokhale, "Enriching your Competence in English", 1<sup>st</sup> ed., Orient Longman, 2003.
8. "Essential Activator", 1<sup>st</sup> edition, Orient Longman, 2000.
9. Mark Lester and Larry, "The McGraw Hill Handbook of English Grammar & Usage", 1<sup>st</sup> ed., TMH, 2009.
10. Margaret M Maison, "Examine your English", 1<sup>st</sup> ed., Orient Longman, 1999.
11. Raymond Murphy, "English Grammar Usage", 3<sup>rd</sup> ed., Cambridge University Press, 2004.

### **(HS108) PHYSICS AND CHEMISTRY LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
-	-	3	3	2

### **PHYSICS LAB:**

1. Verification of laws of transverse vibrations in stretched string - Sonometer
2. Melde's Experiment - Transverse and Longitudinal modes.
3. Determination of Rigidity modulus of a material in the form of a wire - Torsional pendulum
4. Dispersive power of the material of a Prism - Spectrometer
5. Determination of wavelength of a monochromatic light source - Diffraction Grating.
6. Field along the axis of a circular coil – Stewart Gee's apparatus.
7. Volume Resonator.

### **CHEMISTRY LAB:**

1. Estimation of hardness of water
2. Estimation of chlorides by Argentometry
3. Percentage of available chlorine in Bleaching powder
4. Percentage purity of Washing soda
5. Determination of Iron (III) by Dichrometry
6. Preparation of Urea- Formaldehyde resin/ Bakelite
7. Estimation of Calcium in Lime stone

## REFERENCE BOOKS:

1. Aparna, Y and Venkateswara Rao, K. "Lab Manual of Engineering Physics", 1<sup>st</sup> ed., VGS Books Links, Vijayawada, 2009.
2. Mendham, R.C Denney, J.D. Bares, M.Thomas & B. Siva Sankar, "Vogel's Text book of qualitative Chemical Analysis", Vol.-I, Pearson Publications, 2009.

## (EE103) BASIC ELECTRICAL & ELECTRONICS LAB

L	T	P	To	C
-	-	3	3	2

### Section-A

- 1) Load test on 3-phase induction motor
- 2) No-load and short circuit tests on a single phase transformer
- 3) Measurement of power in a 3-phase circuit
- 4) O.C. C and S.C. tests on a 3-phase alternator
- 5) Magnetization characteristic of a D.C. separately excited generator
- 6) Study of a fluorescent lamp
- 7) Series resonance – variation of current with frequency

### Section-B

- 1) Characteristics of PN junction diode
- 2) Characteristics of Zener diode
- 3) Full wave and half wave Rectifier without filter
- 4) Full wave and half wave Rectifier with filter
- 5) Characteristics of CB transistor
- 6) SCR characteristics

## (HS102) ENGLISH LANGUAGE LABORATORY

L	T	P	To	C
-	-	3	3	2

### 1. Speech mechanism & Phonetics

1. Role of various Speech organs
2. Vowels and Consonants
3. Sounds and spellings

### 2. Introduction to Pronunciation

1. Syllable division
  2. Word Pronunciation
  3. Stress Pattern
  4. Intonation and Modulation
- **Speech Solutions**
  - **American Heritage Dictionary**
  - **Cambridge Advanced Learner's Dictionary – Macmillan**

### 3. Listening and Reading Comprehension

Recognizing lecture / talk structure; Active listening, Identifying important markers, signposts; Guessing and Deducing meaning of unfamiliar words and word groups from context and tone of the speaker; Recognizing implications, Information not explicitly stated, recognizing the speaker's attitude, evaluating the importance of information, selecting information and note taking; Understanding intonation, voice emphasis etc.

- Rosetta Stone
- TOEFL Mastery
- Spoken English (CIEFL) in 3 volumes with 6 cassettes.

**4. Integrated Speaking Tasks** Speaking in formal & Informal Contexts; Introducing oneself; Asking Questions (open ended/close ended Q's) and Improving replies; Agreeing and disagreeing, Complaining and apologizing; Advising and Persuading; Taking the initiative; Expressing Intention; Expressing doubt and reservation; Expressing certainty and emphasizing a point; Asking for opinion; Asking for Information; Requesting and Seeking permission; Inviting, obliging; Praising and Complimenting; Expressing Sympathy, Hypothesizing, cautioning or warning; Using Telephone.

**5. Vocabulary** 1000 Academic Word List – Avril Coxhead

#### REFERENCE BOOK :

1. T M Farhathulla, "*Communication Skills for Technical Students*", 1<sup>st</sup> ed., Orient Longman, 2002.

### I Year II - Semester

(HS105) ENGINEERING MATHEMATICS – II	L	T	P	To	C
	3	1	-	4	4

#### UNIT – I

**Complex Analysis:** Introduction to complex functions, Analytical Functions, Cauchy-Riemann equations in Cartesian and polar form, Harmonic Function, Harmonic conjugate, construction of harmonic conjugate.

#### UNIT - II

**Partial Differential Equations:** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions. Solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Classification of second order equations, Method of separation of variables.

#### UNIT – III

**Vector Calculus – Vector Differentiation:** Differentiation of Vector function, Scalar and Vector Field, Gradient, Divergence, Curl and their related properties of sums- products- Laplacian and second order operators.

#### UNIT – IV

**Vector Calculus – Vector Integration :** Vector Integration, Line integral, work done, Potential function, area, surface and volume integrals Vector integral theorems: Green's theorem in Plane, Stoke's and Gauss's Divergence Theorem (Without proof). Verification of Green's, Stoke's and Gauss's Theorems.

#### UNIT - V

**Fourier Series and Fourier Transformations : Fourier Series:** Fourier series of a function having period  $2\pi$ , Dirichlet's conditions, Fourier series of a function having period  $2C$ , even and odd periodic continuation, Half-range Fourier sine and cosine expansions. Fourier



integral theorem (only statement), Fourier sine and cosine integrals. Fourier transform, Fourier sine and cosine transforms, properties, inverse transforms, Finite Fourier transforms.

#### **TEXT BOOKS :**

1. B. V. Raman, "Engineering Mathematics –I", Tata McGraw Hill, 2008.
2. B. V. Raman, "Mathematical Methods", Tata McGraw Hill, 2008.
3. Irvin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> ed., Wiley India Pvt. Ltd, 1999.
4. T.K.V. Iyengar et al, "Text book of Engineering Mathematics", Vol. III", S. Chand & Co., 2009.
5. T .K.V. Iyengar et al, "Mathematical Methods", S. Chand & Co., 2009.

#### **REFERENCE BOOKS :**

1. R.K. Jain, S.R.K. Iyengar, "Advance Engineering Mathematics", 2<sup>nd</sup> ed., Narosa Publishing House.
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, 2008.
3. Debashis Dutta, "TextBook of Engineering Mathematics", Vol.- I &II, New Age International Publishers, 2007.
4. B.S. Grewal, "Higher Engineering Mathematics", 40<sup>th</sup> ed., Khanna Publishers, 2009.

#### **(CE102) ENGINEERING MECHANICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT - I**

**Basic Concepts and Principles of Statics :** Introduction - Laws of Mechanics -forces and moments, system of forces-Coplanar Forces -Resolution and Composition of forces.

#### **UNIT – II**

**Equilibrium of Rigid Bodies:** Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equations of equilibrium of coplanar systems,

#### **UNIT – III**

**Properties of Surfaces and Solids :** Determination of Centroid of lines, Areas and Volumes -second moment of plane areas – Moment of Inertia of sections and shaded areas – Parallel axis theorems and perpendicular axis theorems.

#### **UNIT – IV**

**Friction :** Frictional Force - Laws of Coloumb Friction – Types of Friction – Sliding Friction -Rolling Friction - Belt Friction – Ladder Friction.

#### **UNIT – V**

**Dynamics:** Displacement, Velocity and acceleration their relationship- Relative motion - Newton's Law Work energy equation. Impulse Momentum Equations - Curvilinear motion

#### **TEXT BOOKS:**

1. L. Singer - Harper, "Engineering Mechanics", 3<sup>rd</sup> ed., Fedinand . – Collins, 1975.
2. A. K. Tayal, "Engineering Mechanics", Umesh Publications, 2005.

## REFERENCE BOOKS:

1. Timoshenko & Young, "Engineering Mechanics", 4<sup>th</sup> ed., Tata McGraw Hill, New Delhi, 2007.
2. S. S. Bhavakati & J. G. Rajasekharappa, "Engineering Mechanics", 2<sup>nd</sup> ed., New Age International Publications, New Delhi, 1998.

## (HS110) ENVIRONMENTAL STUDIES

L	T	P	To	C
3	0	-	3	3

### UNIT – I

**Environment and Natural Resources :** Environment: Definition, Scope and Importance – Need for Public Awareness Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest Resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources: Use and over utilization of surface and ground water –Dams its Benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity–Energy resources: renewable and non-renewable energy sources, alternate energy sources. Land resources: Land as a resource, land degradation, Soil erosion – case studies - Role of an individual in conservation of natural resources.

### UNIT – II

**Ecosystems and Biodiversity:** **Ecosystems :** Concept of an ecosystem. - Structure and function of an ecosystem - Ecological succession. - Food chains, food webs -Structure and functional features of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) of India - Value of biodiversity- Biodiversity at global, National and local levels - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India – Conservation of biodiversity.

### UNIT - III

**Environmental Pollution and Applications of Remote Sensing / GIS on Environment:** Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution - Solid waste Management: Causes, effects and control measures of municipal and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides. Remote sensing / GIS: Introduction of remote sensing / GIS, definition of remote sensing, applications of the remote sensing on environment (site selection, land use/land cover pattern, water/air/soil quality models, a criteria of environmental information systems).

### UNIT – IV

**Social issues and EIA :** Sustainable development -Urban problems related to energy and water, water conservation: Cloud Seeding (Artificial rain making system), rainwater harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns-Case Studies -Climate change, global warming, acid rain, ozone layer depletion -Case Studies- Environment Protection Act. - Air (Prevention and Control of Pollution) Act. - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act

EIA: introduction to E.I.A.-definition of E.I.A and E.I.S – scope and objectives of E.I.A.- methods of E.I.A –CEIA, REIA, MOEF, CPCB, SPCB – Importance of E.I.A in proposed Projects / Industry / Developmental activity

## UNIT - V

**Environmental Sanitation : Food sanitation:** Food and drugs Act, public health considerations, food preservations, food borne diseases-Milk sanitation: tests for milk  
**Biodiversity:** introduction of biodiversity, Bio-geographical classification , pasteurization of the milk-Swimming pools: operations and maintenances-water borne diseases-air borne diseases-viral diseases (HIV/AIDS, SARS, bird-flu, anthrax)- maintenance of sanitary and hygienic conditions

**Field Work/Environmental Visit:** Visit to a local area to document environmental assets – river/ forest/ grassland / hill /mountain - Study of local environment - common plants, insects, birds - Study of simple ecosystems – pond, river, hill, slopes etc - Visits to industries, water treatment plants, effluent treatment plants

## TEXT BOOKS:

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2008.
2. Dr. M. Chandrasekhar, “A Text book of Environmental Studies”, HI-TECH publications, 2006
3. Erach Bharucha, “A Text book of Environmental Studies”, UGC Publishers, 2005.

## REFERENCE BOOKS:

1. Dr. M. Anji Reddy, “A Text book of environmental science and Technology”, B S Publications, 2008
2. Dr. K. Mukkanti, “A Text book of Environmental Studies”, S.CHAND Company Ltd, 2009.
3. EHILRS and ST, “Text book of Municipal and Rural Sanitation”, M.S Hill, 1998.
4. C. S. Rao, Wiley Eastern Ltd, “Environmental Pollution Control Engineering”, New Age International Ltd, 2001
5. Dr. M. Anji Reddy, “Introduction to Remote Sensing”, B S Publications, 2004.
6. Kurian Joseph and R.Nagendram, “Essentials of environmental studies”, Pearson Education Pt Ltd, Delhi, 2007.

## (CS102) INTRODUCTION OF COMPUTER PROGRAMMING

L	T	P	To	C
3	1	-	4	4

## UNIT - I

### Basic Structure of C - Operations & expressions

Basic Structure of C Programs, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Class, Assigning Values to Variables, Defining Symbolic Constants, Declaring a Variable as Constant, Arithmetic Operators Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Operator Precedence and Associativity, Simple IF Statement, The IF ELSE Statement, Nesting of IF ELSE Statements, The ELSE IF Ladder, The Switch Statements, The ? : Operator, the GOTO Statement.

## UNIT - II

### Iterative Statements and Arrays

The WHILE Statement, The DO Statement, The FOR Statement, Introduction One-dimensional Arrays, Declaration of One dimensional Arrays, Initialization of One – Dimensional Arrays, Two-dimensional Arrays, Initializing two – dimensional Arrays, Multi-dimensional Arrays, Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screen, String-handling functions.

## UNIT - III

### Functions and Pointers

Need for User-defined Functions, A Multi-function Program, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, Recursion, Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Pointers and Arrays.

## UNIT - IV

**Structures :** Introduction, Defining a structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Copying and comparing Structure Variables, Operations on Individual Members, Arrays of Structures, Arrays within Structures, Structures within Structures, Structures and Functions, Unions, Size of Structures, Bit Fields.

## UNIT - V

**File Operations:** Defining and Opening a File, Closing a File, Input / Output Operations on Files, Random Access to Files, Dynamic Memory Allocation. Dynamic Memory Allocation

### TEXT BOOKS :

1. E. Balagurusamy, “Programming in ANSI C”, 4<sup>th</sup> ed., The McGraw-Hill Companies, 2008.

### REFERENCE BOOKS :

1. B.A. Forouzan and R.F. Gilberg, “Computer science, A structured programming approach using C”, 3<sup>rd</sup> ed., Thomson, 2007.
2. AL Kelley Ira Pohl, “A Book on C Programming in C”, 4<sup>th</sup> ed., Pearson Education, 2009.
3. B.W. Kernighan, Dennis M.Ritchie, “The C Programming Language”, 2<sup>nd</sup> ed., PHI/Pearson Education, 2009.
4. Yashwanth P.Kanethkar, “Let us C”, 8<sup>th</sup> ed., BPB Publisher, 2007.
5. J.A. Jones & K. Harrow, “C Programming with problem solving”, 1<sup>st</sup> ed., Dreamtech Press, 2007.

## (ME102) ELEMENTS OF MECHANICAL AND CIVIL ENGINEERING

L	T	P	To	C
3	1	-	4	4

## UNIT – I

### Introduction to Mechanical Engineering:

Introduction to Mechanical Engineering : Engineering Materials - Classification - Ferrous & Non ferrous metals and alloys - Mechanical Properties. Metal Joining Process (Welding only) Concept of welding - Gas Welding – Oxy acetylene welding - Types of flames - Arc welding-

Straight & Reverse polarity - Manual metal arc welding - Electrode requirements - Soldering. Manufacturing Process:

Casting – Types of patterns - Pattern allowances - Sand mould casting - Forging - Smith, Drop, Press & Machine forging.

## **UNIT – II**

### **Thermodynamic Concepts & Internal Combustion Engine:**

Thermodynamic Concepts : Concept of temperature – Thermodynamics Laws - Zeroth, First and Second Law - Heat Transfer – Types of Heat Transfer - Conduction, Convection and Radiation (Concepts only).

Internal Combustion Engine : Working of Internal Combustion Engine – S.I. Engine – C.I. Engine – 2 stroke engine – 4 stroke engine.

## **UNIT – III**

**Power Generation Techniques:** Various methods of power generation – Working Principle and Layouts of Thermal – Hydro – Nuclear – Wind – Solar power generation – Merits – Demerits.

## **UNIT - IV**

### **Introduction to Civil Engineering:**

Introduction to Civil Engineering, Scope of different field of Civil Engineering – Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources and Irrigation Engineering, Transportation Engineering, Environmental Engineering.

**Roads:** Type of roads, Components of road and their functions. Bridges: Types of bridges and their Functions.

**Dams:** Types of dams, uses of dams.

## **UNIT - V**

### **Building Planning & Surveying:**

Elements of a building, planning requirements of Residential buildings. Surveying: Principles of Surveying, Methods of surveying – Chain Surveying, leveling, theodolite, total station (Scope is limited to brief description of equipment only).

### **TEXT BOOKS:**

1. Rajput, “Elements of Mechanical Engineering” 4<sup>th</sup> ed., Lakshmi Publications, New Delhi, 2006.
2. Jagadeesh T R and Jayaram, “Elements of Civil Engineering”, 4<sup>th</sup> ed., Sapna Book House, Bangalore, 2010.

### **REFERENCES:**

1. S S Bhavikatti, “Elements of Civil Engineering”, 4<sup>th</sup> ed., Vikas Publishing House Pvt. Ltd., New Delhi, 2009.
2. P K Nag, “Power Plant Engineering”, 2<sup>nd</sup> ed., Tata McGraw Hill, New Delhi, 2008.
3. R. Yadav, “Thermodynamics & Heat Engines, Volume-1”, 2<sup>nd</sup> ed., Central Publishing House, Allahabad, 2005.
4. P.N. Rao, “Manufacturing technology”, 2<sup>nd</sup> ed., Tata McGrahill, 2008.

**(ME104) ENGINEERING DRAWING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
1	-	3	4	3

**UNIT- I****Introduction to Engineering drawing:**

Introduction to Engineering Drawing – different lines, lettering, dimensioning – Dividing the line into n parts - Construction of polygon. Projection of points - Projection of straight lines - inclined to one plane and both the planes

**UNIT – II****Projection of Planes & Solids:**

Projection of planes - Simple planes – Planes inclined to reference planes. Projection of solids – prisms – cylinders – cones - pyramids – solid axis inclined to reference plane

**UNIT- III**

**Sections of Solids:** Sectional views of right regular solids – prism, cylinder, pyramid , cone.

**UNIT – IV**

**Introduction to AUTO CAD:** Introduction to CAD - AUTO CAD Commands - Basic commands practice.

**UNIT –V**

**Isometric projections using CAD:** Isometric projections using CAD - Simple objects. Orthographic views using CAD

**TEST BOOKS**

1. N.D.Bhatt, “Engineering Drawing”, 49<sup>th</sup> ed., Charotar Publication, 2007.
2. K. Venugopal, “Engineering Drawing through Auto CAD”, 1<sup>st</sup> ed., New Age Publication, 2008.

**REFERENCE BOOKS**

1. Jhole, “Engineering Drawing”, 2<sup>nd</sup> ed., Tata McGraw Hill, 2008.
2. K.L. Narayana, “Engineering drawing” 2<sup>nd</sup> ed., Scitech Publications, 2008.

**(CS104) COMPUTER PROGRAMMING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
-	-	3	3	2

1. a) Generate a Fahrenheit-Celsius conversion table.  
b) Implement the concept of Fibonacci.  
c) Generate all the prime numbers in a given range.
2. a) Implement a C program that finds the roots of a Quadratic equation.  
b) Implement a C program to evaluate ex.
3. a) Implement the following by using Functions:  
i) Factorial of a given integer using recursive function.  
ii) Check whether the given number is Armstrong or not.
4. a) Implement a C program to find the largest of three numbers using Nested - if.  
b) Implement various Arithmetic operators using Switch.
5. a) Implement a C program that reads N integers and Print them.

- b) Implement the following using Two-dimensional Arrays.
    - i) Addition of Two Matrices
    - ii) Multiplication of Two Matrices
6. a) Implement the following using Functions:
  - i) To insert a sub-string into given main string from a given position.
  - ii) To delete 'n' Characters from a given position in a given string.
- b) Check whether the given string is palindrome or not.
7. a) Implement a C program to count the lines, words and characters in a given text.
- b) Implement a C program that returns the no. of times the given character is found in a given string.
8. a) Implement a C program to generate Pascal's triangle.
- b) Implement a C program to construct a pyramid of numbers.
9. a) Implement a C program on Enumeration.
- b) Demonstrate Unions using C program.
10. Implement a C program that illustrates String-Handling Functions.
11. a) Implement the following
  - i) Reading a complex number
  - ii) Writing a complex number
  - iii) Addition of two complex numbers
  - iv) Multiplication of two complex numbers
12. Implement a C program using Structure that maintains the Student information.
13. a) Implement the following using pointers:
  - i) Add two numbers
  - ii) Subtract two numbers
- b) Implement a C program that reverses the elements of an array. The function must accept only one pointer value and return void.
14. a) Implement a C program that returns the number of words in a given file.
- b) Implement a C program that compares two files to find whether they are equal or not.
15. a) Implement a C program which copies one file to another.
- b) Implement a C program to reverse the first 'n' characters in a file.

#### **TEXT BOOKS:**

1. Let us C, Yashwanth P. Kanethkar, BPB Publisher

#### **REFERENCE BOOKS:**

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, 3<sup>rd</sup> ed., Thomson

#### **(ME106) WORKSHOP PRACTICE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
-	-	3	3	2

#### **MECHANICAL:**

##### **Trades for Exercises:**

1. Carpentry
2. Fitting
3. Tin-Smithy
4. Black Smithy
5. House-wiring

In each trade, the student has to perform three jobs.

### **INFORMATION TECHNOLOGY:**

#### **Word Orientation:**

**Task 1:** Using word to create project certificate.

**Task 2:** Creating project abstract Features

**Task 3:** Creating a Newsletter

**Task 4:** Creating a Feedback form

#### **Excel Orientation**

**Task 1:** Creating a Scheduler

**Task 2:** Calculating GPA

**Task 3:** Performance Analysis

**Task 4:** Cricket Score Card

#### **MS Power Point Orientation**

**Task1:** Creating basic power point presentation

**Task 2:** Making presentations interactive.

**Task 3:** Best practices in designing and preparing power point presentation.

**Task 4:** Using Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing

### **REFERENCES :**

1. Vikas Gupta "Comdex Information Technology course tool kit", 1<sup>st</sup> ed., WILEY Dreamtech, 2002.
2. Cheryl A Schmidt, "The Complete Computer upgrade and repair book", 3<sup>rd</sup> ed., WILEY Dreamtech, 2002.
3. ITL Education Solutions Limited, "Introduction to Information Technology", 1<sup>st</sup> ed., Pearson Education, 2005.
4. Kate J. Chase, "PC Hardware and A+Handbook", 1<sup>st</sup> ed., PHI (Microsoft), 2007.
5. Leslie Lamport, "Latex : A document Preparation Companion", 2<sup>nd</sup> ed., Addison Wisly, 1994.
6. All others related material is available at (a) [www.sssolutions.in](http://www.sssolutions.in) and (b) [www.sontisoftsolutions.org](http://www.sontisoftsolutions.org).

## **II Year I Semester**

### **(AG 201) ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS AND FOOD QUALITY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT I**

Importance of engineering properties of biological materials, Study of different physical and thermal characteristics of important biological materials like shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc.



## **UNIT II**

Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition. Rheological characteristics like stress, strain time effects, rheological models and their equations. Aerodynamic characteristics and frictional properties.

## **UNIT III**

Application of engineering properties in handling processing machines and storage structures. Concept, objectives and need of quality, quality control, methods of quality control, sampling.

## **UNIT IV**

Purpose, sampling techniques, requirements and sampling procedures for liquid, powdered and granular materials, sensory quality control, panel selection methods, interpretation of sensory results in statistical quality control, TQM and TQC, consumer preferences and acceptance.

## **UNIT V**

Food Laws and Regulations in India. Food grades and standards BIS, AGMARK, PFA, FPO, CAC (Codex Alimentarius Commission), sanitation in food industry, GMP, HACCP (Hazard analysis and critical control point) and ISO 9000 Series.

### **TEXT BOOKS:**

1. Birch G G and Paiker K. J. (1990). Control of food quality and food analysis. Elsevier applied science.
2. Herschdoerfer, S.N. (1980). Quality Control in Food Industry. Academic Press Inc.
3. Mohsenin, N. N. (1996). Electrical and Electro-magnetic radiation properties of food and Agricultural materials. Gordon & Breach publishers Inc. U. K.

### **REFERENCE BOOKS:**

1. Rao, M.A and Rizui, S.S.H. (1986). Engineering Properties of Foods. Marcell Dekker, New York.
2. Sara, M & Carol Wallace. (1993). HACCP- A Practical Approach. Chapman & Hall, U.K.
3. Singhal, O.P and Samuel, D.V.K. (2003). Engineering Properties of Biological Materials. Saroj Prakashan, Allahabad.

## **(AG202) SOIL AND FLUID MECHANICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Introduction of soil mechanics, field of soil mechanics, phase diagram physical and index properties of soil classification of soils, general classification based on particles size, textural classification and I.S. soil classification system stress condition in soils, effective and neutral stress, elementary concept of Bousinesque and Westergaard's analysis, new mark influence chart. Shear strength mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress mohr-coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear to be circle, theoretical test. Numerical exercise based on various types of tests.

## **UNIT II**

Compaction composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction text field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory Laboratory consolidation text, calculation of void ratio and coefficient of volume change, Taylor's and Casagrand's method, determination of coefficient of consolidation.

## **UNIT III**

Earth pressure: Plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure active and passive earth pressure for cohesive soils, simple numerical exercise. Stability of slopes: Introduction to stability analysis of infinite and finite slopes friction circles method Taylor's stability number.

## **UNIT IV**

Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, metacentre and metacentric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion.

## **UNIT V**

Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter and nozzle, siphon; Laminar flow: Stress-strain relationships, flow between infinite parallel plates - both plates fixed, one plate moving, discharge, average velocity, shear stress and pressure gradient; Laminar and turbulent flow in pipes, general equation for head loss-Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient, power transmission through pipe; Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.

## **TEXT BOOKS:**

1. Bansal, R.K. (1998). Fluid Mechanics and Hydraulic Machines. Laxmi Publications, Madras.
2. Frank M White. (2003). Fluid Mechanics. Tata Mc Graw Hill Publishers.
3. Grade, R.J. (1992). Fluid mechanics through problems. Wiley Eastern Ltd. Madras.
4. Henderson, F. (1996). Open Channel Flow. Macmillan, New York.
5. William R. Gill and Glen E. Vanden Berg. (1967). Soil dynamics in tillage and traction, Agricultural Research Service, U.S. Dept. of Agriculture

## **REFERENCE BOOKS:**

1. Braja M. Das and G. V. Ramana (2010). Principles of Soil Dynamics, Cengage learning.
2. Modi, P.M. and Seth, S.M. (1991). Hydraulics and Fluid Mechanics. Standard Book House, New Delhi.
3. Shames, I. (1982). Mechanics of Fluids (II ed.). Mc Graw Hill International.
4. Subramanya, K. (1992). Fluid Mechanics. Tata Mc Graw-Hill Pub. Co., New Delhi.

## **(AC201) STRENGTH OF MATERIALS AND DESIGN OF STRUCTURES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Elasticity–Stresses and strains-Elastic limit–Elastic constants-Lateral strain- Composite sections-Temperature stresses-Volumetric strain in a body- Resilience and strain energy.

### **UNIT II**

Analysis of statically determinate beams- Shear force and bending moment diagrams, Bending and shearing stresses in beams – slope and deflection of beams using double integration method, Macaulay’s method, Moment area theorems and conjugate beam method.

### **UNIT III**

Combined bending and direct stresses - Columns and struts - Euler’s theory -Empirical formulae for loads on columns; Stresses in thin cylindrical shells – Torsion of shafts and springs; Analysis of statically indeterminate beams, Propped beams, fixed and continuous beams – Analysis using superposition, Three moment equation and moment distribution methods.

### **UNIT IV**

Analysis and design of singly reinforced and doubly reinforced beams – Shear, bond and torsion – Design of T beams – Slabs – Design of one way and two way slab ( IS code method only) – Columns, Foundations, Retaining walls, Silos and Ferro cement tanks.

### **UNIT V**

Loads and use of BIS codes - Design of riveted and welded connections – Design of structural steel members in tension, compression and bending.

### **TEXT BOOKS:**

1. Bansal, R.K. (1992). Engineering Mechanics and Strength of materials. Laxmi Publications, New Delhi.
2. Gurcharan Singh. (1986). Theory and Design of R.C.C. Structures. Standard Publishers and Distributors, New Delhi.
3. Junnarkar, S.B. (1995).Mechanics of structures (Vol. I and II). Charotar Pub. House, Anand.
4. Khurmi, R.S. (1996)Strength of Materials. S. Chand and Company Limited, New Delhi.
5. Kumar, K. L. (2003). Engineering Mechanics. Tata Mc Graw Hill Publishing Company, New Delhi.
6. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain. (1994). Reinforced Concrete Structures (Vol. I). Laxmi Publications, New Delhi.

### **REFERENCE BOOKS:**

1. Ramamrutham, S. and Narayan, R. (1995). Design of Steel Structures. Dhanpat Rai and Sons, Delhi.
2. Ramamrutham. S. (1984). Engineering Mechanics and strength of Materials. Dhanpat Rai and Sons, Nai Sarak, New Delhi.
3. Ramamrutham. S. and Narayan. R. (1997). Strength of Materials. Dhanpat Rai and Sons, Nai Sarak, New Delhi.
4. Sushil Kumar. (1991). Treasure of R. C. C. Design. Standard Book House, Delhi.

**(HS203) ENGINEERING MATHEMATICS-III (PROBABILITY & STATISTICS)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT – I**

**Probability**- axiomatic definition, conditional probability, Baye's theorem, Dependent and independent events, Random variables. Distribution function, probability mass and density functions, expectation, Chebyshev's inequality.

**UNIT-II**

**Special distributions** – Bernoulli, binomial, Poisson, uniform, exponential, independence of random variables normal and Poisson approximations to binomial.

**UNIT – III**

**Estimation & Sampling Distribution** - Population, sample, parameters, point estimation, unbiasedness, consistency. Comparing two estimators, confidence interval estimation for mean. Difference of means, variance, proportions, sample size problem.

**UNIT – IV**

**Test of Hypotheses** - Test of hypotheses- test of means, variance, two sample problems, test of proportions, relation between confidence interval and Test of hypotheses, chi-square goodness of fit, F- test, T-test.

**UNIT-V**

**Correlation & Regression** - Simple linear regression, curve fitting. Covariance correlation tests for slope and correlation, analysis of variance, regression analysis.

**TEXT BOOKS :**

1. S.C. Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12<sup>th</sup> ed., Sultan Chand & Co., New Delhi, 2005.
2. Shanaz bahthul, "Probability & Statistics", Unitech Publishers, 2008.

**REFERENCE BOOKS :**

1. G.S.S. Bhismarao, "Probability and statistics for engineers", 4<sup>th</sup> ed., Scitech publications, 2010.
2. B.V. Ramana, "Engineering Mathematics", 3<sup>rd</sup> ed., Tata McGraw Hill, 2008.
3. Miller and Freund, "Probability & Statistics for Engineering", pearson, 2001.
4. Kumar and Sah , "Thermal Engineering", 2<sup>nd</sup> edition, Narosa publications, New Delhi. 2010.

**(AG203) FARM POWER AND RENEWABLE ENERGY SOURCES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT I**

Sources of farm power -conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. Study of engine components their construction, operating principles and functions.

## **UNIT II**

Engine systems: valves & valve mechanism. Fuel & air supply, cooling, lubricating, ignition, starting and electrical systems. Study of constructional details, adjustments & operating principles of these systems.

## **UNIT III**

IC engine fuels - their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types & study of their properties. Engine governing systems.

## **UNIT IV**

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Briquetting , Types of Briquetting machines, Wind energy, Types of wind mills, Constructional details and application of wind mills; Modern applications and future potential of renewable energy sources.

## **UNIT V**

Solar energy, Solar flat plate and focusing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications / Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar pumping systems.

## **TEXT BOOKS:**

1. Ballaney, P.L. (1985). Thermal Engineering. Khanna Pulishers, Delhi.
2. Donnel Hunt. Farm Power Machinery and management. Iowa State University Press, Ames, USA.
3. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
4. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair. Sathya Prakashan and Tech India Publications, New Delhi.
5. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw-Hill Publishing Company Ltd, New Delhi.
6. John Twidell and Tony Weir. (1986). Renewable energy resources. . E & F.N Spon Ltd., New York.
7. John Twidell and Tony Weir. (1986). Renewable energy resources. E & F.N Spon Ltd., New York.

## **REFERENCE BOOKS:**

1. Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, . John Wiley & Sons, New-York.
2. Lysen, E.H. (1983). Introduction to Wind Energy. CWD, Netherlands.
3. Mathur, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
4. Mathur,A.N and Rathore,N.S. Renewable energy and environment. Himanshu Publications.,Udaipur. Monga,G.S and Sanctis,V.J. Non-conventional Energy: Growth. Resources and policies.
5. Sukathme, S.P. (1996). Solar Energy. Tata McGraw Hill Publishing Company Ltd., New Delhi.

**(AG204) MECHANICS LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
0	0	3	3	2

1. Determination of water content and specific gravity of soil.
2. Determination of field density of soil by core cutter and sand replacement method.
3. Grain size analysis-sieving (Dry sieve analysis) and hydrometer method.
4. Determination of liquid limit by Casagrande' s method.
5. Determination of liquid limit by cone penetrometer and plastic limit.
6. Determination of shrinkage limit.
7. Determination of permeability by constant head and variable head method.
8. Determination of compaction properties by standard proctor test.
9. Determination of shear parameters by Direct shear test.
10. Determination of unconfined compressive strength of soil.
11. Determination of shear parameters by Triaxial test.
12. Determination of consolidation properties of soils.
13. Verification of Bernoulli' s theorem.
14. Determination of coefficient of discharge of venturimeter and orifice meter.
15. Determination of coefficient of friction in pipeline.
16. Determination of coefficient of discharge for rectangular and triangular notch.
17. Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice.
18. Measurement of force exerted by water-jets on flat and hemispherical vanes.
19. Determination of metacentric height.
20. Determination of efficiency of hydraulic ram.
21. Performance evaluation of Pelton and Francis turbine.
22. Velocity distribution in open channels and determination of Manning' s coefficient of rugosity.

**(AC202) STRENGTH OF MATERIALS AND DESIGN OF STRUCTURES LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
0	0	3	2	2

1. Tension test on metal specimen (M.S., C.I.) and observing the behaviour of materials under load.
2. Calculating the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture.
3. To perform the compression test on; Concrete cylinders &cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties.
4. To perform the bending test on the specimens; M.S. Girder, Wooden beam, Plain concrete beams & R.C.C. beam, and to determine the various physical and mechanical properties.
5. To determine Young' s modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points.
6. To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants.
7. To study load deflection and other physical properties of closely coiled helical spring in tension and compression.
8. To perform the Rockwell, Vicker' s and Brinell' s Hardness tests on the given specimens.

9. To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens.
10. To determine compressive & tensile strength of cement after making cubes and briquettes.
11. To measure workability of concrete (slump test, compaction factor test).
12. To determine voids ratio & bulk density of cement, fine aggregates and coarse aggregates.
13. To determine fatigue strength of a given specimen.
14. Design and drawing of steel roof truss.
15. Design and drawing of RCC building.
16. Design and drawing of Retaining wall.

### **(AG205) FARM POWER AND RENEWABLE ENERGY SOURCES LAB**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Introduction to different systems of an CI engine; Engine parts and functions, working principles etc.					
2. Valve system – study, construction and adjustments.					
3. Air cleaning system and Fuel supply system of SI engine.					
4. Diesel injection system & timing.					
5. Cooling system and fan performance, thermostat and radiator performance evaluation; Part load efficiencies & governing.					
6. Lubricating system & adjustments.					
7. Starting and electrical system and Ignition system.					
8. Tractor engine heat balance and engine performance curves.					
9. Preparation of biomass sample and determination of calorific value.					
10. Estimation of ash content and moisture content of biomass.					
11. Estimation of fixed carbon and volatile matter of biomass.					
12. Demonstration of down draft throatless and with throat rice husk gasifier.					
13. Demonstration of working of a fixed dome type biogas plants.					
14. Demonstration of working of a floating drum type biogas plants.					
15. Demonstration of biodiesel preparation.					
16. Measurement of basic solar parameters and demonstration of solar water heater.					
17. Demonstration of solar cooker.					

## **II Year II Semester**

### **(AC203) HEAT AND MASS TRANSFER & REFRIGERATION AND AIR CONDITIONING**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	3	1	-	4	4

#### **UNIT I**

Heat transfer mechanism and types. Conduction; Fourier's law, heat transfer through various geometries, steady state uni directional flow, insulation. Convection; natural and forced convection. Radiation; Stefan Boltzmann's law, Krichoff's law and Plank's law. Concepts of black body and grey body. Emissivity; shape factor.

## **UNIT II**

Heat exchangers; parallel, counter and cross flow. Logarithmic mean temperature difference. Condensation heat transfer. Introduction to mass transfer, Fick's law of diffusion, steady state diffusion of gases and liquid through solids, Equimolar diffusion. Convective mass transfer, Analogy between heat, mass and momentum transfer, Application of mass transfer phenomena in food processing.

## **UNIT III**

Principles of refrigeration, second law of thermodynamics applied to refrigeration, carnot cycle, reversed carnot cycle, coefficient of performance, unit of refrigeration. Refrigeration in food industry, types of refrigeration system, mechanical vapour compression, vapour absorption system, components of mechanical refrigeration, refrigerant, desirable properties of ideal refrigerant.

## **UNIT IV**

Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems, ultra low temperature refrigeration, cold storages, insulation material, design of cold storages, defrosting. Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process.

## **UNIT V**

Air conditioning – principles- Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems – humidifiers and dehumidifiers – cooling load calculations, types of air conditioners –applications.

### **TEXT BOOKS:**

1. Ballaney, P.L. (1980). Refrigeration and Air Conditioning. Khanna Publishers, Delhi- 6. P 765.
2. Arora, C.P. (1981). Refrigeration and Air Conditioning. . Tata- McGraw Hill Publishing Co., New Delhi. P.710.
3. Arora, S.C and Domkundwar, S. (1984). A Course in Heat & Mass Transfer (3 ed.). Dhanpat Rai & Sons, Delhi.
4. Ballalny,P.L. (1980). Thermal Engineering (14 ed.). Khanna Publishing, Delhi.
5. Geankoplis, C.J. (1997). Transport Processes and Unit Operations. Prentice Hall of India, New Delhi.
6. Holman,J.P. (1989). Heat Transfer S.I. Metric Edition. McGraw Hill Book Company Ltd., New Delhi.

### **REFERENCE BOOKS:**

1. Jordoan and Prister. (1973). Refrigeration and Air Conditioning. Prentice- Hall of India, New Delhi.
2. Kapoor, H.R. (1983). Thermal Engineering (Vol. 1). Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Khurmi R. S. and Guptha J. K. (2004). A text book of Refrigeration & Air conditioning. Eurasia Publishing house (P) Ltd. New Delhi.
4. Patel, R.C. (1970). Refrigeration and Air Conditioning. Acharya Book Depot. Baroda.
5. Treybal, R.E. (1981). Mass transfer Operation. McGraw Hill Book.



## **(AG206) SOIL AND WATER CONSERVATION AND STRUCTURES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Soil erosion - causes, types and agents of soil erosion; water erosion - forms of water erosion, mechanics of erosion; Effect of slope, slope length, soil, vegetation, topographical features and rainfall on erosion, gullies and their classification, stages of gully development; soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters.

### **UNIT II**

erosion control measures agronomic measures - contour cropping, strip cropping, mulching; mechanical measures - terraces – level and graded broad base terraces and their design, bench terraces and their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design; gully and ravine reclamation - principles of gully control - vegetative and temporary structures; control measures for stream bank and coastal erosion.

### **UNIT III**

Landslides-factors causing it, land slips, Measures for control; Sedimentation-sedimentation in reservoirs and streams; Estimation and measurement, sediment delivery ratio, trap efficiency; Land use capability classification; Grassed waterways and their design; Introduction to water harvesting techniques; introduction to stream water quality and pollution. Use of Geotextiles in soil and water conservation.

Wind erosion - factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks and shelterbelts, sand dunes stabilization.

### **UNIT IV**

Classification of conservation structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force, flow transitions due to hump and width variations; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy; straight drop spillway - general description, functional use, advantages and disadvantages, structural parts and functions; components of spillway, hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow.

### **UNIT V**

Structural design of a drop spillway-loads on headwall, variables affecting equivalent fluid pressure, determination of saturation line for different flow conditions, seepage under the structure, equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension; chute spillway- general description and its components, hydraulic design, energy dissipaters, design criteria of a SAF stilling basin and its limitations, drop inlet spillway-general description, functional use, design criteria; design of diversions; small earth embankments-their types and design principles, farm ponds, percolation ponds, check dams and reservoirs. Environmental impact assessment.

**TEXT BOOKS:**

1. Chow, V. T. (1957). Open Channel Hydraulics. McGraw Hill.
2. Dhruvanarayana, V. V. (1993). Soil and Water Conservation Research in India. ICAR, New Delhi.
3. Goldman, S. J, Jackson K. and Bursztynsky, T. A. (1986). Erosion and Sediment Control Handbook. McGraw- Hill Book Company.
4. Michael, A. M. and Ojha, T.P. (1985). Principles of Agricultural Engineering. (Vol. II). Jain brothers, New Delhi.
5. Murthy, V.V.N. (1998). Land and Water Management. Kalyani Publishing, New Delhi.

**REFERENCE BOOKS:**

1. Schwab, G.O, Frevert, R.K., Edminister T.W., and Barnes, K.K. (1993). Soil and water conservation engineering. John Wiley and sons.
2. Singh, G. (1985). Manual of Soil and water conservation Practice in India.. Central Soil and water conservation Research and training institute, Dehradun.
3. Suresh, R. (1997). Soil and water Conservation Engineering. Standard Publishers and Distributors.
4. USBR. (1978). Design of Small Canal Structures. U S Bureau of Reclamation.
5. USBR. (1987). Design of Small Dams. US Bureau of Reclamation.

**(AG207) CROP PROCESS AND DRYING AND STORAGE ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT I**

Scope and importance of food processing, post harvest losses, principles and methods of food processing. Processing of farm crops; cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed. Processing of animal products, minimal processing, Principle of size reduction, grain shape, size reduction machines; crushers, grinders, cutting machines etc. – operation, efficiency and power requirement – Rittinger's, Kick' s and Bond' s equation, fineness modulus.

**UNIT II**

Theory of mixing, types of mixtures for dry and paste materials, rate of mixing and power requirement, mixing index. Theory of separation, size and unsized separation, types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation.

**UNIT III**

Microwave and Dielectric heating. Extrusion processing, Scope & importance of material handling devices, study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.

**UNIT IV**

Moisture content and methods for determination, importance of EMC and methods of its determination, EMC curve and EMC model, principle of drying, theory of diffusion, mechanism of drying- falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, drying models, calculation of drying air temperature and air flow rate, air pressure within the grain bed, Shred' s and Hukill' s curve, different methods of

drying including puff drying, foam mat drying, freeze drying, etc. Study of different types of dryers- performance, energy utilization pattern and efficiency, study of drying and dehydration of agricultural products.

## UNIT V

Types and causes of spoilage in storage, conditions for storage of perishable products, functional requirements of storage, control of temperature and relative humidities inside storage, calculation of refrigeration load; modified atmospheric storage and control of its environment, air movement inside the storage, storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through different methods, warehouse - design and control of environment. Storage condition for various fruits and vegetables under cold and CA storage system. Economic, aspects of storage.

### TEXT BOOKS:

1. Carl.W.Hall. (1980). Crop drying. AVI Publishing Co. Inc.
2. Chakravarty,A . (1995). Post Harvest technology of Cereals,Pulses and Oil Seeds. Oxford and IBH Pub.Co., Calcutta.
3. Earle,R.L. (1985). Unit Operations in Food Processing. Pergamon Press, Oxford.U.K.
4. Fellows,P . (1993). Food Processing technology, Principles and Practice. Ellis Horwood,USA.
5. Handerson,S.M and Perry,R.L. (1955). Agri.Process Engg. John,Wiley & Sons, New York.
6. Majumdar, A.S . (2000). Drying Technology in Agriculture & Food Science. Oxford and IBH Publishing House.
7. Mc Cab,W.L and Smith,J.C . (1990). Unit Operation in Chemical Engg. McGraw Hill, Tokyo.

### REFERENCE BOOKS:

1. Multon,J.L. (1989). Preservation and Storage of Grains, Seeds and their By-Products: Cereals, oil Seeds, Pulses and Animal Feed. CBS Publishing and Distributions, Delhi.
2. Ooraikul, B and Stiles, M.E. (1992). Modified atmosphere Packaging of Food. Ellis Horwood Publication, New York.
3. Pande,P.H. (1994). Principles of Agricultural Processing- A Text Book. Kalyani Publishers, Ludhiyana.
4. Ryall Lipton. (1989). Handling, Transportation and Storage of Fruits and Vegetables (Vol. 1 and 2). AVI Publishing Co., West Port, USA.
5. Sahay, K.M and Singh, K.K. (1994). Unit Operation of Agri. Processing. Vikas Publishing House Pvt Ltd, New Delhi.
6. Vijaya Raghavan, S. (1994). Grain Storage Engg.& Technology. Batra Book Service, New Delhi.

## (AC204) THEORY OF MACHINES

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

## UNIT I

Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.

## **UNIT II**

Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers.

Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications.

## **UNIT III**

Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method.

## **UNIT IV**

Chain drives. Types of friction, laws of dry friction. Friction of pivots and collars. Single disc and multiple disc clutches.

Types of governors. constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness, stability, hunting, iso-chronism, power and effort of a governor.

## **UNIT V**

Static and dynamic balancing. Balancing of rotating masses in one and different planes. Partial primary balancing of reciprocating masses.

### **TEXT BOOKS:**

1. Balleney, P.L. Theory of Machines. ,Khanna Publishers, New Delhi.
2. Kurmi R.S. Theory of machines. S.Chand publications., New Delhi.
3. Rattan, S.S. Theory of Machines. Tata Mc Graw Hill Publishing Company Limited. New Delhi.

### **REFERENCE BOOKS:**

1. Erdman.A.G and Sandor G.N. Mechanism Design:Analysis Synthesis (Vol. 1 and 2). Prentice Hall of India, New Delhi.
2. Lal, J.S. Theory of machines. Metropolitan Publishers., New Delhi.
3. Rao, J.S. Theory of Machines through solved problems. New Age International publishers, New Delhi.

## **(AG208) CROP PRODUCTION TECHNOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Soils: Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders; important soil physical properties; and their importance; soil particle distribution; soil inorganic colloids – their composition, properties and origin of charge; ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acid, saline and sodic soils.

### **UNIT II**

Quality or irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils.

Horticulture: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties.

### **UNIT III**

Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilth and its characteristics.

### **UNIT IV**

Soil water plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping.

Garden tools, management of orchard, Extraction and storage of vegetables seeds.

### **UNIT V**

Criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices.

### **TEXT BOOKS:**

1. Bose, T.K and S.K. Mitra. (1990). Fruits, Tropical and Subtropical. Naya Prakash, 206 Bidthan saran, Calcutta.
2. Brady, Nyle C. (1988). The nature and properties of Soils. Eurasia Publishing House Pvt Ltd, New Delhi.
3. Das, P.C. (1993). Vegetable Crops of India. Kalayani Publishers, New Delhi.

### **REFERENCE BOOKS:**

1. De, G.C. (1989). Fundamentals of Agronomy. Oxford & IBH Publishing Co Pvt Ltd, New Delhi.
2. Russel. Soil Condition and Plant Growth. ELBS, Longmans, U.K.

### **(AC205) HMT& REFRIGERATION AND AIR CONDITIONING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
0	0	3	3	2

1. Determination of thermal conductivity of rod and powder.
2. Determination of heat conduction through slabs and composite slabs.
3. Determination of heat transfer through lagged pipes.
4. Determination of film coefficient of heat transfer for free convection and forced convection.
5. Determination of emissivity.
6. Design of heat exchangers LMTD and NTU methods.
7. Study of vapour compression and vapour absorption systems.
8. Solving problems on refrigeration on vapour absorption system.
9. Experiments with the refrigeration tutor to study various components of refrigeration.
10. Determination of the coefficient of performance of the refrigeration tutor.
11. Experiment on humidifier for the determination of humidifying efficiency.
12. Experiment on dehumidifier for the determination of dehumidifying efficiency.
13. Experiment on the cooling efficiency of a domestic refrigerator.
14. Experiments on working details of a cold storage plant and air conditioning unit.
15. Experiments with air conditioning tutor to study various components.

16. Determination of the coefficient of performance of air conditioning tutor.
17. Estimation of refrigeration load.
18. Estimation of cooling load for air conditioner.
19. Estimation of humidification and dehumidification load.

**(AG209) SOIL AND WATER CONSERVATION AND STRUCTURES LAB**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Study of soil loss measurement techniques.					
2. Study of details of Coshocton wheel.					
3. Study of details of multi-slot runoff samplers.					
4. Study of rainfall simulators and runoff plots.					
5. Determination of sediment concentration by oven drying method.					
6. Preparation of contour map of an area and its analysis.					
7. Design of vegetated waterways and contour bunding system.					
8. Design of graded bunding system.					
9. Design of various types of bench terracing systems.					
10. Determination of rate of sedimentation and storage loss in reservoir.					
11. Design of Shelter belts and wind breaks.					
12. Construction of specific energy and specific force diagram.					
13. Design of H-flume and Parshall flume.					
14. Measurement of hydraulic jump parameters and amount of energy dissipation.					
15. Hydraulic design of a straight drop spillway.					
16. Determination of uplift force and construction of uplift pressure diagram.					
17. Determination of loads on headwall and construction of triangular load diagram.					
18. Hydraulic design of a chute spillway.					
19. Design of a SAF energy dissipater.					
20. Design of small earth embankments.					
21. Design of water harvesting structures.					
22. EIA analysis and cost estimation of structures.					

**(AG210) CROP PROCESS AND DRYING AND STORAGE ENGINEERING LAB**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Preparation of flow and layout charts of a food processing plant.					
2. Determination of fineness modulus and uniformity index.					
3. Performance evaluation of hammer mill.					
4. Performance evaluation of attrition mill.					
5. Study of cleaning equipment.					
6. Separation behavior in pneumatic separation.					
7. Study of grading equipment.					
8. Evaluation of performance of indented cylinder separator.					
9. Performance evaluation of screen pre-cleaner.					
10. Determination of mixing index and study of mixers.					
11. Study of conveying equipments.					
12. Performance evaluation of belt conveyor.					
13. Performance evaluation of bucket elevator.					
14. Performance evaluation of screw conveyor.					

15. Study of mechanics of bulk solids affecting cleaning.
16. Study of mechanics of drying of grains.
17. Measurement of moisture content during drying and aeration.
18. Measurement of relative humidity during drying and aeration using different techniques.
19. Measurement of air velocity during drying and aeration.
20. Problems using psychometric chart.
21. Drying characteristic and determination of drying constant.
22. Determination of EMC and ERH.
23. Study of various types of dryers.
24. Design of dryers.

### **III Year I Semester**

#### **(AC301) MACHINE DRAWING AND MACHINE DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT I**

Free hand sketching in machine drawing-Machine components, detailed assembly and manufacturing drawing-Forms of screw threads- B.S.W., square, metric, representations of threads, bolts, studs, screws, nuts-hexagonal and square headed.

#### **UNIT II**

Different types of keys-Sunk taper key, hollow saddle key, Flat saddle key, key with gib-head, round key, Feather key, wood ruff key. Cotter joints, Gib and cotter joint, Socket and spigot joints, sleeve joints, Knuckle joints.

#### **UNIT III**

Shaft couplings-muff-flanged/flexible. Shaft bearings-Journal bearing, bushed hearing plummer block. Pulleys-Fast and loose pulleys, stepped pulleys.

#### **UNIT IV**

Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear.

#### **UNIT V**

Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs. Design of flat belt and V-belt drives. Design of gears. Design of levers, thin cylindrical shells. Design and selection of anti-friction bearings. Crane hooks, circular rings, universal coupling etc.

#### **TEXT BOOKS:**

1. Bhat, N.D. (1986). Machine Drawing. Charotar Publishing Home, Anand.
2. Chakravarti, A. (1978). Design data Hand Book .
3. Khurmi, R.S. and Gupta, J.K. (1984). Machine Design. Eurasia Publishing House, New Delhi.

- Maleev and Hartman. (1978). Mechanical Design of Machines. CBS Publications, New Delhi.
- Norton.R.L. Machine Design. Pearson Education, New Delhi.

#### **REFERENCE BOOKS:**

- Pandya, N.C. and Shah,C.S. (1981). Machine Design. Charotar Book Stall, Anand.
- PSG, Coimbatore. (1984). Design data Hand Book.
- Sharma, P.C. and Aggrawal, D.K. (1985). Machine Design. Dhanpat Rai & Sons, New Delhi.
- Shingley J.E and C.R Mischke. Mechanical Engineering Design. Tata Mc Graw Hill

### **(AC302) ELECTRICAL MACHINES AND POWER UTILIZATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT I**

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses.

#### **UNIT II**

Transformer: principle of working, construction of single phase transformer, EMF equation, phasor diagram on load, leakage reactance, transformer on load, equivalent circuit, voltage regulation, power and energy efficiency, open circuit and short circuit tests.

#### **UNIT III**

Principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics, DC motor characteristics.

#### **UNIT IV**

Starting of shunt and series motor, starters, speed control methods-field and armature control, polyphase induction motor: construction, operation, equivalent circuit, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods.

#### **UNIT V**

Single phase induction motor: double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors, disadvantage of low power factor and power factor improvement, various methods of single and three phase power measurement.

#### **TEXT BOOKS:**

- Bimbhra, Dr.P.S. Electrical Machinery. Khanna Publishers., New Delhi.
- Cotton, H. (1999). Advanced Electrical Technology (7 ed.). Wheeler Publishing.

#### **REFERENCE BOOKS:**

- Nagrath, Kothari. Electric Machines. Tata Mc GrawHill publishing company., New Delhi.
- Theraja, A.K and Theraja, B.L. A Textbook of Electrical Technology (Vol. 1). S.Chand



## **(AG301) FARM MACHINERY AND EQUIPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Objectives of farm mechanization. Classification of farm machines. Materials of construction & heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics.

### **UNIT II**

Tillage; primary and secondary tillage equipment. Forces acting on tillage tools. Field operation patterns. Draft measurement of tillage equipment : Earth moving equipment - their construction & working principles viz Bulldozer, Trencher, Excavators etc.; sowing, planting & transplanting equipment - their calibration and adjustments.

### **UNIT III**

Fertilizer application equipment. Weed control and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments. Work physiology of men and women.

### **UNIT IV**

Principles & types of cutting mechanisms. Construction & adjustments of shear & impact-type cutting mechanisms. Crop harvesting machinery: mowers, windrowers, reapers, reaper binders and forage harvesters. Forage chopping & handling equipment. Threshing mechanics & various types of threshers. Threshers, straw combines & grain combines, maize harvesting & shelling equipment, Root crop harvesting equipment-potato, groundnut etc., Cotton picking & Sugarcane harvesting equipment.

### **UNIT V**

Principles of plantation crops and fruit harvesting tools and machines. Horticultural tools and gadgets. Testing of farm machine. Test codes & procedure. Interpretation of test results. Selection and management of farm machines for optimum performance. Workplace layout for men and women.

### **TEXT BOOKS:**

1. Bosoi, E.S. (1990). Theory, Construction and Calculation of Agricultural Machines (Vol. 1 and 2). Oxonion Press Pvt. Ltd., New Delhi.
2. Donnel Hunt. Farm Machinery and management. Iowa State University Press, Ames, USA.
3. Ghosh, P.K, and Swain, S. (1993). Practical Agricultural Engineering. Naya Prokash, Calcutta.
4. Kelnin, N.I., Popov, I.F., and Sakun, V.A. (1985). Agricultural Machines. Amerind Publishers, New Delhi.
5. Srivastava, A.C. (1990). Elements of Farm Machinery. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

### **REFERENCE BOOKS:**

1. Kepner, R.A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery, . CBS Publishers and Distributors, Delhi-17.
2. Kurtz, G.L., Thompson and Claer, P. (1984). Design of Agricultural Machinery. John Wiley & Sons, New York.

3. Michael, A. M. and Ojha, T.P. (1985). Principles of Agricultural Engineering. (Vol. II). Jain brothers, New Delhi.
4. Smith Harris Pearson, H.E., and Lambent Herry Wilkes, M.S. (1977). Farm Machinery and Equipment. Tata Mc Graw-Hill Publishing Company Ltd., New Delhi.
5. Kanafoshi, C.Z. and Karwawshi, T. (1976). Agricultural Machines, Theory and Construction (Vol. 1 and 2). USDA, Poland.

<b>(AG302) GROUND WATER, WELLS AND PUMPS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	3	1	-	4	4

#### **UNIT I**

Occurrence and movement of ground water, aquifer and its types, classification of wells, steady and transient flow into partially, fully and non-penetrating tube wells and open wells, familiarization of various types of bore wells common in the State.

#### **UNIT II**

Design of open well, groundwater exploration techniques, methods of drilling of wells, percussion, rotary, reverse rotary, design of assembly and gravel pack, installation of well screen, completion and development of well, groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow' s etc. Their recovery method, well interference, multiple well systems.

#### **UNIT III**

Surface and subsurface exploitation and estimation of ground water potential, quality of ground water, artificial groundwater recharge planning, modeling, ground water project formulation.

#### **UNIT IV**

Pumping Systems: Water lifting devices; different types of pumping machinery, classification of pumps, component parts of centrifugal pumps; pump selection, installation and troubleshooting.

#### **UNIT V**

Design of centrifugal pumps, performance curves, effect of speed on head capacity, power capacity and efficiency curves, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; priming, self priming devices, rotodynamic pumps for special purposes such as deep well turbine pump and submersible pump.

#### **TEXT BOOKS:**

1. Chow, V.T. (1964). Hand Book of Applied Hydrology. Mc Graw Hill, New York.
2. Jack, K. and Rend, B. (1991). Sprinkler and Trickle Irrigation. Van Nostra Reinhold, New York.
3. James, L.G. (1988). Principles of Farm Irrigation system Design. John Wiley & Sons, New York.
4. Michael, A. M. (1992). Water Well and Pump Engineering. Tata Mc Graw- Hill Pub. Co. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Modi, P.M. and Seth, S.M. (1991). Hydraulics and Fluid Mechanics. Standard Book House, New Delhi .
2. Sivanappan, R.K. (1987). Sprinkler irrigation. Oxford & IBH Publishing Company, New Delhi.
3. Subramanhya. (1994). Engineering Hydrology. Tata Mc Graw Hill. New York.
4. Todd, D.K. (2004). Ground Water Hydrology. John Wiley & Sons, New York.

**(AG303) WATERSHED HYDROLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT I**

Introduction; Hydrologic cycle; Precipitation-forms, Weather systems for precipitation, Characteristics of precipitation in India; Rainfall measurement, rain gauge network, optimum number; Representation of rainfall data-Mass curve, hyetograph, Moving average curve etc; Mean precipitation over an area-Different methods.

**UNIT II**

Frequency analysis of point rainfall, Calculation of rainfall return period and probability, plotting position; Estimation of missing data, test for consistency of rainfall records; Double mass curve technique; Abstractions from precipitation- interception; Depression storage; infiltration; evaporation; evapo-transpiration - estimation and measurement; Reservoir evaporation-methods of reduction, Infiltration indices.

**UNIT III**

Geomorphology of watersheds - stream number, stream length, stream area, stream slope and Horton's laws; Runoff - factors affecting, measurement; Runoff characteristics of streams, estimation of peak runoff rate and volume; Rational method, Cook's method, SCS Curve number method.

**UNIT IV**

Stream flow- measurement of stage and velocity, rating curve, extension of rating curve; Hydrograph; components, Factors affecting the shape of hydrograph, base flow separation, unit hydrograph theory – Assumptions, applications, derivation of unit hydrographs, unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.

**UNIT V**

Floods-Terms and definitions, Head water flood control - methods, retards and their location; flood routing – graphical methods of reservoir flood routing; Channel routing-Muskingum method; Hydrology of dry land areas - drought and its classification; introduction to watershed management and planning.

**TEXT BOOKS:**

1. Chow, V.T. (1964). Hand Book of Applied Hydrology. Mc Graw Hill, New York.
2. Linsley, R.K., Kohler, M.A., and Paulhus, J.L.H. (1984). Hydrology for Engineers. Mc Graw Hill Pub.Co. Japan.
3. McCuen, R. H. (1989). Hydrologic Analysis and Design. Printice Hall.
4. Mutreja, K.N. (1990). Applied Hydrology. Tata Mc Graw Hill Pub. Co., New York.

**REFERENCE BOOKS:**

1. Raghunath, H.M. (2006). Hydrology-Principles, Analysis and design. New age International (P) Ltd.
2. Singh, V. P. (1992). Elementary Hydrology. Prentice Hall India.
3. Subrahmanya, K. (1987). Engineering Hydrology. TataMcGrawHillPub.Co. New Delhi.

**(AC303) MACHINE DRAWING AND MACHINE DESIGN LAB**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Problems based on load and stress analysis of machine components.					
2. Problems based on practical application of theories of failure and fatigue and determination of factor of safety.					
3. Design and drawing of pin connections, Knuckle joint.					
4. Exercises on design of levers and rocker arm for diesel engines.					
5. Problems on design of shafts, keys, coupling and belts.					
6. Problems on design of helical and leaf spring.					
7. Problems on design of spur gears.					
8. Free hand sketching in machine drawing-Machine components, detailed, assembly and manufacturing drawing.					
9. Forms of screw threads-B.S.W. square, metric, representations of threads.					
10. Bolts, studs, screws, nuts-hexagonal and square headed.					
11. Different types of keys-sunk taper key, hollow saddle key, flat saddle key.					
12. Key with gib-head, Round key, Feather key, wood ruff key.					
13. Gib and cotter joints.					
14. Socket and spigot joints.					
15. Sleeve and knuckle joints.					
16. Shaft couplings box or muff coupling.					
17. Flexible, flanged and universal coupling.					
18. Shaft bearing-Journal, solid, bushed and foot step bearing.					
19. Method of fixing pulley-Belt pulleys.					
20. Fast and loose pulleys.					
21. Stepped pulleys or speed cones.					
22. Split pulleys-Rope pulleys-V belt pulleys.					

**(AG304) FARM MACHINERY AND EQUIPMENT LAB**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Introduction to various farm machines.					
2. Field capacity and field efficiency measurement for at least two machines/implements.					
3. Draft& fuel consumption measurement for different implements under different soil conditions.					
4. Construction details, adjustments and working of M.B. plow, disc plow and disc harrow and secondary tillage tools.					
5. Construction and working of rotavators and other rotary tillers, measurement of speed & working width.					
6. Working of seed-cum-fertilizer drills, planters and their calibration in field.					

7. Construction and Working of rice and crop transplanters for potato, sugarcane, cotton etc., and their field operation patterns.
8. Weeding equipment and their use.
9. Study of sprayers and dusters, measurement of nozzle discharge, field capacity etc.
10. Familiarization with various Farm machines related to harvesting, threshing, root harvesting, combine etc.
11. Study of various types of mowers, constructional details, materials and working.
12. Study of various types of reaper, constructional details, materials and working & performance.
13. Study of various types of reaper binder, constructional details, materials and working.
14. Study of various types of potato harvesters, constructional details, materials and working.
15. Study of various types of groundnut harvesters, constructional details, materials and working & performance.
16. Study of various types of forage harvester, constructional details, materials and working.
17. Study of various types of sugarcane harvester, constructional details, materials and working.
18. Study of various types of maize sheller, constructional details, materials and working & performance.
19. Study of various types of threshers, constructional details, materials and working & performance.
20. Study of various types of cotton pickers and strippers, constructional details, materials and working.
21. Study of various types of harvester tools, constructional details, materials and working.
22. Study of various types of combine harvester, constructional details, materials and working.
23. Study of various types of straw combines, constructional details, materials and working.
24. Study of various types of fruit harvester equipment, constructional details, materials and working.

#### **(AC304) DATABASE MANAGEMENT AND INTERNET**

- | <b>L</b> | <b>T</b> | <b>P</b> | <b>To</b> | <b>C</b> |
|----------|----------|----------|-----------|----------|
| 0        | 0        | 3        | 3         | 2        |
1. Creating a table, data base, inserting, manipulation.
  2. Programming using select statement.
  3. Programming using in and between operators.
  4. Programming using like operators.
  5. Programming using sub queries.
  6. Group by clause.
  7. Programming using aggregate function sum, min, max.
  8. Order by clause.
  9. Set operators.
  10. Internet applications.
  11. Tools required-tags, attributes.
  12. Formatting-text, heading, paragraph.
  13. Designing a web page-background color, marquee, adding, images, and sound.

## **III Year II Semester**

### **(AG305) IRRIGATION AND DRAINAGE ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT I**

Water resources utilization and irrigation development in India. Introduction to Irrigation. Water conveyance, underground pipe conveyance system, design, accessories, irrigation structures, land grading, different design methods and estimation of earth work and cost. Soil water plant relationship, soil water movement, infiltration, evapotranspiration, depth of irrigation, frequency of irrigation, irrigation scheduling, irrigation efficiencies.

#### **UNIT II**

surface irrigation methods of water application, border, check basin, furrow and contour irrigation; sprinkler and drip irrigation method, merits, demerits, selection and design.

Command area concepts and components, irrigation terminologies relevant to command area, on-farm development works, farmer participation in water distribution, water delivery methods, design of unlined alluvial channels- silt theories, design of lined channels, materials for lining.

#### **UNIT III**

Drainage definition; Need for land drainage; History of land drainage; Design considerations for land drainage; Definitions of parameters in drainage equations: hydraulic conductivity, transmissivity, drainable porosity, drainage coefficient; Subsurface flow to drains-Steady state equations; The Hooghoudt's equation- derivation, importance of equivalent depth; The Ernst equation- derivation, horizontal, vertical and radial flow; Unsteady state equations- The Glover-Dumm equation; Comparison between Steady State and Unsteady State.

#### **UNIT IV**

Surface drainage systems- Bedding, Field drains, Field laterals; Layout of field drains and laterals; Diversion or interceptor drains; Subsurface drainage systems- drain materials, envelopes, filters and surrounds; Functions of envelope, envelope materials, envelope requirements in relation to soil characteristics, gravel envelopes, organic envelopes, synthetic envelopes; Layout, construction and installation of drains; Drainage structures; Tubewell drainage-introduction, physical and economic feasibility; Mole drainage.

#### **UNIT V**

Hydraulics of Drainage pipes- Manning's equation for pipe flow- hydraulic gradient and slope; Investigations of drain design parameters through drain testing- hydraulic conductivity, transmissivity, drainable porosity; Observation wells and their installation; Recording water table data and drain discharges; Flow equations used in drainage testing- steady state and non steady state conditions; Drainage design criteria and system economics.

#### **TEXT BOOKS:**

1. Garg, S. K. (1987). Irrigation Engineering and Hydraulic Structures. Khanna Publishers, New Delhi.
2. Israelson and Hassan. (1981). Irrigation Principles and Practices. John Wiley and sons, New York.

3. Michael, A.M. (1986). Irrigation Theory and Practice. Vikas Publishing House, New Delhi.
4. Luthin, J. (1984). Drainage Engineering. John Wiley & Sons, New York.
5. Modi, P. (1987). Irrigation Water Resources and Water Power Engineering. Standard Book House, New Delhi.
6. Ritzema H. P. (1994). Drainage Principles and Applications (2 ed.). ILRI Publication

#### **REFERENCE BOOKS:**

1. James, J.G. (1988). Principles of Farm Irrigation system Design. John Wiley & Sons, New York.
2. Lal, R. (1983). Irrigation Hydraulics. Saroj Prakashan Publishers, Allahabad.
3. Majumdar, D. K. (2000). Irrigation Water Management Principles and Practice. Prentice-Hall of India, New Delhi.
4. Michael, A. M. and Ojha, T.P. (1985). Principles of Agricultural Engineering. (Vol. II). Jain brothers, New Delhi.
5. Murthy, C. S. (1997). Water Resources Engineering Principles and Practice. New Age International (P) Ltd. New Delhi.
6. Murthy, V. (1998). Land and Water Management. Kalyani Publishing, New Delhi.

<b>(AG306) TRACTOR SYSTEMS AND CONTROLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	3	1	-	4	4

#### **UNIT I**

Study of transmission systems, clutches: functioning, parts and design problem on clutch system, Gear box: different types of gear box, calculation of speed ratios, design problems on gear box, Study on differential and final drive and planetary gears, Differential and final drive mechanism.

#### **UNIT II**

Familiarization of brake mechanism, Design problems. Steering geometry and adjustments Ackerman and hydraulic steering and hydraulic systems.

#### **UNIT III**

Tractor power outlets: P.T.O., belt pulley, drawbar, etc. Tractor chassis mechanics and design for tractor stability. Methods of finding CG of the tractor, Methods for finding moment of inertia of the tractor.

#### **UNIT IV**

Ergonomic considerations and operational safety. Importance of anthropometric requirements in design.

Power Tiller: Construction and working, Power transmission system.

#### **UNIT V**

Balancing of front and rear attached machinery. Importance of balancing, Techniques in balancing.

**TEXT BOOKS:**

1. Barger, E.L., Liledahl, J.B., Carleton, W.M. and Mckibben, E.G. (1978). *Tractor and their power units*. Wiley Eastern pvt. Ltd, New York.
2. Radhey Lal and Datta, A.C. (1978). *Problems in Agricultural Engineering*. Sathya Prakashan, Allahabad.

**REFERENCE BOOKS:**

1. Mehta, M.L., Verma, S.R., Misra, S.K., and Sharma, V.K. (1995). *Testing and evaluation of Agricultural Machinery*. National Agricultural Technology Information Centre, Ludhiana.

**(AG307) DAIRY AND FOOD ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT I**

Dairy development in India. Engineering, thermal and chemical properties of milk and milk products, unit operations of various dairy and food processing systems

**UNIT II**

Process flow charts for product manufacture, working principles of equipment for receiving, pasteurization, sterilization, homogenization, filling & packaging, butter manufacture

**UNIT III**

Dairy plant design and layout, composition and proximate analysis of food products. Deterioration in products and their controls. Physical, chemical and biological methods of food preservation

**UNIT IV**

Changes undergone by the food components during processing, evaporation, drying, freezing and chilling

**UNIT V**

Behavior of food products in extraction, leaching, crystallization, filtration, membrane separation, thermal processing. Plant utilities requirement.

**TEXT BOOKS:**

1. Ahamed Tuffail. (1997). *Dairy Plant Engineering & Management*. Kitab Mahal Publishers, Allahabad.
2. Charm, S.E. (1971). *The Fundamentals of Food Engg*. AVI Pub.Co. Inc.
3. Christy Gean Koplis. (1997). *Transport Processes and Unit Operations*. Prentice Hall of India Publications, New Delhi.
4. Farrall, A.W. (1980). *Engineering for Dairy & Food Products*. John Wiley and Sons Inc., New York.
5. Handerson, S.M. et al. (1990). *Principles of Process Engg*. ASAE, USA.

**REFERENCE BOOKS:**

1. Lalat Chander. (2005). *Text Book of dairy plant layout and Design*. ICAR, New Delhi.



2. McCabe W.L. and Smith J.C. (1990). Unit Operations of Chemical Engg. McGraw Hill, Tokyo, Japan.
3. Paul Sing. (2004). Food Engineering. Marcel Dekker Pub.
4. Sanga, K.P.S. (2001) Dairy Processing Technology. Saroj Prakashan, Allahabad.
5. Sukumar De. (1997). Outlines of Dairy Technology. Oxford University press, Delhi.

**(AG309) FIELD OPERATION AND MAINTENANCE OF TRACTORS  
AND FARM MACHINERY (LAB)**

	<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
	0	0	3	3	2
1. Introduction to various systems of a tractor viz. fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive system.					
2. Familiarization with tractor controls and learning procedure of tractor starting and stopping.					
3. Hitching, adjustments, settings and field operation of farm machinery.					
4. Familiarization with different makes and models of 4- wheeled tractors.					
5. Starting and stopping practice of the tractor and familiarization with instrumentation panel and controls.					
6. Road signs, traffic rules, road safety, driving & parking of tractor.					
7. Tractor driving - forward & reverse driving practice.					
8. Tractor driving practice with two wheeled tractor trailer forward & reverse.					
9. Study and practicing the hitching and de-hitching of implements.					
10. Study operation and field adjustments of M.B. plough & disk plough.					
11. Field operation of trailing & mounted disk harrow.					
12. Field operation and adjustments of seed drill/planter/sprayer.					
13. Familiarization with tools and equipment used for maintaining and servicing of tractors and farm machines.					
14. Maintenance after 10, 50, 100, 250, 500 and 1000 hours of operation, adjustment of tractor track.					
15. Dismantling and assembling of major engine parts.					
16. Visit to tractor/ engine repair workshop, injection pump injector repair shop.					
17. Doing minor repair of electric, mechanical and hydraulic system.					
18. Adjustment and maintenance of seeding and planting and transplanting machines.					
19. Adjustment and maintenance of reapers and threshers.					
20. Adjustment and maintenance of combine harvesters, straw combines, balers etc.					
21. Visit to small scale farm machinery manufacturers and their repair shops, seasonal repair of farm machinery.					

**TEXT BOOKS:**

1. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair, . Sathya Prakashan and Tech India Publications, New Delhi.
2. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
3. Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, John Wiley & Sons, New-York.
4. Mathus, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
5. Mehta, M.L., Verma, S.R., Misra, S.K., and Sharma, V.K. (1995). Testing and Evaluation of Agricultural Machinery. National Agricultural Technology Information

6. Donnel Hunt. Farm Power Machinery and Management. Iowa State University Press, Ames, USA.

#### **REFERENCE BOOKS:**

1. Ghosh, P.K, and Swain, S. (1993). Practical Agricultural Engineering. Naya Prokash, Calcutta.
2. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
3. Kepner, R. A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery. CBS Publishers and Distributors, Delhi-17.
4. Michael, A. M. and Ojha, T.P. (1985). Principles of Agricultural Engineering. (Vol. II). Jain brothers, New Delhi.
5. Smith Harris Pearson, H.E., and Lambent Herry Wilkes, M.S. (1977). Farm Machinery and Equipment, . Tata Mc Graw-Hill Publishing Company Ltd., New Delhi.

#### **(AG308) IRRIGATION AND DRAINAGE ENGINEERING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
0	0	3	3	2

1. Measurement of soil moisture by different soil moisture measuring instruments.
2. Determination of soil moisture constants by pressure plate and pressure membrane apparatus.
3. Measurement of irrigation water and infiltration rate.
4. Computation of evapotranspiration.
5. Determination of crop water requirement.
6. Irrigation scheduling.
7. Land grading exercises.
8. Design of underground pipe line system.
9. Design of drip and sprinkler irrigation.
10. Measurement of uniformity coefficient of sprinkler irrigation method.
11. Measurement of uniformity coefficient of drip irrigation method.
12. Field problems and remedial measures for sprinkler and drip irrigation method.
13. *In-situ* measurement of hydraulic conductivity- Auger hole method.
14. Determination of drainage coefficients.
15. Preparation of water contour maps.
16. Measurement of hydraulic conductivity through drain testing.
17. Measurement of drainable porosity through drain testing.
18. Design of surface drainage systems.
19. Design of subsurface drainage systems.
20. Installation techniques of sub-surface drainage system.
21. Cost analysis of surface and sub-surface drainage system.

#### **(AG310) DAIRY AND FOOD ENGINEERING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
0	0	3	3	2

1. Study of a composite pilot milk processing plant & equipments.
2. Study of pasteurizers.

3. Study of sterilizers.
4. Study of homogenizers.
5. Study of separators.
6. Study of butter churners.
7. Study of evaporators.
8. Study of milk dryers.
9. Study of freezers.
10. Design of food processing plants & preparation of layout.
11. Visit to multiproduct dairy plant.
12. Determination of physical properties of food products.
13. Estimation of steam requirements.
14. Estimation of refrigeration requirements in dairy & food plant.
15. Visit to Food industry.

## **IV Year I Semester**

### **(AG401) AGRICULTURAL STRUCTURES AND ENVIRONMENT CONTROL**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT I**

Planning and layout of farmstead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities.

#### **UNIT II**

BIS. Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.

#### **UNIT III**

Engineering for rural living and development, rural roads, farm fencing, their construction cost and repair and maintenance.

#### **UNIT IV**

Design of septic tank for small family. Solid waste management system.

#### **UNIT V**

BOD and COD of food plant waste, primary and secondary treatment of food plant waste.

#### **TEXT BOOKS:**

1. Albright, L. D.(1996). Environmental control for Animals and Plants. ASAE, Michigan, USA.
2. Clark, J.A. (1980). Environmental Aspects of Housing for Animal Production. Butter worths, London.
3. Goel, J. K. (2002). Energy and Environment of Buildings & Farms. Saroj Prakashan, Alahabad.
4. Jagadish Prasad. (1996). Principles and Practices of Dairy Farm Management. Kalyani Publishers, New Delhi.

**REFERENCE BOOKS:**

1. Maton, A et al. (1986). Housing of Animals- Developments in Agri.Engg. Elsevier Science Publishing Co. Inc.
2. Michael and Ohja (2002). Principles of Agricultural Engineering (Vol. 1). Jain Brothers, New Delhi.

**(AG402) AGRIBUSINESS MANAGEMENT AND  
ENTREPRENEURSHIP DEVELOPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT I**

Management concepts and principles, process of management, functions of management, concept of agribusiness and application of management principles to agribusiness, production, consumption, and marketing of agricultural products, agricultural processing, meaning and theories of international trade, WTO provisions for trade in agricultural and food commodities.

**UNIT II**

India's contribution to international trade in food and agri-commodities. Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business /entrepreneurial environment.

**UNIT III**

Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis.

**UNIT IV**

Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs.

**UNIT V**

Export and Import Policies relevant to horticulture sector. Venture capital. Contract Agro Industry Projects and joint ventures, public-private partnerships. Characteristics of Indian farm machinery industry. Social Responsibility of Business.

**TEXT BOOKS:**

1. Agarwal R.D. (1993). Organization & Management. Tata-Mc Graw Hill Publishing Company Ltd.
2. Anil. S. Kumar, S.C Poornima, M.K. Abraham, K. Jayashree . Entrepreneurship Development. New Age International Publishers, New Delhi.
3. Bhowmik S.R. and Bhowmik M. Entrepreneurship-A tool for economic growth and key to business success. New Age International, New Delhi.
4. Mathew.J. Manimala . Entrepreneurship Policies and Strategies-The Innovators Choice. Sage Books, India.

**REFERENCE BOOKS:**

1. S.K. Basu, K.C. Sahu, & N.K. Data. (1993). Work Organization & Management . Oxford & IBH Publishing Company Ltd.
2. Shivaganesh Bhargava. Development aspects of Entrepreneurship. Sage Publications, New Delhi.

**Elective courses**

(AG501) FOOD PACKAGING TECHNOLOGY	L	T	P	To	C
	3	1	-	4	4

**UNIT 1**

Factors affecting shelf life of food material during storage; spoilage mechanism during storage; definition, requirement, importance and scope of packaging of foods.

**UNIT II**

Types and classification of packaging system; advantage of modern packaging system. Different types of packaging materials used.

**UNIT III**

Different forms of packaging, metal container, glass container, plastic container, flexible films, shrink packaging, vacuum & gas packaging.

**UNIT IV**

Packaging requirement & their selection for the raw & processed foods. Advantages & disadvantages of these packaging materials; effect of these materials on packed commodities, Package testing, Printing, labeling and lamination.

**UNIT V**

Economics of packaging; performance evaluation of different methods of packaging food products; their merits and demerits; scope for improvements; disposal and recycle of packaging waste.

**TEXT BOOKS:**

1. Crosby. (2000). Food Packaging Material. Applied Science Publishers.
2. Gopakumar, K. (1998). Fish Packaging Technology- materials and Methods. Concept Pu b.C, New Delhi.
3. Gordon and Roberston. (2000). Food Packaging. AVI Pub.Co.

**REFERENCE BOOKS:**

1. Mathlonthi, M. (1997). Food Packaging and Preservation- Theory and Practice. Elsevier Applied Science.
2. Paine. (1998). Food Packaging. AVI Publishing Co.
3. Saccron & Graffin. (1998). Food Packaging. AVI Pub.Co.

## **(AG502) DEVELOPMENT OF PROCESSED PRODUCTS AND EQUIPMENTS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Applications of unit operations to the food industry, analytical processing concepts with regards to mass and energy balances, equipment involved in the commercially important food processing methods and unit operations; value addition to cereals like rice, wheat etc.

### **UNIT II**

Parboiling of rice, quality of processed products of rice & wheat. Processing of pulses, extruded food product, fermented food product, frozen and dried product, technology of meat, fish and poultry products, technology of milk and milk products.

### **UNIT III**

Technology of oilseeds and fat products, snack foods, Fruits and vegetable products: candy, nutraceuticals, food product development trends, food additives and labeling.

### **UNIT IV**

Process equipment for thermal processing-evaporation, dehydration, drying, blanching, pasteurization, distillation; mechanical separation-filtration, sieving, centrifugation, sedimentation;

### **UNIT V**

Mechanical handling-conveying and elevation; size reduction and classification-mixing; kneading, blending and emulsification.

### **TEXT BOOKS:**

1. Carl.W. Hall. (1988). Processing Equipments for Agri.Products. McGraw Hill Pub.Co.
2. Girdhari Lal, G.S. Siddappa & G.L. Tandon . (1998). Preservation of Fruits and Vegetables. ICAR, New Delhi.
3. Gould, G. (1989). Mechanism of action of Food Preservation Procedures. Elsevier applied Science.
4. Kent, N.L. (1975). Technology of Cereals. Oxford Pergamon.

### **REFERENCE BOOKS:**

1. Kessle, H.G. Food Engineering and Dairy Technology. U.A. Kessler Freising, Germany.
2. Matz,S.A. (1970). Cereal Technology. AVI Publishers.
3. Romeo,T, Toledo. (1996). Fundamentals of Food Process Engineering. CBS Pub. & Distributors, New Delhi.
4. Sukumar De. (1997). Outlines of Dairy Technology. Oxford University press, Delhi.

## **(AG503) FOOD PROCESSING PLANT DESIGN AND LAYOUT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Meaning and definition of plant layout. Objectives and principles of layout. Types of layout.

### **UNIT II**

Salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products.

### **UNIT III**

Milk and milk products. Location selection criteria, selection of processes, plant capacity, project design, flow diagrams.

### **UNIT IV**

Selection of equipments, process and controls, handling equipments, plant layout, Plant elevation, requirement of plant building and its components, labour requirement, plant installation.

### **UNIT V**

Power and power transmission, sanitation. Cost analysis, preparation of feasibility report.

### **TEXT BOOKS:**

1. Apple, J.M. (2000). Plant Layout and Material Handling. Willey eastern Pub.
2. Lalat Chander. (2005). Text Book of dairy plant layout and Design. ICAR, New Delhi.
3. Norman, G. M. (2003). Principles of Food Sanitations. Chapman & Hall Pub. New York.

### **REFERENCE BOOKS:**

1. Slade, S. (1990). Food Processing Plant (Vol. 1). Leonard Hill Books.
2. Zacharias, B. et al. (1998). Food Process Design. Marcel Dekker Pub. Co.

## **(AG504) FOOD PROCESSING PLANT DESIGN AND LAYOUT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Meaning and definition o plant layout. Objectives and principles of layout. Types of layout.

### **UNIT II**

Salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products.

### **UNIT III**

Location selection criteria, selection of processes, plant capacity, project design, flow diagrams, selection of equipments, process and controls, handling equipments.

#### **UNIT IV**

Plant layout, Plant elevation, requirement of plant building and its components, labour requirement.

#### **UNIT V**

Plant installation, power and power transmission, sanitation. Cost analysis, preparation of feasibility report.

#### **TEXT BOOKS:**

1. Apple, J.M. (2000). Plant Layout and Material Handling. Willey eastern Pub.
2. Lalat Chander. (2005). Text Book of dairy plant layout and Design. ICAR, New Delhi.

#### **REFERENCE BOOKS:**

1. Norman, G. M. (2003). Principles of Food Sanitations. Chapman & Hall Pub. New York.
2. Slade, S. (1990). Food Processing Plant (Vol. 1). Leonard Hill Books.

#### **(AG505) SYSTEMS ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT 1**

System concepts. Requirements for a Linear programming problems. Mathematical Formulation of Linear Programming problems and its Graphical solution.

#### **UNIT II**

Response of Systems. Computer as a tool in system analysis. Simplex method. Degeneracy and Duality in Linear programming. Artificial variable techniques, Big M method and two-phase methods.

#### **UNIT III**

Mathematical models of physical systems. Modelling of Agricultural Systems and operations. Cost analysis.

#### **UNIT IV**

Transportation problems. Assignment problems. Waiting line problems.

#### **UNIT V**

Project management by PERT/CPM. Resource scheduling.

#### **TEXT BOOKS:**

1. Dharani. S and Venkata Krishnan. (1990). Operations Research Principles & Problems. Keerthi Publishing homes Pvt. Ltd.
2. Gupta, P.K. and Man Mohan. (1994). Problems in Operations Research. Sultan chand & sons, New Delhi.

#### **REFERENCE BOOKS:**

1. Kapoor, V.K. (1994). Operations Research. Sultan chand & sons, New Delhi.



**(AG506) ENVIRONMENTAL ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT 1**

Importance of safe water supply system. Domestic water requirements for urban and rural areas.

**UNIT II**

Sources of Water supply. Intakes and transportation of water. Drinking water quality. Indian Standards of drinking water.

**UNIT III**

Introduction to water treatment. Importance of sanitation. Domestic waste water: quantity, characteristics, disposal in urban and rural areas.

**UNIT IV**

Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment. Design of septic tank. Solid waste: quantity, characteristics and disposal for urban and rural areas.

**UNIT V**

Introduction to air pollution. Types of pollutants properties and their effects on living beings. ISI standards for pollutants in air and their abetments. Imparting awareness of domestic sanitation in women.

**TEXT BOOKS:**

1. Garg, S.K. (1992). Environmental Engineering (vol 1) Water supply Engineering. (Vol 1). Khanna Publishers, Delhi.
2. Metcalf and Eddy. (1997). Waste Water Engineering-Treatment, Disposal, reuse. Tata-Mc Graw Hill Publishing Co. Ltd. New Delhi.

**REFERENCE BOOKS:**

1. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G.C. (1986). Environmental Engineering. Mc Graw Hill Book Co., New York.
2. Rangwala, S.C. (1992). Water Supply and Sanitary Engineering. Charotar Publishing House, Anand.

**(AG507) DESIGN AND MAINTENANCE OF GREENHOUSE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT 1**

History and types of greenhouses; importance, function and features of green house; scope and development of green house technology.

**UNIT II**

Location, Planning and various component of greenhouse; design criteria and calculation; constructional material and methods of construction; covering materials and its characteristics.

### **UNIT III**

Solar heat transfer, solar fraction for green house, steady state analysis of green house, Greenhouse heating, cooling, shedding and ventilation systems.

### **UNIT IV**

Carbon Dioxide generation and monitoring and lighting systems, instrumentation & computerized environmental Control Systems. Watering, fertilization, root substrata and its pasteurization, containers and benches, plant nutrition.

### **UNIT V**

Alternative cropping systems; plant tissue culture, chemical growth regulation; disease control; integrated pest management.

Postproduction quality and handling Cost analysis of greenhouse production; Applications of green house & its repair & maintenance.

### **TEXT BOOKS:**

1. Manohar, K.R. and Iga Thinathane. C. Green House Technology and Management. B.S. Publications, Hyderabad.

### **(AG508) MICRO IRRIGATION SYSTEM DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Past, present and future need of micro-irrigation systems, Role of Govt. for the promotion of micro-irrigation in India, Merits and demerits of micro-irrigation system.

### **UNIT II**

Types and components of micro-irrigation system, Micro-irrigation system- design, installation, and maintenance. Sprinkler irrigation - types, planning factors, uniformity and efficiency, laying pipeline, hydraulic lateral, sub-mains and main line design, pump and power unit selection.

### **UNIT III**

Drip irrigation – potential, automation, crops suitability. Fertigation – Fertilizer application criteria, suitability of fertilizer compounds, fertilizer mixing, injection duration, rate and frequency, capacity of fertilizer tank.

### **UNIT IV**

Quality control in micro-irrigation components, design and maintenance of polyhouse, importance and application of polyhouse.

### **UNIT V**

Prospects of waste land development –hills, semi-arid, coastal areas, water scarce areas, Benefit and Cost analysis.

### **TEXT BOOKS:**

1. Cuenca, H.R. (1989). Irrigation System Design-An Engineering Approach. Prentice Hall, Engle wood, Cliffs, New Jersey.

2. Israelson and Hassan. (1981). Irrigation Principles and Practices. John Wiley and sons, New York.
3. Jack, K. and Rend, B. Sprinkler and Trickle Irrigation. Van Nostra Reinhold, New York.
4. Lal, R. (1983). Irrigation Hydraulics. Saroj Prakashan Publishers, Allahabad.

#### **REFERENCE BOOKS:**

1. Larry, G.J. (1982). Principles of Farm Irrigation System Design. John Wiley Sons, New York.
2. Michael, A.M. (1986). Irrigation Theory and Practice. Vikas Publishing House, New Delhi.
3. Sivanappan, R.K. (1987). Sprinkler irrigation. Oxford & IBH Publishing Company, New Delhi.

#### **(AG509) WATERSHED PLANNING AND MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT 1**

Watershed management - problems and prospects; Principles, Objectives, benefits and components of watershed management, Identification of watershed problems.

#### **UNIT II**

watershed based land use planning, watershed characteristics – physical and geomorphologic, factors affecting watershed management, hydrologic data for watershed planning, watershed delineation, delineation of priority watershed.

#### **UNIT III**

Water yield assessment and measurement from a watershed; hydrologic and hydraulic design of earthen embankments and diversion structures; sediment yield estimation and measurement from a watershed, sediment yield models; rainwater conservation technologies - in-situ and storage.

#### **UNIT IV**

Design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system, land management and cultural practices on watershed hydrology.

#### **UNIT V**

Evaluation and monitoring of watershed programmes; people's participation in watershed management programmes; planning and formulation of project proposal; cost benefits analysis of watershed programmes; watershed modeling-optimal land use models; case studies.

#### **TEXT BOOKS:**

1. Dhruva Narayana, V.V., Sastri, G. and Patnaik, U.S. (1990). Watershed Management. ICAR., New Delhi.
2. ICAR. Soil and Water Conservation Research in India.
3. Singh, G., Venkataraman, C., Sastri, C., Joshi, B.P. (1985). Manual of Soil Water conservation practices. Oxford IBM Publishing Co Pvt.Ltd. New Delhi.

4. Singh, R.V. (2000). Watershed Planning and Management. Yash Publishing House, Bikaner.

#### **REFERENCE BOOKS:**

1. Suresh, R. (1997). Soil and water Conservation Engineering. Standard Publishers and Distributors.
2. Wasi Ulla, Gupta, S.K., Dalal, S.S. (1972). Hydrological measurements for watershed research. Jugal Kishore & Co, Dehradun.

### **(AG510) MINOR IRRIGATION AND COMMAND AREA DEVELOPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT 1**

Major, medium and minor irrigation projects – their comparative performance; development and utilization of water resources through different minor irrigation schemes.

#### **UNIT II**

Basic concepts of command area – definition, need, scope, and development approaches: historical perspective, command area development authorities.

#### **UNIT III**

Interaction/collaboration of irrigation water use efficiency and agricultural production. Planning and execution of on farm development activities within the scope of command area development.

#### **UNIT IV**

Use of remote sensing techniques for command area development; case studies of some selected commands.

#### **UNIT V**

Farmer's participation in command area development. Case studies in related areas.

#### **TEXT BOOKS:**

1. Punmia, B.C and Pande, B.B. (1999). Irrigation and Water Power Engg. Standard Publishers and Distributors, New Delhi.
2. Hoffman, G.J., Howell, T.A and Soloman, K.N. (1990). Management of Farm Irrigation System. ASAE.
3. Michael, A. M. (1990). Irrigation Theory and Practice. Vani Educational Books
4. Modi, P. N. (1995). Irrigation Water Resources and Water Power Engineering. Std Book House, New Delhi.

#### **REFERENCE BOOKS:**

1. Murthy, C.S. (1990). Design of Minor irrigation and canal structures. Wiley eastern Limited, New Delhi.
2. Murthy, V.V.N. (1998). Land and Water Management. Kalyani Publishing, New Delhi.
3. Proc. of seminar on water Management. (1992). Vol 1 & II. Water Management Forum, Gandhinagar.

## **(AG511) GULLY AND RAVINE CONTROL STRUCTURES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Introduction; floods - causes of occurrence, flood classification - probable maximum flood, standard project flood.

### **UNIT II**

Design flood, flood estimation - methods of estimation; estimation of flood peak - Rational method, empirical methods, Unit hydrograph method.

### **UNIT III**

Statistics in hydrology, flood frequency methods - Log normal, Gumbel' s extreme value, Log-Pearson type-III distribution; depth-area-duration analysis.

### **UNIT IV**

flood forecasting, flood routing – channel routing, Muskingum method, reservoir routing, modified Pul' s method; flood control - history of flood control, structural and non-structural methods of flood control measures.

### **UNIT V**

storage and detention reservoirs, levees, channel improvement; Gulley erosion and its control; soil erosion and sediment control measures; river training works, planning of flood control projects and their economics.

### **TEXT BOOKS:**

1. Dhruvanarayana, V. V. (1993). Soil and Water Conservation Research in India. ICAR, New Delhi.
2. Goldman, S. J, Jackson K. and Bursztynsky, T. A. (1986). Erosion and Sediment Control Handbook. McGraw- Hill Book Company.
3. Murthy, V.V.N. (1998). Land and Water Management. Kalyani Publishing, New Delhi.

### **REFERENCE BOOKS:**

1. Suresh, R. (1997). Soil and water Conservation Engineering. Standard Publishers and Distributors.
2. USBR. (1978). Design of Small Canal Structures. U S Bureau of Reclamation.
3. USBR. (1987). Design of Small Dams. US Bureau of Reclamation.

## **(AG512) REMOTE SENSING & GIS APPLICATIONS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Introduction, History of remote sensing, Physics of Radiant Energy –Electromagnetic spectrum and its nature, Interactions of electromagnetic radiation with different media, Atmospheric effects in remote sensing, Spectral Reflectance curves of vegetation, soil and water, Ideal and real remote sensing. Atmospheric windows, Active and Passive remote sensing; Remote Sensing Platforms and Sensors: Introduction, Earth Resources Satellites – IRS series, Landsat Series and SPOT, Meteorological and Other satellites, Sensor Parameters

and Sensor Systems used in Imaging; Resolution: Spatial, Spectral, Radiometric and Temporal.

## **UNIT II**

Aerial Remote Sensing: Introduction to Photogrammetry, Geometry of vertical photograph, Stereo viewing, Stereoscopic depth perception, Use of stereoscopes, Mosaicing; Microwave Remote Sensing: Introduction, radar principle, radar image properties, distortions, applications. Radar Polarimetry. SAR Images. Radiometry for crop monitoring and hydrologic forecasting; Data Products, Visual and Digital Image Processing; Image analysis: Visual interpretation, digital processing, preprocessing, enhancement, transformation, classification, Integration; Image interpretation: Basic principles, factors governing quality of an image, factors governing interpretability, visibility of objects, techniques of interpretation, digital image processing.

## **UNIT III**

Satellite data Products, their different types, Visual Image Interpretation and its key elements, Introduction and Basic character of digital image, Image Preprocessing and Image registration; Applications of RS: RS in Agricultural Engineering, agriculture, hydrology, land cover, mapping etc; Image interpretation for water resources development and soil conservation survey.

Fundamentals of GIS, Introduction to GIS, Roots of GIS, Overview of Information System, GIS definitions and terminology.

## **UNIT IV**

GIS architecture, Framework of GIS, Spatial data modeling , Vector GIS models and Raster GIS models, GIS data management. Database management system: Data file management, database models, storage of GIS data, object based data models, Topology, DBMS in GIS. Data input and editing: data stream, data input methods, GPS for data capture, data editing. Data quality issues: Introduction, accuracy, precision and resolution, consistency, completeness, sources of error in GIS, modeling errors, error evaluation by GIS.

## **UNIT V**

Data analysis and modeling: Introduction, format conversion, data medium conversion, spatial measurement methods, reclassification, buffering techniques, overlay analysis, modeling surfaces: DTM, TIN, slope model, GIS outputs. Integration of RS and GIS: RS and GIS synergy need for integration, facilities for integration, RS & GIS applications in Agrl. Engineering. Entering data in computer, digitizer – scanner- data compression.

## **TEXT BOOKS:**

1. Scanda, E. (1976). Remote sensing for environmental sciences. Springer.
2. Anji Reddy M. (2006). Remote sensing & GIS. BS Publications.
3. Crocneckell, A.P. (1981). Remote sensing in meteorology Oceanography and hydrology.
4. Lillesand and Keifer. (1994). Remote sensing and image interpretation. John Wiley.
5. Philip H.S et al . (1978). Remote sensing the quantitative approach. Mc Graw Hill.
6. Agarwal, C. S. & Garg, P. K. (2000). Remote Sensing. Wheeler publishing.

## **REFERENCE BOOKS:**

1. Sabins, F. (1978). Remote sensing principles and interpretation.

- Burroughs, P. A. (1986). Principles of Geographic Information Systems for land Resources Assessment. Clarendon Press, Oxford.
- Chang, K. T. (2006). Introduction to GIS. Tata McGraw Hill.
- Jensen, J R. (1996). Introductory Digital Image Processing. Prentice Hall .
- Jensen, J. R. (2000). Remote Sensing of the Environment. Pearson Education.
- Langley P, McGuire D, Goodchild M F and Rhind, D. (2001). GIS- Principles and Applications. Longman.

## **(AG513) RESERVOIR AND FARM POND DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Earthen embankments - functions, advantages and disadvantages, classification – hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type.

### **UNIT II**

Foundation requirements, grouting, seepage through dams - estimation of seepage discharge, location of seepage/phreatic line by graphical and analytical methods, flow-net and its properties.

### **UNIT III**

seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.

### **UNIT IV**

Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc; stability of slopes - analysis of failure by slice method.

### **UNIT V**

Types of reservoirs and farm ponds, design and estimation of earth work; cost analysis.

### **TEXT BOOKS:**

- Alam Singh and Chowdhary, G. R. (1997). Soil Engineering – in Theory and Practice. Part 3. CBS Publishers and Distributors. New Delhi.
- Bowles, Joseph. E. (1984). Soil Mechanics and Foundation Engineering. Mc Graw – Hill International Book Company.
- Suresh, R. (1997). Soil and water Conservation Engineering. Standard Publishers and Distributors. Ludhiana.
- Murty, V. V. N. (1998). Land and Water management Engineering (2 ed.). Kalyani Publishers.

### **REFERENCE BOOKS:**

- ICAR. (1956-1971). Soil and Water Conservation Research in India.
- Punmia, B.C. (1981). Soil Mechanics and Foundations. Standard Book House, Delhi.
- Schwab, G.O, Frevert, R.K., Edminister T.W., and Barnes, K.K. (1993). Soil and water conservation engineering. John Wiley and sons.
- Singh, G., Venkataraman, C., Sastri, C., Joshi, B.P. (1985). Manual of Soil Water conservation practices. Oxford IBM Publishing Co Pvt.Ltd. New Delhi.

**(AG514) TRACTOR DESIGN AND TESTING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT 1**

Procedure for design and development of agricultural tractor, Study of parameters for balanced design of tractor for stability & weight distribution.

**UNIT II**

Hydraulic lift and hitch system design. Design of mechanical power transmission in agricultural tractors.

**UNIT III**

Design of Ackerman Steering and tractor hydraulic systems. Essential features of steering and hydraulic systems, problems associated in hydraulic systems.

**UNIT IV**

Study of special design features of tractor engines and their selection.

**UNIT V**

Design of seat and controls of an agricultural tractor. Tractor Testing.

**TEXT BOOKS:**

1. Barger, E.L., Liledahl, J.B., Carleton, W.M. and McKibben, E.G. (1978). Tractor and their power units. Wiley Eastern Pvt. Ltd, New York.
2. Kanafoshi, C.Z. and Karwawshi, T. (1976). Agricultural Machines, Theory and Construction (Vol. 1 and 2). USDA, Poland.
3. Pandya, N.C. and Shah, C.S. (1981). Elements of Machine Design. Charotar Publishing House, Anand.

**REFERENCE BOOKS:**

1. Kurtz, G.L., Thompson and Claer, P. (1984). Design of Agricultural Machinery. John Wiley & Sons, New York.
2. Radhey Lal and Datta, A.C. (1978). Problems in Agricultural Engineering. Sathya Prakashan, Allahabad.

**(AG515) HYDRAULIC DRIVE & CONTROLS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT 1**

Hydraulic Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Color Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements.

**UNIT II**

Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors. Pumps, Pump Classifications, Performance, Displacement, Designs, Gear Pumps, Vane Pumps, Piston Pumps, Pump Operation.



### **UNIT III**

Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors. Valves, Pressure-Control Valves, Directional-Control Valves, Flow-Control Valves, Valve Installation, Valve Failures and Remedies.

### **UNIT IV**

Valve Assembly, Troubleshooting Valves Hydraulic Circuit Diagrams and Troubleshooting, United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC.

### **UNIT V**

Pneumatics: Air services, logic units, Fail safe and safety systems Robotics: Use of Hydraulics and Pneumatics drives in agricultural systems, PLCs (Programmable Logic Controls).

### **TEXT BOOKS:**

1. Anthony Esposito. Fluid Power with applications. Pearson Education.
2. Blackburn, J.F., G. Reethof and J.L. Shearer. Fluid Power Control. New York, Technology Press of M.I.T. and Wiley.
3. Blaine W. Andersen. The analysis and design of pneumatic systems. John Wiley and Sons, Inc.
4. Ernst, W. Oil Hydraulic Power and its Industrial applications. New York: Mc Graw Hill.
5. Fitch, Jr., E.C. Fluid Power Control Systems. Mc Graw Hill, New York.
6. Hasebrink J.P., Kobler R. Fundamentals of pneumatics/ electro pneumatics. FESTO Didactic publication No.7301, Esslingen Germany.
7. Herbert E. Merritt. Hydraulic control systems. John Wiley and Sons Inc.
8. Ian Mencal. Hydraulic operation and control of machine tools. Ronald Press.

### **REFERENCE BOOKS:**

1. John Watton. Fluid Power Systems: modelling, simulation and micro computer control. Prentice Hall International.
2. 10.Khaimovitch. Hydraulic and Pneumatic control of Machine Tools.
3. 11.Lewis, E.E., and H. Stern. Design of Hydraulic Control Systems. New York; Mc Graw Hill.
4. 12.Pippenger, J.J., and R.M. Koff. Fluid Power control systems. New York: Mc Graw Hill.
5. 13.Sterwart. Hydraulic and Pneumatic power for production. Industrial Press.
6. 14.Thoma Jean U. Hydrostatic Power Transmission. Trade and Technical Press, Surrey, England.
7. 15.Werner Deppert and Kurt Stoll. Pneumatic control-An introduction to the principles. Vogel-Verlag.

### **(AG516) FARM POWER AND MACHINERY MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

The role of mechanization and its relationship to productivity, employment, social and Technological change.

## **UNIT II**

Performance and power analysis; cost analysis of machinery: fixed cost and variable costs, effect of inflation on cost.

## **UNIT III**

Selection of optimum machinery and Replacement criteria; Break-even analysis, reliability and cash flow problems.

## **UNIT IV**

Mechanization Planning; case studies of agricultural mechanization in India.

## **UNIT V**

Human Engineering aspects and gender studies.

### **TEXT BOOKS:**

1. Barger, E.L., Liledahl, J.B., Carleton, W.M. and Mckibben, E.G. (1978). Tractor and their power units. Wiley Eastern pvt. Ltd, New York
2. Donnel Hunt. Farm Machinery and management. Iowa State University Press, Ames, USA.
3. Kepner, R.A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery, . CBS Publishers and Distributors, Delhi-17

### **REFERENCE BOOKS:**

1. Mehta M.L. et al. (1995). Testing and Evaluation of Agricultural Technology. Information Centre, Ludhiana, India
2. Radhey Lal and Datta, A.C. (1978). Problems in Agricultural Engineering. Sathya Prakashan, Allahabad
3. RNAM . (1955). Test codes and Procedure for farm machinery

## **(AG517) PRODUCTION TECHNOLOGY FOR AGRICULTURAL MACHINERY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT 1**

Critical appraisal in production of Agricultural Machinery; Modelling and stress analysis of Machinery parts by using standard software.

### **UNIT II**

Advances in material used for tractor & Agril. Machinery. Cutting tools including CNC tools and finishing tools. Advanced manufacturing techniques like powder metallurgy, EDM (Electro-Discharge Machining), Heat Treatment of Steels.

### **UNIT III**

Ferrous metallurgy, iron-carbon diagram, alloying of elements, phase diagram, TTT diagram, surface treatment techniques: thermo chemical treatment including pack carburizing shot pining process, chemical vapor deposition (CVD) etc.

#### **UNIT IV**

Limits, Fits & Tolerances, Jigs & Fixtures, Microstructure Analysis. Industrial layout Planning, Quality management, Economics of process selection. Techno-economic feasibility of Project Report. Selection of Standard/ critical components.

#### **UNIT V**

Case studies of manufacturing of Agril. Machinery. Servomotors, drives & controllers, CNC controllers for machine tools. CNC programming. Assembly and plant automation. Storage and transportation.

#### **TEXT BOOKS:**

1. Callister, W.D. Materials science and engineering. Wiley, New Delhi.
2. Everett.E.Adam and JR.Ronald. J.Ebert. Production and operations management concepts, models and behaviour. Prentice Hall of India Pvt Ltd, New Delhi.
3. Martand.T.Telsang. Production management. S Chand and company Ltd, Ram nagar.,New Delhi.

#### **REFERENCE BOOKS:**

1. Paul Degram.E, Blach.J.T and Ronald A Kosher. Materials and process in manufacturing.,. Prentice Hall of India.
2. Prabhu Dev. Handbook of heat treatment of steel. Tata McGraw Hill.Ltd, New Delhi.

#### **(AG518) MECHANICS OF TILLAGE AND TRACTION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

#### **UNIT 1**

Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship.

#### **UNIT II**

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**

Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction.

#### **UNIT IV**

Tyre size, tyre lug geometry and their effects, tyre testing, soil compaction and plant growth.

#### **UNIT V**

Variability and geo statistic, application of GIS in soil dynamics.

#### **TEXT BOOKS:**

1. Mc Kyes.E. Agricultural engineering soil mechanics. Elsevier Amsterdam.
2. Milligan, G.M.E and Houlsby, G.T. Basic Soil mechanics,. Butter worth scientific London.

**REFERENCE BOOKS:**

1. Mc Kyes.E. Soil Cutting. Elsevier Amsterdam.
2. William Lambe.T.Whiteman and Robert.V. Soil Mechanics. Wiley Eastern Ltd., New Delhi.

**(AG519) HUMAN ENGINEERING AND SAFETY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

**UNIT 1**

Human factors in system development – concept of systems; basic processes in system development, performance reliability.

**UNIT II**

Human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays. Speech communications.

**UNIT III**

Biomechanics of motion, types of movements, Range of movements, Strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices.

**UNIT IV**

Anthropometry: use and incorporation of anthropometric data in design of tools and equipment. Arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

**UNIT V**

Vibration and noise measurements in machinery operation, effect of reduction of vibration and noise, Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

**TEXT BOOKS:**

1. Astrand, O.P and Rodhal, J. (1977). Work Physiology. Mc Graw hill Co. New York.
2. Ernest and Mc Cormick, E.L. (1970). Human factors in engineering and design. Mc Graw Hill Co., New York.
3. Grandjean, E. (1988). Fitting the task to the man. Taylor and Francis, London.

**REFERENCE BOOKS:**

1. Liljedhal, J.B, Carleton, W.M, Smith, P.K and David, M. (1978). Tractors and power units. John Wiley and sons, New York.
2. Murrel, K.H.F. (1978). Ergonomics, Man in his working environment. Chapman and Hall, London.

## **(AG520) BIOMASS MANAGEMENT FOR FODDER AND ENERGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>To</b>	<b>C</b>
3	1	-	4	4

### **UNIT I**

Introduction to biomass management, biomass resource assessment management techniques/supply chains.

### **UNIT II**

Processing of paddy straw, densification- Extrusion process, pellets, mills and cubers, Baling-classification, uses.

### **UNIT III**

residue management for surface mulch and soil incorporation, Paddy Straw choppers and spreaders as an attachment to combine Harvester, Mulch seeder.

### **UNIT IV**

Paddy Straw Chopper-cum-Loader, Balar for collection of straw; Processing of straw/ fodder for animal use.

### **UNIT V**

Agricultural and horticultural use, Cushioning material for fruits and vegetables, Mulching and Composting, Paper and cardboard manufacturing, Straw as a fuel.

### **TEXT BOOKS:**

1. Chahal, D.S. (1985). Food, Feed and Fuel from Bio mass. IBH Publishing. Pvt. Ltd. NewDelhi.
2. Chakravarty, A. (1989). Bio Technology and other Alternative Technologies for Utilisation of Bio-mass/Agri.Wastes. Oxford & IBH Pub.Co.Pvt Ltd.

### **REFERENCE BOOKS:**

1. Alba S. A.E. Humphery and N.E. Milles. (1973). Bio Chemical Engineering (2 ed.).
2. Baily, J.E and D.F. Ollies. (1986). Bi Chemical Engineering Fundamentals (2 ed.). Prescott and Dunn Industrial Micro Biology.