**PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018**

**AUTONOMOUS**

**B.E. AGRICULTURE ENGINEERING**

**CURRICULUM**

**REGULATION 2015**

**SEMESTER III**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| MA15301 | Transforms and Boundary Value Problems | 3 | 2 | 0 | 4 |
| AI15306 | Strength of Materials | 3 | 2 | 0 | 4 |
| AI15301 | Principles and Practices of Crop Production | 3 | 0 | 0 | 3 |
| AI15302 | Theory of Machines | 3 | 0 | 0 | 3 |
| AI15303 | Surveying | 3 | 0 | 0 | 3 |
| AI15304 | Unit Operations in Agricultural Processing | 3 | 0 | 0 | 3 |
| AI15305 | Soil Science and Engineering | 3 | 0 | 0 | 3 |
| AI15307 | Surveying Laboratory | 0 | 0 | 4 | 2 |
| AI15308 | Crop Husbandry Laboratory | 0 | 0 | 4 | 2 |
| EN15301 | Business English Course Laboratory | 0 | 0 | 2 | 1 |

**SEMESTER IV**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| MA15403 | Probability and Statistics | 3 | 2 | 0 | 4 |
| ME15405 | Thermodynamics | 3 | 2 | 0 | 4 |
| AI15401 | Principles of Agricultural Engineering | 3 | 0 | 0 | 3 |
| AI15402 | Soil and Water Conservation Engineering | 3 | 0 | 0 | 3 |
| AI15403 | Hydrology and Water Resources Engineering | 3 | 0 | 0 | 3 |
| AI15404 | Fluid Mechanics and Hydraulics | 3 | 2 | 0 | 4 |
| AI15405 | Drawing of Farm Structures | 0 | 0 | 4 | 2 |
| AI15406 | Agricultural Engineering Practices Lab | 0 | 0 | 4 | 2 |
| AI15407 | Fluid Mechanics and Strength of Materials Laboratory | 0 | 0 | 4 | 2 |

**MA15301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 2 0 4**

**COURSE OBJECTIVES**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes.
- To determine the steady state solution of two-dimensional equation of heat conduction.
- To develop Z transform techniques for discrete time systems.

**UNIT I FOURIER SERIES 15**

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

**UNIT II FOURIER TRANSFORMS 15**

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

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15**

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

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15**

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

At the end of the course, the students would

- have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.

- have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair and specialization on Fourier transform pair, their properties.
- have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- have learnt the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

**TEXT BOOKS**


1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students",Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.


**REFERENCES**


1. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Enginears", SPIE Optical Engineering Press, Washington USA (1999).
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.


**WEB LINKS**

1. https://www.youtube.com/watch?v=coe-UA5ONI0
2. https://www.youtube.com/watch?v=gZNm7L96pfY
3. https://www.youtube.com/watch?v=4GHY8sRKPaU
4. http://172.16.100.200/NPTEL/displayweb.html?type1=111103021%2F35.pdf

**AI15306 STRENGTH OF MATERIALS 3 2 0 4**

**COURSE OBJECTIVES**

- To impart knowledge in the fundamental concepts of stress and strain in mechanics of solids and structures.
- To estimate the stresses developed in bars, beams, shafts, cylinders and spheres.
- To understand torsion formulation stresses and deformation
- To study methods and theorems in deflection of beams
- To develop and analyse problem solving skill related to mechanical elements

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 15**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr‟s circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 15**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 15**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 15**

Double Integration method – Macaulay‟s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell‟s reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 15**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame‟s theorem.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

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

- understand the fundamental concepts of stress and strain in mechanics of solids and structures.
- analyse and determine beams and trusses in shear forces, bending moments and axial forces.

- gain sufficient knowledge in designing shafts to transmit required power and also springs for its maximum energy storage capacities.
- calculate the deformation behavior of simple structures.
- analyse the critical problems arrive at solutions related to mechanical elements and the deformation behavior for different types of loads.

**TEXTBOOKS**


1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007


**REFERENCES**


1. Egor. P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series,2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing ,,co. Ltd., New Delhi, 2005.

**AI15301 PRINCIPLES AND PRACTICES OF CROP PRODUCTION 3 0 0 3**

**COURSE OBJECTIVES**

- To impart knowledge in the basics of Agriculture
- To introduce the students about the regional and seasonal selection of crops
- To gain knowledge in crop water management
- To study the production practices of crops
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

**UNIT I AGRICULTURE AND CROP PRODUCTION 9**

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

**UNIT II CROP SELECTION AND ESTABLISHMENT 9**

Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.

**UNIT III CROP MANAGEMENT 9**

Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.

**UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS 9**

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

**UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS 9**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- acquire knowledge in factors affecting growth and production of crops
- analyse the regional and seasonal selection of crops
- understand the crop management practices of agricultural crops.
- practice crop management practices of horticultural crops.
- relate agricultural and irrigation engineering in relation to various crop production practices

**TEXTBOOKS**


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


**REFERENCES**


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

**AI15302 THEORY OF MACHINES 3 0 0 3**

**COURSE OBJECTIVES**

- To introduce the students the theory of machines pertaining to agricultural engineering.
- To study various terminologies used in machines
- To understand concept of sliding and rolling friction
- To impart knowledge in gears
- To delineate the concepts of flywheel and balancing

**UNIT I TERMINOLOGY 9**

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

**UNIT II FRICTION AND APPLICATIONS 9**

Sliding and rolling friction –friction in screw threads-Bearing and lubrication- Friction clutches- Belt drives- Friction aspects in brakes.

**UNIT III MOTION OF CAM AND FOLLOWER 9**

Cam and follower - types - application – displacement diagrams - profile layout for uniform velocity - Uniform acceleration and retardation - simple harmonic and cycloid motion.

**UNIT IV GEARS AND GEAR TRAINS 9**

Gears - classification - terminology -law of gearing - tooth profile - interference between rack and pinion. Gear trains - simple - compound reverted. Simple epi-cyclic gear trains.

**UNIT V FLYWHEEL AND BALANCING 9**

Inertia - turning moment - flywheel - fluctuation of speed and energy. Balancing of rotating masses and reciprocating masses.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- Gain inputs in the terminologies pertaining to agricultural machineries.
- Acquire basic knowledge in the friction applications, gear and gear trains.
- apply practical utility in sliding and rolling friction
- to know the motion of cam and follower
- to implement ideas of rotating masses and reciprocating masses

**TEXTBOOKS**


1. Rattan, S.S, Theory of Machines, 3rd Edition, Tata McGraw-Hill, 2009.
2. Khurmi, R.S. and Gupta, J.K, Theory of machines, Eurasia Publication House, 1994.

**REFERENCES**


1. Thomas Beven, Theory of Machines, CBS Publishers and Distributors, New Delhi, 1984.
2. Ballaney, P.L, Theory of machines, Khanna Publishers, New Delhi,1994


**WEB LINKS**

1. http://www.softintegration.com/chhtml/toolkit/mechanism/

**AI15303 SURVEYING 3 0 0 3**

**COURSE OBJECTIVES**

- To introduce students the principle of surveying
- To provide exposure in various methods and applications of surveying to Agricultural Engineering projects.
- To understand the advanced level of surveying equipments
- To demonstrate methodologies involved in levelling
- To study the applications of leveling

**UNIT I FUNDAMENTALS AND CHAIN SURVEYING 9**

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

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

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

**UNIT III THEODOLITE AND MODERN SURVEYING 9**

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

**UNIT IV LEVELLING 9**

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

**UNIT V LEVELLING APPLICATIONS 9**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- use all surveying equipments,
- gain knowledge in the principles and classification of chain surveying and ranging
- understand the different types of bearing and traversing
- demonstrate the theodolite, total station and global position system
- prepare LS & CS, contour maps and carryout surveying works related to land and civil engineering projects

**TEXT BOOKS**


1. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.


**REFERENCES**


1. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
2. A.M. Chandra, Plane Surveying, New Age International Publishers 2002.
3. Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.

**AI15304 UNIT OPERATIONS IN AGRICULTURAL PROCESSING 3 0 0 3**

**COURSE OBJECTIVES**

- To introduce the scope, importance and key concepts of the agro processing
- To expose the fundamentals of various unit operations in Agricultural Processing
- To gain fundamental knowledge in Evaporation, Filtration, Sedimentation, Processing, Crystallization and Distillation in processing of agricultural produce.
- To impart knowledge in the concepts of size reduction
- To understand the factors influencing various unit operations in agriculture processing

**UNIT I EVAPORATION AND CONCENTRATION 9**

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

**UNITII FILTRATION AND SEDIMENTATION 9**

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

**UNIT III SIZE REDUCTION 9**

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

**UNIT IV PROCESSING 9**

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

**UNIT V CRYSTALLISATION AND DISTILLATION 9**

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

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES

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

- Understand scope, importance and key concepts of the agro processing
- Know the fundamentals of various unit operations of Agricultural Processing
- use the processing methods of agricultural produce
- apply the concepts of size reduction
- Know the factors influencing various unit operations in agriculture processing.

**TEXTBOOKS**


1. Earle, R.L., “Unit operations in Food Processing”, Pergamon Press, Oxford, U.K, 1985.
2. Sahay. K.M. and Singh, K.K., “Unit Operations of Agricultural Processing”, Vikas Publishing House Pvt. Ltd., New Delhi, 2008.
3. McCabe, W.L., and Smith, J.C., “Unit Operations of Chemical Engineering”, Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.


**REFERENCE**


1. Coulson, J.M., and Richardson, J.F., “Chemical Engineering”, Vol. 1, The Pergamonress New York, 1977.

**AI15305 SOIL SCIENCE AND ENGINEERING 3 0 0 3**

**COURSE OBJECTIVES**

- To introduce the fundamental knowledge in soil physical parameters
- To impart knowledge in types and methods of soil survey and interpretative groupings
- To understand the phase relationship and laboratory soil compaction methods
- To gain fundamental knowledge in engineering properties of different types of soil
- To study bearing capacity of different types of soil

**UNIT I INTRODUCTION AND SOIL PHYSICS 9**

Soil - definition - major components – Soil forming minerals and processes - soil profile –Physical properties - texture – density – porosity – consistence - colour- - specific gravity - capillary and non - capillary - plasticity. Soil air - soil temperature - soil water - classification of soil water - Movement soil water. Soil colloids – organic and inorganic matter - Ion exchange - pH – Plant nutrient availability

**UNIT II SOIL CLASSIFICATION AND SURVEY 9**

Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping- mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.

**UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION 9**

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

**UNIT IV ENGINEERING PROPERTIES OF SOIL 9**

Shear strength of cohesive and cohesion-less - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Tri-axial and vane shear test- -Permeability- Coefficient of Permeability-Darcy's law-field and lab methods - Assessment of seepage - Compressibility.

**UNIT V BEARING CAPACITY AND SLOPE STABILITY 9**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- gain ideas in fundamentals of soil physical parameters and classification of soils.
- acquire knowledge in the procedures involved in soil survey, field soil mapping and suitability of soil.
- understand the soil compaction and engineering classification of soil.

- analyse engineering properties of soil and darcy law.
- apply the concepts of bearing capacity, slope stability and BIS standard for soil.

**TEXTBOOKS**


1. Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008.
2. Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.


**REFERENCES**


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

**AI15307 SURVEYING LABORATORY 0 0 4 2**

**COURSE OBJECTIVES**

- To provide exposure in various methods and applications of surveying to Agricultural Engineering projects.
- To train the student to acquire skill in operating various surveying instruments
- To develop skill to operate levelling instruments
- To train the student, how to demonstrate the total station and gps
- To study the applications of leveling

## LIST OF EXPERIMENTS

1. **CHAIN SURVEYING**
    a. Ranging, Chaining and Pacing
    b. Chain traversing
2. **COMPASS SURVEYING**
    a. Triangulation Problem
    b. Compass traversing
3. **PLANE TABLE SURVEYING**
    a. Radiation
    b. Intersection - Triangulation problem
    c. Plane table traversing
4. **THEODOLITE SURVEYING**
    a. Measurement of horizontal & vertical angles
    b. Tangential & Stadia Tacheometry
5. **LEVELLING**
    a. Fly levelling using Dumpy level
    b. Fly levelling using Tilting level
    c. Check levelling
    d. Block Levelling
    e. Radial Contouring
6. **DEMONSTRATION OF TOTAL STATION AND GPS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES**

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

- use all surveying equipments
- gain knowledge in the principles and classification of chain surveying and ranging

- demonstrate the theodolite, total station and global position system
- understand the different types of bearing and traversing
- prepare LS & CS, contour maps and carryout surveying works related to land and civil engineering projects

**AI15308 CROP HUSBANDRY LABORATORY 0 0 4 2**

**COURSE OBJECTIVE**

- To impart knowledge in the basics of Agriculture
- To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
- To introduce the students about the regional and seasonal selection of crops
- To gain knowledge in crop water management
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

**LIST OF EXPERIMENTS**

1. Field preparation studies
2. Seed selection and seed treatment procedures
3. Seed bed and nursery preparation
4. Sowing / Transplanting
5. Biometric observation for crops
6. Nutrient management studies
7. Water management and irrigation scheduling
8. Weed management studies
9. Integrated Pest Management studies
10. Harvesting
11. Post harvesting

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES**

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

- acquire knowledge in factors affecting growth and production of crops
- analyse the regional and seasonal selection of crops
- understand the seed selection and seed treatment procedures
- know the water management and irrigation scheduling
- sintegrated pest management

**EN15301 BUSINESS ENGLISH COURSE LABORATORY 0 0 2 1**

**COURSE OBJECTIVES**

- To develop the reading skills of the students and make them familiarize in skimming and scanning.
- To instill the communication concepts to enhance the students' conversational skills through various practice sessions and to familiarize them with a variety of business correspondence.
- To inculcate the receptive skills i.e. Listening and Reading and to make the students well versed in the Productive skills and to assist them in improving their vocabulary and comprehension of grammar.

**UNIT I READING AND VOCABULARY**

Understanding short, real notices, messages - detailed comprehension of factual material- skimming & scanning skills - interpreting visual information - reading for detailed factual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information transfer.

**UNIT II WRITING**

Re-arranging appointments - asking for permission - giving instructions - apologizing and offering compensation - making or altering reservations - dealing with requests - giving information about a product.

**UNIT III LISTENING**

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific information - Listening to conversation- interview, discussion.

**UNIT IV SPEAKING**

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organising a larger unit of discourse - giving information and expressing opinions - two way conversation between candidates followed by further prompting from the interlocutor- Expressing opinions- agreeing and disagreeing

**TOTAL: 30 PERIODS**

## COURSE OUTCOMES

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

- enrich the vocabulary through reading and to develop their pronunciation skills.
- speak effectively in English in all occasions.
- prepare flawless reports and proposals.

**TEXT BOOKS**


1. Cambridge BEC Preliminary, Self-Study Edition, Cambridge University Press, New York, 2012.
2. Whitby, Norman. Business Benchmark, Pre-intermediate to intermediate, Business Preliminary, Shree Maitrey Printech Pvt. Ltd., Noida, 2014.


**REFERENCE BOOKS**


1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice.Oxford University Press, New Delhi. 2011.
2. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
3. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.


**WEB LINK**

1. http://www.cambridge.org/us/cambridgeenglish/catalog/cambridge-english-exams-ielts/business-benchmark

**SEMESTER – IV**

**MA15403 PROBABILITY AND STATISTICS 3 2 0 4**

**COURSE OBJECTIVES**

- To discuss the outcome of a random experiment by a number.
- To learn about the characteristics of the outcomes of a random variable.
- To analyze the decisions made about the population on the basis of sample information.
- To analyze the design of experiments to control the extraneous variables.
- To maintain the quality of the goods manufactured and marketing them at reasonable prices.

**UNIT I RANDOM VARIABLES 15**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 15**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS 15**

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

**UNIT IV DESIGN OF EXPERIMENTS 15**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

**UNIT V STATISTICAL QUALITY CONTROL 15**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

At the end of course, students will be able to

- understand the fundamental knowledge of the concepts of probability.
- acquire the knowledge of standard distributions which can describe real life phenomenon.
- learn the sampling distributions and statistical techniques for engineering and management problems.
- realize the principles that are adopted for designing the experiments.

- appreciate the Control charts and the basics of manufacturing processes.

**TEXTBOOKS**


1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund‟s Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes" McGraw Hill Education India , 4th Edition, New Delhi , 2010.


**REFERENCES**


1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum‟s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.


**WEB LINKS**

1. https://www.youtube.com/watch?v=IYdiKeQ9xEI
2. https://www.youtube.com/watch?v=J70dP_AECzQ
3. https://www.youtube.com/watch?v=pvvoK4rlzqQ
4. https://www.youtube.com/watch?v=IEP3swFeauE
5. https://www.youtube.com/watch?v=SAfS56Ez0QY

**ME15405 THERMODYNAMICS 3 2 0 4**

**COURSE OBJECTIVES**

- To understand the basic laws of thermodynamics and heat transfer.
- To study the principle of operation of thermal equipments
- To impart knowledge in the properties of mixture of gases
- To introduce modes of heat transfer
- To furnish ideas related to the applications of laws of thermodynamics

**UNIT I BASIC CONCEPTS OF THERMODYNAMICS 15**

Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Pure substances – Phase change processes of pure substances – Property diagrams – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

**UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS 15**

First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility - Applications.

**UNIT III HEAT ENGINES 15**

Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine , Turbine Components - Refrigeration Cycle – Vapour Compression & Vapour Absorption System ,Gas Refrigeration System – Environmental friendly Refrigerants – Air Conditioning.

**UNIT IV GASES AND VAPOUR MIXTURES 15**

Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart - Properties of mixture of gases – Dalton‟s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.

**UNIT V HEAT TRANSFER 15**

Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

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

- gain knowledge in different gas power cycles
- use gas power cycles in IC and R&AC applications.
- understand the concepts of internal Combustion Engines
- know the properties of gases and vapour mixtures
- differentiate three modes of heat transfer

**TEXTBOOKS**


1. Yunus A. Cenegal and Michael A.Boles, "Thermodynamics: An Engineering Approach", Fourth Edition, Tata McGraw-hill, 2004.
2. Michael J.Moran, Howard N.Shapiro, "Fundamentals of Engineering Thermodynamics", Fourth Editon, John wiley &Sons, 2000.


**REFERENCES**


1. R.K.Rajput, "A Text book of Engineering Thermodynamics", Third Edition, Laxmi publication (P) Ltd., 2007.
2. Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.
3. Domkundwar.S., C.P.Kothandaraman "A Course in Thermal Engineering", Fifth Edition, Dhanpat Rai & Co (p) Ltd, 2000.

**AI15401 PRINCIPLES OF AGRICULTURAL ENGINEERING 3 0 0 3**

**COURSE OBJECTIVES**

- To study the basic theory and practice for various areas of Agricultural Engineering, application of engineering to the problems of agricultural production.
- To impart knowledge in farm structures
- To introduce students the harvesting and mowing equipments
- To give outline in the cold storage and packaging of agricultural produce
- To define the concepts of energy requirement in agricultural operations

**UNIT I INTRODUCTION, SOIL & WATER CONSERVATION AND IRRIGATION ENGINEERING 10**

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

**UNIT II FARM STRUCTURES 8**

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

**UNIT III FARM MACHINERY AND EQUIPMENT 8**

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

**UNIT IV AGRICULTURAL PROCESS ENGINEERING 10**

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

**UNIT V AGRO ENERGY 9**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- acquire knowledge in soil water conservation, irrigation engineering and farm structures

- utilize the agricultural waste effectively
- understand the post harvest technology of agricultural crops
- know the energy efficient cooking stoves and alternative cooking fuels
- understand the milk processing and dairy products

**TEXTBOOKS**


1. Michael, A.M. & Ojha, T.P. "Principles of Agricultural Engineering Vol. I & II", Seventh Edition, Jain Brothers, New Delhi, 2011.
2. Jagdishwar Sahay. "Elements of Agricultural Engineering", Standard Publishers Distributors, 2010.
3. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007.

**AI15402 SOIL AND WATER CONSERVATION ENGINEERING 3 0 0 3**

**COURSE OBJECTIVES**

- To present the concepts of erosion so that students get a sound knowledge in the problems associated with it.
- To introduce the Classification of eroded soils and Runoff computation for soil conservation
- To impart knowledge in various practices to control erosion
- To study the water harvesting principles and techniques
- To enable the students to make use of the principles and concepts to solve issues related to soil and water management.

**UNIT I SOIL EROSION PRINCIPLES 9**

Approaches to soil conservation – Soil conservation in India - Erosion – Agents - Causes - Mechanics of water erosion – Soil erosion problems - Types of water erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully – Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways - Prerequisites for soil and water conservation measures.

**UNIT II ESTIMATION OF SOIL EROSION 9**

Runoff computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation-2 - Permissible erosion – Land use capability classification - Classification of eroded soils.

**UNIT III EROSION CONTROL MEASURES 10**

Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Bunding: Types and design specifications - Mechanical measures for hill slopes – Terracing: Classification and design specification of bench terrace – Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures.

**UNIT IV WATER CONSERVATION MEASURES 9**

In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis - Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.

**UNIT V SEDIMENTATION 8**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- gain knowledge in the concepts of erosion and sedimentation.
- design specification of terracing
- implement water harvesting principles and techniques
- know the construction and protection of dams
- understand the factors affecting sediment distribution pattern.

**TEXTBOOKS**


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


**REFERENCES**


1. Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.
2. Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.
3. Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002

**AI15403 HYDROLOGY AND WATER RESOURCES ENGINEERING 3 0 0 3**

**COURSE OBJECTIVES**

- To introduce the student the concept of hydrological aspects of water availability and requirements
- To give idea in the factors affecting runoff
- To study the properties of aquifers
- To impart knowledge to quantify, control and regulate the water resources
- To develop skill to conduct Spatial analysis of rainfall data and design of water storage reservoirs

**UNIT I PRECIPITATION AND ABSTRACTIONS 10**

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

**UNIT II RUNOFF 8**

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

**UNIT III FLOOD AND DROUGHT 9**

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

**UNIT IV RESERVOIRS 8**

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

**UNIT V GROUNDWATER AND MANAGEMENT 10**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- understand the key drivers on water resources, hydrological processes and their integrated behaviour in catchments
- gain knowledge in properties of aquifers

- to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
- to conduct Spatial analysis of rainfall data
- to design water storage reservoirs

**TEXTBOOKS**


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


**REFERENCES**


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

**AI15404 FLUID MECHANICS AND HYDRAULICS 3 2 0 4**

## COURSE OBJECTIVES

- To introduce the students the mechanics of fluids through a thorough the properties and behaviour of fluids under static conditions.
- To impart idea in the dynamics of fluids through the control volume approach
- To expose the applications of the conservation laws
- To study the various hydraulic engineering problems like open channel flows and hydraulic pumps.
- To understand and practice the theory related to hydraulic engineering.

**UNIT I PROPERTIES OF FLUIDS 15**

Properties of fluids – definition – units of measurement - Mass density – specific weight, specific volume – specific gravity - equation of state – perfect gas - Viscosity – vapour pressure – compressibility and elasticity - surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure - Horizontal- vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancy – meta centre – metacentric height.

**UNIT II FLUID FLOW ANALYSIS 15**

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

**UNIT III FLOW MEASUREMENTS 15**

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter - rota meter – elbow meter - pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen-William‟s formula - Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves

**UNIT IV OPEN CHANNEL FLOW 15**

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and

triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

**UNIT V DIMENSIONAL ANALYSIS & PUMPS 15**

Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh‟s method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Importantnon dimensional numbers – Reynolds, Froude, Euler, Mach and Weber - Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristic curves. Turbine and submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump- Hydraulic ram.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

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

- understand the properties, behaviour of fluids under static conditions.
- relate the theory and practice problems in hydraulic engineering.
- get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- know various hydraulic engineering problems like open channel flows and hydraulic pumps
- apply physical laws in addressing problems in hydraulics

**TEXTBOOKS**


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


**REFERENCES**


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


**WEB LINKS**

1. www.onesmartclick.com/engineering/fluid-mechanics.html
2. www.it.iitb.ac.in/vweb/engr/civil/fluid_mech/course.html

**AI15405 DRAWING OF FARM STRUCTURES 0 0 4 2**

## COURSE OBJECTIVES

- To conceive and design various farm structures related to agricultural engineering.
- To plan and to draw layout for farm structures
- To enhance the knowledge to design fencing system

## LIST OF EXERCISES

1. Planning and Layout of farmstead
2. Design of stall bam
3. Design of loose housing and milk parlors
4. Design of poultry house
5. Design of a sheep / goat house
6. Design of ventilation system for dairy and poultry house
7. Design of silos – over ground and underground and hay storages
8. Design of farm fencing system
9. Design of farm trusses
10. Design of machinery and equipment shed and workshops
11. Design of septic tank and sanitary structures
12. Design of rural/farm roads and culverts.
13. Design of biogas plant

**TOTAL: 60 PERIODS**

## COURSE OUTCOMES

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

- design various form structures related to agricultural engineering
- plan and layout of farmstead
- design machinery and equipment shed and workshops
- design biogas plant
- design silos – over ground and underground and hay storages

## TEXTBOOKS


1. Barre, H.J. and Sammet, L.L. "Farm Structures". John Wiley and Sons Inc. 1950."
2. Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 1961.
3. Khanna, S.K. and Justo, C.E.G. "Highway Engineering". Nemchand and Bros., Roorkee, India.
4. Dutta, B.N. "Estimating and Costing in Civil Engineering Theory and Practice". S. Dutta and Co.
5. Bazirani, V.N. and Ratwani, M.M. "Steel Structures". Khanna Publishers, Delhi, 1981.
6. Justo, C.E.G. and Khanna, S.K. "Highway Engineering". Nemchand and Bros., Roorkee, India (Revised).

**AI15406 AGRICULTURAL ENGINEERING PRACTICES LAB 0 0 4 2**

**COURSE OBJECTIVES**

- To practice various aspects of agricultural engineering by performing basic experiments in lab.
- To identify food crops
- To Estimate biometric parameters of different food crops
- To measure soil and water parameters
- To demonstrate Agro-energy equipment

**AGROMETEOROLOGY 12**

1. Meteorology – Precipitation – Rain gauges - recording and non-recording rain gauges - Automatic Weather Station (AWS)
2. Measurement of evaporation using evaporimeter
3. Measurement of humidity, sunshine, solar radiation, wind direction and speed

**SEEDS AND CROPS 12**

1. Identification of food grains and crops
2. Estimation of germination rate for cereals, pulses and oilseeds by conventional method and using Seed Growth germinator
3. Estimation of biometric parameters of different food crops

**SOIL AND WATER PARAMETERS 9**

1. Soil Moisture estimation by different methods
2. pH and EC measurement using electrode device

**AGRICULTURAL MACHINERY 12**

1. Demonstration of Agricultural machineries and equipment
2. Demonstration of Agricultural processing equipment
3. Demonstration of Agro-energy equipment

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES**

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

- know various aspects of agricultural engineering
- identify food crops
- Estimate biometric parameters of different food crops
- measure soil and water parameters
- demonstrate Agro-energy equipment

**REFERENCES**


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

**AI15407 FLUID MECHANICS & STRENGTH OF MATERIALS LABORATORY 0 0 4 2**

**COURSE OBJECTIVES**

- To verify the various principles by performing the experiments in lab.
- To expose the testing of different materials under the action of various forces and determination of their characteristics experimentally.

**LIST OF EXPERIMENTS - FLUID MECHANICS**

**1. Flow Measurement**

Calibration of Rotometer.

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

**2. Losses in Pipes**

3. Determination of friction coefficient in pipes.
1. Determination of losses due to bends, fittings and elbows.

**3. Pumps**

1. Characteristics of Centrifugal pump.
2. Characteristics of Submersible pump.
3. Characteristics of Reciprocating pump.
4. Characteristics of Jet pump.

**LIST OF EXPERIMENTS - STRENGTH OF MATERIALS**

1. Tension test on mild steel rod.
2. Compression test on wood.
3. Double shear test on metal.
4. Torsion test on mild steel rod.
5. Impact test on metal specimen (Izod and Charpy).
6. Hardness test on metals (Rockwell and Brinell Hardness Tests).
7. Deflection test on metal beam.
8. Compression test on helical spring.
9. Deflection test on carriage spring.
10. Test on Cement. **TOTAL: 60 PERIODS**

**COURSE OUTCOMES**

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

- measure flow in pipes and determine frictional losses.
- develop characteristics of pumps and turbines.
- acquire knowledge in the area of testing of materials and components of structural elements experimentally.

**REFERENCES**


1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House, New Delhi, 2000.
3. Subramanya, K. Flow in Open Channels, Tata McGraw - Hill Pub. Co.1992.
4. Subramanya, K. Fluid Mechanics, Tata McGraw- Hill Pub. Co., New Delhi, 1992.
5. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.
6. IS1786-2008, Specification for cold worked steel high strength deformed bars for concrete reinforcement, 2008.