JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

B. TECH AGRICUTLTURAL ENGINEERING

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year – I SEMESTER

S. No.	Course Code	Subject	L	T	P	Credits
1	BS1101	Mathematics - I	3	0	0	3
2	BS1102	Mathematics – II	3	0	0	3
3	BS1108	Engineering Physics	3	0	0	3
4	AG1101	Surveying and Leveling	3	0	0	3
5	ES1103	Engineering Drawing	1	0	3	2.5
6	BS1102	English Lab	0	0	3	1.5
7	BS1109	Engineering Physics Laboratory	0	0	3	1.5
8	AG1102	Surveying and Leveling Lab	0	0	3	1.5
9	MC1104	Constitution of India	2	0	0	0
		Total Credits				**19**

I Year – II SEMESTER

S. No.	Course Code	Subject	L	T	P	Credits
1	HS1201	English	3	0	0	3
2	BS1210	Engineering Chemistry	3	0	0	3
3	ES1204	Engineering Mechanics	3	0	0	3
4	BS1214	Principles of Soil Science & Agronomy	3	0	0	3
5	ES1201	Programming for problem Solving Using C	3	0	0	3
6	BS1211	Engineering Chemistry Laboratory	0	0	3	1.5
7	HS1203	Communication Skills Lab	0	0	3	1.5
8	ES1202	Programming for problem Solving Using C Lab	0	0	3	1.5
9	ES1220	Engineering Workshop & IT Workshop	0	0	3	1.5
10	MC1201	Environmental Science	2	0	0	0
		Total Credits				**21**

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II Year I Semester

S. No.	Subject	L	T	P	Credits
1	Mathematics - III	3	0	0	3
2	Fluid Mechanics and Open Channel Hydraulics	3	0	0	3
3	Renewable Energy Sources	3	0	0	3
4	Ground Water Hydrology, Well and Pumps	3	0	0	3
5	Properties and Strength of Materials	3	0	0	3
6	Electrical Systems	3	0	0	3
7	Fluid Mechanics and Open Channel Hydraulics Lab	0	0	3	1.5
8	Soil Science and Agronomy Field Lab	0	0	3	1.5
	Total Credits				**21.0**

II Year II Semester

S. No.	Subject	L	T	P	Credits
1	Theory of Structures	3	0	0	3
2	Heat and Mass Transfer	3	0	0	3
3	Theory of Machines	3	0	0	3
4	Soil Mechanics	3	0	0	3
5	Surface Water Hydrology	3	0	0	3
6	Farm Power and Tractor Systems	3	0	0	3
7	Field Operation and Maintenance of Tractors Lab - I	0	0	3	1.5
8	Machine Drawing and Computer Graphics Lab	0	0	3	1.5
	Total Credits				**21.0**

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III Year I Semester

S. No.	Subject	L	T	P	Credits
1	Thermodynamics and Refrigeration systems	3	0	0	3
2	Soil and Water Conservation Engineering	3	0	0	3
3	Agricultural Process Engineering	3	0	0	3
4	Farm Machinery and Equipment - I	3	0	0	3
5	Managerial Economics and Financial Analysis	3	0	0	3
6	Agricultural Process Engineering Lab	0	0	3	1.5
7	Soil and Water Engineering Lab	0	0	2	1.0
8	Farm Machinery Lab - I	0	0	3	1.5
	Total Credits				**19**

III Year II Semester

S. No.	Subject	L	T	P	Credits
1	Irrigation and Drainage Engineering	3	0	0	3
2	Engineering Properties of Biological Materials	3	0	0	3
3	Farm Machinery Equipment - II	3	0	0	3
4	Dairy and Food Engineering	3	0	0	3
5	**Professional Elective- I** 1. Seed Processing and Storage Engineering 2. Greenhouse Technology 3. Tractor Design and Testing	3	0	0	3
6	**Open Elective - I** 1. Operations Research 2. Robotics and Automation 3. Finite Element Method	3	0	0	3
7	Field Operation and Maintenance of Tractors Lab - II	0	0	3	1.5
8	Dairy and Food Engineering Lab	0	0	3	1.5
	Total Credits				**21.0**

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IV Year I Semester

S. No.	Subject	L	T	P	Credits
1	Micro Irrigation Engineering	3	0	0	3
2	Post Harvest Engineering for Horticulture Produce	3	0	0	3
3	**Open Elective - II** 1. Mechanical Measurements and Instrumentation 2. Artificial Intelligence in Agricultural Engineering 3. Photovoltaic Technology and Systems	3	0	0	3
4	**Professional Elective – II** 1. Food Packaging Technology 2. Watershed Management 3. Human Engineering and Safety	3	0	0	3
5	**Professional Elective – III** 1. GIS and Remote Sensing 2. Production Technology of Agricultural Machinery 3. Food Plant Design and Management	3	0	0	3
6	Farm Machinery Lab - II	0	0	3	1.5
7	Summer In-Plant Training/Internship (After 6th Semester) for 4 weeks	0	0	2	1
8	Research Project – Part - I	0	0	3	1.5
	Total Credits				**19.0**

IV Year II Semester

S. No.	Subject	L	T	P	Credits
1	**Open Elective – III** 1. Design of Agricultural Machinery 2. Food Quality and Control 3. Industrial Pollution Control Engineering	3	0	0	3
2	**Open Elective - IV** 1. Agro Industries and By-Products Utilization 2. Hydraulic Devices and Controls 3. Water Resource System Planning and Management	3	0	0	3
3	**Professional Elective – IV** 1. Design of Soil and Water Conservation and Form Systems 2. Process Equipment Design 3. Digital Control Systems	3	0	0	3
4	Agricultural Extension Techniques and Business Management	3	0	0	3
5	Seminar	0	0	3	1.5
6	Research Project – Part - II	0	0	11	5.5
	Total Credits				**19**

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
	Mathematics-I (BS1101) **(Common to all Branch's for I Year B. Tech)**				

Course Objectives:

- This course will illuminate the students in the concepts of calculus.

- To enlighten the learners in the concept of differential equations and multivariable calculus.

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- utilize mean value theorems to real life problems (L3)

- solve the differential equations related to various engineering fields (L3)

- familiarize with functions of several variables which is useful in optimization (L3)

- Apply double integration techniques in evaluating areas bounded by region (L3)

- students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5)

UNIT I: Sequences, Series and Mean value theorems: $\qquad$ **(10 hrs)**

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

UNIT II: Differential equations of first order and first degree: $\qquad$ **(10 hrs)**

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

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UNIT III: Linear differential equations of higher order: (10 hrs)

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT IV: Partial differentiation: (10 hrs)

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT V: Multiple integrals: (8 hrs)

Double and Triple integrals – Change of order of integration – Change of variables.
Applications: Finding Areas and Volumes.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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I Year - I Semester		L	T	P	C
		3	0	0	3
	MATHEMATICS - II (BS1102) **(Common to all Branch's for I Year B. Tech)**				

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)

- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)

- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)

- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)

- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: **(10 hrs)**

Rank of a matrix by echelon form and normal form – Solving system of   homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.

Unit-II: Cayley-Hamilton theorem and Quadratic forms: **(10 hrs)**

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).

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UNIT III: Iterative methods: (8 hrs)

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT IV: Interpolation: (10 hrs)

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.

UNIT V: Numerical integration and solution of ordinary differential equations: (10 hrs)

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **David Poole,** Linear Algebra- A modern introduction, 4th Edition, Cengage.
2. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press.

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I Year - I Semester		L	T	P	C
		3	0	0	3
ENGINEERING PHYSICS (BS1108)					

Course Objectives:

Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by JNTUniversity:kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart concepts of mechanics required to identify forces and moments in mechanical systems by vector representation-extend Newton's second law for inertial and non-inertial frames of reference- study different types of harmonic oscillatory motions.
- Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls- impart concepts of flaw detection techniques using ultrasonics.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.
- Impart knowledge in basic concepts of LASERs along with its Engineering applications- Familiarize types of sensors for various engineering applications
- Explore the knowledge of magnetic and dielectric materials and their utility in appliances.

UNIT-I (10hrs)

MECHANICS: Basic laws of vectors and scalars, rotational frames-conservative and non – conservative forces , $F = -$ grad V, Newton's laws in inertial and linear accelerating non-inertial frames of reference, rotating frame of reference with constant angular velocity, Harmonic oscillator ; damped harmonic motion ; Forced oscillations and resonance.

Outcome:

The students will be able to

- Identify forces and moments in mechanical systems using scalar and vector techniques
- extend Newton's second law for inertial and non-inertial frame of reference
- explain simple harmonic motion and damped harmonic motions

UNIT-II (10hrs)

ACOUSTICS & ULTRASONICS: Introduction – Reverberation - Reverberation time - Sabine's formula (Derivation using growth and decay method)–absorption coefficient and its determination-factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by Magnetostriction and piezoelectric methods – Detection of ultrasonics - acoustic grating - Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications.

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Outcome:

The students will be able to

- explain how sound is propagated in buildings
- analyze acoustic properties of typically used materials in buildings
- recognize sound level disruptors and their use in architectural acoustics
- Use of ultrasonics in flaw detection using NDT technique

UNIT-III (9hrs)

ELASTICITY:, stress, strain, Hooke's law, stress-strain curve, generalized Hooke's law with and without thermal strains for isotropic materials, different types of moduli and their relations, bending of beams – Bending moment of a beam – Depression of cantilever.

Outcome:

The students will be able to

- Understand the elasticity and plasticity concepts
- Study different types of moduli and their relation
- Analyze the concepts of shearing force and moment of inertia

UNIT-IV (9hrs)

LASERS & SENSORS: Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium Neon laser – Applications.

SENSORS (qualitative description only): Different types of sensors and applications; Strain and Pressure sensors- Piezoelectric, magnetostrictive sensors, Temperature sensor - bimetallic strip, pyroelectric detectors.

Outcome:

The students will be able to

- **Understand** the basic concepts of LASER light Sources
- Study Different types of laser systems
- Identify different types of sensors and their working principles

UNIT-V (10hrs)

MAGNETISM & DIELECTRICS: Introduction – Magnetic dipole moment – Magnetization-Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr Magneton - Classification of magnetic materials (Dia, Para and Ferro) – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – Applications of Ferromagnetic materials.

Introduction - Dielectric polarization **–** Dielectric polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative)-Lorentz internal field – Claussius_Mossoti equation- Frequency dependence of polarization - Applications of dielectrics.

Outcome:

The students will be able to

- **explain** the concept of dielectric constant and polarization in dielectric materials.
- **summarize** various types of polarization of dielectrics .
- **interpret** Lorentz field and Claussius_Mosotti relation in dielectrics.
- **classify** the magnetic materials based on susceptibility and their temperature dependence.
- **explain** the applications of dielectric and magnetic materials .
- **Apply** the concept of magnetism to FirstRanker.com

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Text Books:

1. "Engineering Mechanics" by Manoj K Harbola, Cengage Publications 2nd Eds.
2. "A text book of Engineering Physics" by P G Kshirsagar & M N Avadhanulu, S Chand & Company Ltd.
3. "Engineering Physics" by R K Gaur and S L Gupta, Dhanpat Rai Publications.
4. "Sensor and Transducers" by Ian R Sinclair, Elsevier (Newnes) 3rd Eds.

Reference Books:

1. "Engineering Physics" by M R Srinivasan, New Age International Publishers.
2. "Lectures on Physics" by Richard P Feynman, Pearson Publishers, New Millennium Eds.
3. "Lasers and Non-linear Optics" by B B Laud, New Age International Publishers (3rd Eds.).

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I Year - I Semester		L	T	P	C
		3	0	0	3
	SURVEYING AND LEVELING (AG1101)				

Course Objectives:

Surveying and leveling curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by JNTUniversity:kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

UNIT – I   (9 hrs)

INTRODUCTION: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

UNIT – II   (7 hrs)

LEVELING AND CONTOURING: Concept and Terminology, Temporary and permanent adjustments- method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys and their plotting.

UNIT – III   (10 hrs)

COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

UNIT - IV   (8 hrs)

THEODOLITE: Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrical leveling, Traversing.

UNIT – V   (14 hrs)

TACHEOMETRIC SURVEYING:

Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position. Types of curves, design and setting out – simple and compound curves.

INDTRODUCTION TO ADVANCED SURVEYING : Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS).

TEXT BOOKS:

1. "Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi

2. Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc-Graw Hill Publishing Co. Ltd. New Delhi, 2004.

3. Text book of surveying by C. Venkataramaiah, University Press.

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REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000

2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004

3. Chandra A M, "Plane Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.

4. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.

5. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.

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I Year - I Semester		L	T	P	C
		1	0	3	2.5
	ENGINEERING DRAWING (ES1103)				

Course Objective: Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves.

Scales: Plain scales, diagonal scales and vernier scales

Unit II

Objective: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

Unit III

Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Unit IV

Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

Unit V

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

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Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:
1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:
1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

Course Outcome: The student will learn how to visualize 2D & 3D objects.

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I Year - I Semester		L	T	P	C
		0	0	3	1.5
	ENGLISH LAB (HS1102)				

UNIT I:

Vowels, Consonants, Pronunciation, Phonetic Transcription

UNIT II:

Past tense markers, word stress-di-syllabic words, Poly-Syllabic words

UNIT III:

Rhythm & Intonation

UNIT IV:

Contrastive Stress (Homographs)

UNIT V:

Word Stress: Weak and Strong forms
Stress in compound words

References books:

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

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I Year - I Semester		L	T	P	C
		0	0	3	1.5
	ENGINEERING PHYSICS LAB (BS1109)				

(Any 10 of the following listed 15 experiments)

LIST OF EXPERIMENTS:

1. Determination of Rigidity modulus of a material- Torsional Pendulum.

2. Determination of Young's modulus by method of single cantilever oscillations.

3. Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum.

4. Verification of laws of vibrations in stretched strings – Sonometer.

5. Determination of spring constant of springs using coupled oscillators.

6. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus

7. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).

8. Measurement of magnetic susceptibility by Gouy's method.

9. Determination of ultrasonic velocity in liquid (Acoustic Grating)

10. Determination of dielectric constant by charging and discharging method

11. Determination of wavelength of Laser by diffraction grating

12. Determination of particle size using Laser.

13. Determeination of Pressure variation using strain Gauge sensor.

14. Determination of Moment of Inertia of a Fly Wheel.

15. Determination of Velocity of sound –Volume Resoantor.

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I Year - I Semester		L	T	P	C
		0	0	3	1.5
SURVEYING AND LEVLEING LAB (AG1102)					

(Any 10 of the following listed 15 experiments)

LIST OF EXPERIMENTS:

1. Survey of an area by chain survey (closed traverse) & Plotting.

2. Determination of distance between two inaccessible points with compass.

3. Surveying of a given area by prismatic compass (closed traverse) and plotting after adjustment.

4. Radiation method, intersection methods by plane Table survey.

5. Two point and three point problems in plane table survey.

6. Fly leveling (differential leveling).

7. An exercise of L.S and C.S and plotting.

8. One exercise on contouring.

9. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.

10. Measurement of horizontal angles by method of repetition and reiteration.

11. Trigonometric Leveling - Heights and distance problem (Two Exercises).

12. Heights and distance using Principles of tacheometric surveying (Two Exercises).

13. Area determination, traversing contouring using total station.

14. Determination of remote height and state out using total station.

15. Distance, gradient, Difference in height between two inaccessible points using total station.

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www.FirstRanker.com R-19 Syllabus for Agri. JNTU Kakinada. www.FirstRanker.com-20

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - I Semester		L	T	P	C
		2	0	0	0
	CONSTITUTION OF INDIA (MC1104)				

Course Objectives:

➢ To Enable the student to understand the importance of constitution
➢ To understand the structure of executive, legislature and judiciary
➢ To understand philosophy of fundamental rights and duties
➢ To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
➢ To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes:

After completion of this unit student will

● Understand the concept of Indian constitution
● Apply the knowledge on directive principle of state policy
● Analyze the History, features of Indian constitution
● Evaluate Preamble Fundamental Rights and Duties

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

Learning outcomes:-After completion of this unit student will

● Understand the structure of Indian government
● Differentiate between the state and central government
● Explain the role of President and Prime Minister
● Know the Structure of supreme court and High court

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

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Learning outcomes:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes:-After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

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9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

➢ Understand historical background of the constitution making and its importance for building a democratic India.
➢ Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
➢ Understand the value of the fundamental rights and duties for becoming good citizen of India.
➢ Analyze the decentralization of power between central, state and local self-government.
➢ Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
  1. Know the sources, features and principles of Indian Constitution.
  2. Learn about Union Government, State government and its administration.
  3. Get acquainted with Local administration and Pachayati Raj.
  4. Be aware of basic concepts and developments of Human Rights.

Gain knowledge on roles and functioning of Election Commission

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
	ENGLISH (HS1201)				

Introduction
The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

Course Objectives
➢ Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
➢ Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
➢ Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
➢ Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
➢ Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Learning Outcomes
At the end of the module, the learners will be able to
➢ understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
➢ ask and answer general questions on familiar topics and introduce oneself/others
➢ employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
➢ recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
➢ form sentences using proper grammatical structures and correct word forms

Unit 1:

Lesson-1: A Drawer full of happiness from "**Infotech English**", Maruthi Publications

Lesson-2: Deliverance by Premchand from "**The Individual Society**", Pearson Publications. (Non-detailed)

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DEPARTMENT OF AGRICULTURAL ENGINEERING

Listening: Listening to short audio texts and identifying the topic. Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions both in speaking and writing.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications

Lesson-2: Bosom Friend by Hira Bansode from "**The Individual Society**", Pearson Publications. (Non-detailed)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

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Pronunciation: Past tense markers, word stress-di-syllabic words

Unit 3:

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "**Infotech English**", Maruthi Publications

Lesson-2: Shakespeare's Sister by Virginia Woolf from "**The Individual Society**", Pearson Publications. (Non-detailed**)**

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.
Pronunciation: word stress-poly-syllabic words

Unit 4:

Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography from "**Infotech English**", Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from "**The Individual Society**", Pearson Publications**.** (Non-detailed)

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

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Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

<u>**Unit 5:**</u>

Lesson-1: Stay Hungry-Stay foolish from "**Infotech English**", Maruthi Publications

Lesson-2: Still I Rise by Maya Angelou from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Prescribed text books for theory for Semester-I:

1. "**Infotech English**", Maruthi Publications. (Detailed)

2. "**The Individual Society",** Pearson Publications. (Non-detailed)

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Reference books:

1. Infotech English, Maruthi Publications. (with Compact Disc)
2. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
3. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
4. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
5. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ENGINEERING CHEMISTRY (BS1210)					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Learning Objectives:
- **Importance** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
  Express the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
  Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also **summarized**.
- **Relate** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- **Explain** the importance and usage of water as basic material in almost all the industries; **interpret** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

UNIT I: POLYMER TECHNOLOGY
Polymerisation:- Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.
Plastics: Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.
Elastomers:- Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).
Composite materials: Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.
  Learning Outcomes: At the end of this unit, the students will be able to
- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Interpret** the mechanism of conduction in conducting polymers .
- **Discuss** natural and synthetic rubbers and their applications.

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UNIT II: ELECTROCHEMICAL CELLS AND CORROSION

Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells: H_2-O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion:-Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

Learning Outcomes: At the end of this unit, the students will be able to
- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

UNIT III: CHEMISTRY OF MATERIALS

Part- A:

Nano materials:- Introduction-sol-gel method-characterization by BET, SEM and TEM methods-applications of graphene-carbon nanotubes and fullerenes:Types, preparation and applications

Thermal analysis techniques: Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Part-B:

Refractories: - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: - Definition, mechanism of lubricants and properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

Learning Outcomes: At the end of this unit, the students will be able to
- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure changes of state of reaction.
- **Illustrate** the commonly used industrial materials.

UNIT IV: FUELS

Introduction-calorific value-HCV and LCV-problems using Dulong's formula-proximate and ultimate analysis of coal sample-significance of these analyses-problems-Petroleum (refining-cracking)-Synthetic petrol (Fischer Tropsch and Bergius)-petrol knocking-diesel knocking-octane and cetane ratings-anti-knock agents-Introduction to alternative fuels (Bio-diesel, ethanol, methanol, Natural gas, LPG, CNG)-Flue gas analysis by Orsat apparatus-Rocket fuels.

Learning Outcomes: At the end of this unit, the students will be able to
- **Differentiate** petroleum, petrol, synthetic petrol and have knowledge how they are produced.
- **Study** alternate fuels.
- **Analyse** flue gases.

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UNIT V: WATER TECHNOLOGY

Hardness of water-determination of hardness by complexometric method-boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement)-internal treatments-softening of hard water (zeolite processs and related sums, ion exchange process)-treatment of industrial waste water

Portable water and its specifications-steps involved in purification of water-chlorination, break point chlorination-reverse osmosis and electro dialysis.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the impurities present in raw water, problems associated with them and how to avoid them are understood.

Standard Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co. Latest edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co. Latest edition

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
	ENIGINEERING MECHANICS (BS1204)				

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.
Introduction to Engg. Mechanics – Basic Concepts.
Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.
Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II
Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III
Objectives : The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.
Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – IV
Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- Work Energy method and applications to particle motion- Impulse momentum method.

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UNIT – V

Objectives: The students are to be exposed to rigid motion kinematics and kinetics

Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

TEXT BOOK:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

Course outcomes:

1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. He should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. He should be able to determine area and mass movement of inertia for composite sections
4. He should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
PRINCIPLES OF SOIL SCIENCE & AGRONOMY (BS1214)					

Objective:- To impart Knowledge on Soil genesis, properties etc, so as to enable students to design implements in related to soil, soil conservation, irrigation and drainage applications. Also to enable students to understand farming principles, to grow agricultural field and orchard crop and farming practices.

Unit –I: (10 hrs)

Soil: Definition –soil as a three phase four component system-branches of Soil science difference between surface and sub surface soil, Rocks: Definition – classification of rocks based on mode of formation-igneous sedimentary and metamorphic rocks, Minerals: Definition, classification, primary, secondary, essential, accessory, silicate, non silicate minerals, light and heavy minerals primary silicate minerals; quartz, feldspars-micas pyroxenes amphiboles secondary silicate; secondary minerals, Ca, Mg, S and Micronutrient containing minerals-chemical formulate, Weathering:- Definition-types of weathering physical weathering of rocks, agents of physical weathering, temperature, water, wind and glaciers, Chemical weathering, solution, hydration, hydrolysis carbonation-oxidation-reduction biological weathering role of plants and animals in weathering.

Soil formation: Soil forming factors –active and passive soil factors and their role in soil formation, Soil forming processes: Elluviation, illuviation, humification, calcification, laterization, podzolozation, salinization, alkalization and gleization, Soil Profile, Detailed description of theoretical soil profile, Soil physical properties:- Soil separates and their properties. Specific surface, soil texture-definition-textural classes-methods of determination of soil texture, importance of soil structure,

Unit:- II: (10 hrs)

Soil structure; Definition-classification based on type, class and grade, factors influencing formation of aggregates-importance and management of soil structure, Soil structure; Definition-classification based on type, class and grade-factors influencing formation of aggregates-importance and management of soil structure, Soil consistency; Definition-forms of consistency and importance of soil consistency, Bulk density and particle density; factors influencing and their importance; porosity –types-calculation-importance, Soil water; structure o f water and the effect of H-bonding on properties of water retention of water in soils-soil moisture tension-soil moisture potential –soil moisture constants.

Soil water movement; saturated, unsaturated and vapour flows, laws governing water flow-Darcy's and poiseuille's law- Infiltration; Factors-importance. Evaporation; Factors influencing evaporation- Ways to minimize it-soil mulch-organic mulch etc, Soil air; Composition of soil air-processes of gaseous exchange –soil aeration indices –and their importance (oxygen content-ODR-aeration porosity-redox potential) management of soil air, Soil temperature; influence of soil temperature on plant growth-factors influencing soil temperature-management of soil temperature. Soil color determination importance, Soil colloids:- Definition-general properties-inorganic and organic colloids origin of charge on colloids (positive & negative).

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Unit-III: (10 hrs)

Secondary silicate clay minerals (inorganic soil colloids) Kaolinite montmoriloniteillite their structures and properties, Ion exchange, Cation and anion exchange –factors influencing ion exchange capacity of soils importance of ion exchange calculation of base saturation and exchangeable acidity, Soil organic matter: importance of organic matter CN ration of organic matter and its importance, Soil biology;- Soil flora and fauna their characteristics role of beneficial organisms mineralization–immobilization, nitrogen fixation, nitrification, denitrification, solubilization of phosphorus and sulphur, Soil fertility:- Concepts of soil fertility and soil productivity:- definitions and differences Arnon's criteria of essentiality-essential and beneficial elements-factors influencing availability of nutrients. Problem Soils:- Definition –Physical problems soil depth slope soil crust soil compaction drainage submergence (formation-adverse effects-effect on soil properties and plant growth management), Chemical problems –classification acid, saline, saline saline-sodic and calcareous soils-characteristics-nutrient availability in problem soils and their reclamation.

Unit-IV: (10 hrs)

Irrigation water:- Quality of irrigation water-classification based on EC, SAR,RSC and Boron content-use of saline waters in agriculture, Soil taxonomy:- New comprehensive system of soil classification (7th approximation) soil orders and their characteristics, Important soil groups of India:- Alluvial soils-black soils –red soils laterite soils and coastal soils.

Meaning and scope of agronomy, History of agricultural development in ancient India, Agriculture in civilization era, National and International Agricultural Research Institutes in India, Classification of crops, Classification of field crops, According to Origin, Botanical Commercial, Economical, seasonal, Ontogeny, Agronomic, Lead Morphology and Special Purpose crops, Definition of climate and weather, Definition of meteorology, Climatology, Agri-meteorology, Introduction, scope and practical utility of Agricultural meteorology, composition and structure of atmosphere, Influence of weather on crop grain development, essential Resources for crop production, factors influencing plant growth, Biotic and Abiotic factors, Crop seasons, Kharif, Rabi and summer seasons in A.P.-Agro climatic zones of A.P. and India.

Unit-V: (8 hrs)

Tillage and tilth, Objective of tillage, characteristic of good seed bed, effect of tillage on soil properties (Pore space, texture, structure, bulk density, colour of the soil), Types of Tillage, preparatory cultivation, inter cultivation, after cultivation and preparatory cultivation for lowland rice pudding, implement used for seed bed preparation, sowing, inter-cultivation and special operation, Sowing, Methods of sowing, time and depth of sowing of major agricultural crops, Methods and time of application of manure and fertilizers.

Weeds- Influence of weeds on crop production, principles and practices of weed management, Basics on soil plant-water relationship, Types of Soil Erosion, Factors influencing soil erosion, Soil conservation, erosion preventive measures, Agronomic measures for soil and water conservation, Dry land Agriculture, Problems of Crop production in dry farming, Agronomic measure in reducing evapo-transpiration losses,

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Watershed management, aims and Objectives, Organic farming-Sustainable Agriculture, Definition, Principles and importance.

TEXT BOOKS:
1. Principles of Agronomy, Yella Manda Reddy T & Shankar Reddy, Publications.
2. Nature and Properties of soils. Brady Nyle C and Ray R Well 2002. Pearson Education Inc., New Delhi.
3. Fundamental of Soil Science. Indian Society of Soil Science 1988. IARI, New Delhi.

REFERENCES:
1. Meteorology, William L Donn, 1965, McGraw-Hill Book. Co. New York.
2. Crop Production in Dry Regions, Arnon L 1972, Leonard Hill Publishing Co., London.
3. Manures and Fertilizers, Yawalkar K S and Agrawal J P, 1977, Agricultural Horticultural Publishing House, Nagpur.
4. Principle of Weed Science, Rao V S, 1992, Oxford and IBH Publishing Co. Ltd., New Delhi.
5. Soil Fertility and Fertilizers, Tisdale S L, Nelson W L, Beaton J D and Havlin J L 1995. Prentice-Hall of India, New Delhi.
6. Introduction to Soil Physics, Hillel D 1982. Academic Press, London.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
PROGRAMMING FOR PROBLEM SOLVING USING C (ES1201)					

COURSE OBJECTIVES:
The objectives of Programming for Problem Solving Using C are
1) To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2) To gain knowledge of the operators, selection, control statements and repetition in C
3) To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
4) To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5) To assimilate about File I/O and significance of functions

UNIT I
Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

UNIT II
Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

UNIT III
Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

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UNIT IV
Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value
Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application
Processor Commands: Processor Commands

UNIT V
Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion
Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions
Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

REFERENCES:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

COURSE OUTCOMES:

Upon the completion of the course the student will learn
1) To write algorithms and to draw flowcharts for solving problems
2) To convert flowcharts/algorithms to C Programs, compile and debug programs
3) To use different operators, data types and write programs that use two-way/ multi-way selection
4) To select the best loop construct for a given problem
5) To design and implement programs to analyze the different pointer applications
6) To decompose a problem into functions and to develop modular reusable code
7) To apply File I/O operations

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
	ENGINEERING CHEMISTRY LAB (BS1211)				

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of copper (II) using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of iron (III) by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of the concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ present in an egg shell.
13. Estimation of Vitamin C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books
1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
COMMUNICATION SKILLS LAB (HS1203)					

UNIT I:

Oral Activity: JAM, Hypothetical Situations, Self/Peer Profile

Common Errors in Pronunciation, Neutralising Accent

UNIT II:

Oral Activity: Telephonic Etiquette, Role Plays

Poster Presentations

UNIT III:

Oral Activity: Oral Presentation skills, Public speaking

Data Interpretation

UNIT IV:

Oral Activity: Group Discussions: Do's and Don'ts- Types, Modalities

UNIT V:

Oral Activity: Interview Skills: Preparatory Techniques, Frequently asked questions, Mock Interviews.

Pronunciation: Connected speech (Pausing, Tempo, Tone, Fluency etc.,)

References:

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendrea Singh Chauhan, Smita Kashiramka, Cengage Publications.

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
PROGRAMMING FOR PROBLEM SOLVING USING C LAB (ES1202)					

Course Objectives:

1) Apply the principles of C language in problem solving.
2) To design flowcharts, algorithms and knowing how to debug programs.
3) To design & develop of C programs using arrays, strings pointers & functions.
4) To review the file operations, preprocessor commands.

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. $1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n$ terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

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Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

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Course Outcomes:

By the end of the Lab, the student

1) Gains Knowledge on various concepts of a C language.
2) Able to draw flowcharts and write algorithms.
3) Able design and development of C problem solving skills.
4) Able to design and develop modular programming skills.
5) Able to trace and debug a program

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
	ENGINEERING WORKSHOP & IT WORKSHOP				

Engg Workshop

Course Objective: To impart hands-on practice on basic engineering trades and skills.

Note: At least two exercises to be done from each trade.

Trade:

1.Carpentry	1. T-Lap Joint
	2. Cross Lap Joint
	3. Dovetail Joint
	4. Mortise and Tenon Joint
2.Fitting	1. Vee Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
3.Black Smithy	1. Round rod to Square
	2. S-Hook
	3. Round Rod to Flat Ring
	4. Round Rod to Square headed bolt
4.House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance
5.Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Open Scoop
	4. Funnel
6.IT Workshop	1.Assembly & Disassembly of Computer

IT Workshop

COURSE OBJECTIVES:

The objective of IT Workshop is to

1. Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
2. Demonstrate basic command line interface commands on Linux
3. Teach the usage of Internet for productivity and self paced lifelong learning
4. Describe about Compression, Multimedia and Antivirus tools
5. Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

Computer Hardware:

Experiment 1: Identification of peripherals of a PC, Laptop, Server and Smart Phones: Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.

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Operating Systems:

Experiment 2: Internet Services:

- Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/ plugins
- Antivirus installation, configuring a firewall, blocking pop-ups
- Email creation and usage, Creating a Digital Profile on LinkedIn
- Source control on Github, Hackerrank, Codechef, HackerEarth, etc
- Google hangout/ Skype/ gotomeeting video conferencing
- archive.org for accessing archived resources on the web

Productivity Tools:

Experiment 3: Demonstration and Practice on archival and compression tools
- scanning and image editing tools
- OCR and text extraction
- audio players, recording using Mic, editing, podcast preparation
- video players, recording using webcam/camcorder, editing
- podcast, screencast, vodcast, webcasting

Office Tools:
Experiment 4: Demonstration and Practice on Text Editors like Notepad++, Sublime Text, Atom, Brackets, Visual code, etc

Experiment 5: Demonstration and practice on Microsoft Word, Power Point

Experiment 6: Demonstration and practice on Microsoft Excel.

Experiment 7: Demonstration and practice on LaTeX and produce professional pdf documents.

Experiment 8: Cloud based productivity enhancement and collaboration tools:

- Store, sync, and share files with ease in the cloud using Google Drive
- Document creation and editing text documents in your web browser using Google docs
- Handle task lists, create project plans, analyze data with charts and filters using Google Sheets
- Create pitch decks, project presentations, training modules using Google Slides
- Manage event registrations, create quizzes, analyze responses using Google Forms
- Build public sites, internal project hubs using Google Sites
- Online collaboration through cross-platform support using Jamboard
- Keep track of important events, sharing one's schedule, and create multiple calendars using Google Calendar

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TEXT BOOKS:
1. Computer Fundamentals, Anita Goel, Pearson Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH

REFERENCES:
1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Vekateswarlu, S.Chand

WEB RESOURCES:

1. https://explorersposts.grc.nasa.gov/post631/2006-2007/computer_basics/ComputerPorts.doc
2. https://explorersposts.grc.nasa.gov/post631/2006-2007/bitsnbyte/Digital_Storage_Basics.doc
3. https://www.thegeekstuff.com/2009/07/linux-ls-command-examples
4. https://www.pcsuggest.com/basic-linux-commands/
5. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf
6. https://geek-university.com/vmware-player/manually-install-a-guest-operating-system/
7. https://gsuite.google.com/learning-center/products/#!/

COURSE OUTCOMES:

Students should be able to:
1. Assemble and disassemble components of a PC
2. Construct a fully functional virtual machine, Summarize various Linux operating system commands,
3. Secure a computer from cyber threats, Learn and practice programming skill in Github, Hackerrank, Codechef, HackerEarth etc.
4. Recognize characters & extract text from scanned images, Create audio files and podcasts
5. Create video tutorials and publishing, Use office tools for documentation, Build interactive presentations, Build websites, Create quizzes & analyze responses.

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I Year - II Semester		L	T	P	C
		2	0	0	0
	ENVIRONMENTAL SCIENCE (MC1201)				

Learning Objectives:

The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

UNIT-I:

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II:

Natural Resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

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UNIT-III:
Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.
Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.
UNIT – V Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. - Public awareness.
Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.
The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:
1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula   Rani; Pearson Education, Chennai

Reference:
1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage   Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

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II Year - I Semester		L	T	P	C
		3	0	0	3
	MATHEMATICS-III				

Course Objectives:
- To familiarize the techniques in partial differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Objectives: At the end of the course, the student will be able to
- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations (L3).
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms(L3)
- Identify solution methods for partial differential equations that model physical processes (L3)

UNIT I: Vector calculus: (10 hrs)

Vector Differentiation: Gradient — Directional derivative — Divergence — Curl — Scalar Potential.

Vector Integration: Line integral — Work done — Area — Surface and volume integrals — Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

UNIT II:Laplace Transforms: (10 hrs)

Laplace transforms of standard functions — Shifting theorems — Transforms of derivatives and integrals —

Unit step function — Dirac's delta function — Inverse Laplace transforms — Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III:Fourier series and Fourier Transforms: (10 hrs)

Fourier Series: Introduction — Periodic functions — Fourier series of periodic function — Dirichlet's conditions — Even and odd functions — Change of interval — Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) — Fourier sine and cosine integrals — Sine and cosine transforms — Properties — inverse transforms — Finite Fourier transforms.

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UNIT IV:PDE of first order: **(8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions — Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT V: Second order PDE and Applications: **(10 hrs)**

Second order PDE: Solutions of linear partial differential equations with constant coefficients —

RHS term of the type $e^{ax + by}$,sin(ax + by), cos(ax + by), $x^m y^n$

Applications of PDE: Method of separation of Variables — Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10thEdition, Wiley-India.

2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.

3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.

4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
	FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS				

Objective: To enable the students to design efficient water conveyance systems like canals, channels and pipes from places of origin to delivery points by acquiring knowledge on the principles of mechanics of fluids, water measurement and regulation and open channel hydraulic principles.

Outcomes:

Acquaintance of skills on basic principles of fluid, their properties, flow patterns, classification of flow regimes etc.,

Impart knowledge on boundary layer theory and their principals, alynamies of fluid flow and theories of flow regimes – energy calculations.

Development of skills on Buoyancy principals, flow measuring devises, their flow dynamics.

Skill development on flow through pipes & their concepts, dynamics of mix flow principles of dimensional analysis and similitude, open channel flow dynamic.

Skill development on open channel flow dynamics, concepts & principles, their design procedures.

Unit – I:

Fluids-Definitions-classification-properties, dimensions. Fluid pressure–Introduction– measurement of fluid pressure, peizometer tube manometry, types of manometers. Mechanical gauges-Bourdon's tube pressure gauge, diaphragm pressure gauge, dead weight pressure gauge. Fluid static force on submerged surfaces, total force on horizontal, vertical and inclined surfaces. Center of pressure of an inclined immersed surface, centre of pressure of a composite section. Pressure on a curved surface and its applications. Kinematics of fluid flow– Introduction, continuity of fluid flow, Types of flow lines.

Unit –II:

Boundary layer theory- Thickness of boundary layer, Thickness of boundary layer in a laminar flow, Thickness of boundary layer in a turbulent flow, Prandtl's experiment of boundary layer separation. Dynamics of fluid flow – Various forms of energy in fluid flow, frictional loss, general equation. Bernoulli's theorem, Euler's equation of motion. Practical applications of Bernoulli's theorem, verturimeter, pitot tube, orifice meter.

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Unit – III:

Buoyancy of flotation – metacentric height. Flow through orifices (measurement of discharge) – Types of orifices, jet of water, vena contracta, hydraulic coefficients, experimental method for hydraulic Coefficients, discharge through a rectangular orifice. Flow through orifices (measurement of time) – Time of emptying a square, rectangular or circular tank through an orifice at its bottom, time of emptying a hemispherical tank through an orifice at its bottom. Time of emptying a circular horizontal tank through an orifice at its bottom. Time of emptying a tank of variable cross-section through an orifice. Flow through mouthpieces – Types of Mouthpieces; Loss of head of a liquid flowing in a pipe, discharge through a mouthpiece. Flow over notches- Types of notches, discharge over a rectangular notch, triangular notch, stepped notch. Time of emptying a tank over a rectangular notch, triangular notch. Flow over weirs – Types of weirs, discharge over a weir, Francis's formula for discharge over a rectangular weir (effect of end contractions), Bazin's formula for discharge over a rectangular weir, velocity of approach, determination of velocity of approach.

Unit – IV:

Flow through simple pipes – Loss of head in pipes, Darcy's formula for loss of head in pipes, Chezy's formula for loss of head in pipes. Transmission of power through pipes, Time of emptying a tank through a long pipe, Time of flow from one tank into another through a long pipe. Flow through compound pipes – Discharge through a compound pipe (pipes in series), discharge through pipes in parallel, equivalent size of a pipe, discharge through branded pipes from one reservoir to another. Dimensional analysis and similitude – Rayleigh's method and Buckingham's pi theorem. Types of similarities, dimensional analysis, dimensionless numbers, introduction to fluid machinery. Open channel hydraulics- classification of open channel and definitions. Chezy's formula for discharge through an open channel.

Unit – V:

Bazin's formula for discharge through open channel, numerical problems on design through open channel, Kutter's formula for discharge, problems on design. Manning's formula for discharge through an open channel. Channels of most economical cross sections – Conditions for maximum discharge through a channel of rectangular section, trapezoidal section, circular section. Specific energy concept - Specific energy of a following fluid, specific energy diagram, critical depth, type of flows, critical velocity. Velocity and pressure profiles in open channels. Hydraulic jump, types of hydraulic jumps, depth of hydraulic jump, loss of head due to hydraulic jump.

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TEXT BOOKS:

1. Hydraulics and Fluid Mechanics, Modi P M and Seth S. M. 1973. Standard Book House, Delhi.
2. Open Channel Hydraulics, Chow V T, 1983, McGraw Hill Book Co., New Delhi.

REFERENCES:

1. A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines, Khurmi, R. S. 1970. S. Chand & Company Ltd., New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
	RENEWABLE ENERGY SOURCES				

Objective: To impart skill to the students on principals and design of non convention / Renewable energy systems like solar, wind, bio-energy, gasification, geothermal, ocean energy and direct energy.

   Outcomes:
Skill development on solar energy & its application in agriculture, devices for converting solar energy into useful form;
Skill development on solar and wind energy potentials, their applications.
Skill development on bio-energy applications, bio-gas plants, gasifies, their principles and design.
Skill development on Geothermal and ocean energy concepts and applications
Skill development on Direct Energy conversion, theory and concepts application and fuel cells.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-II

SOLAR & WIND ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar application - Solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion. Wind Energy - Sources and potentials, horizontal and vertical axis wind mills, performance characteristics, Betz criteria.

UNIT-III

BIO-MASS: Principles of bio-conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. engine operation and economic aspects. Gasifiers   - crop residue convertion to energy.

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UNIT-IV

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.

UNIT-V

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and Joule-Thomson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, Faraday's law thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy Sources /G.D. Rai

REFERENCES:

1. Renewable Energy Sources /Twidell & Weir
2. Solar Energy /Sukhatme
3. Solar Power Engineering/ B.S Magal Frank Kreith & J.F Kreith.
4. Principles of Solar Energy / Frank Krieth & John F Kreider.
5. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
6. Non-Conventional Energy Systems / K Mittal /Wheeler
7. Renewable Energy Technologies /Ramesh & Kumar /Narosa

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
	GROUND WATER HYDROLOGY, WELLS AND PUMPS				

Objective: To enable the students to acquire knowledge on aquifers and estimation of their different properties like hydraulic conductivity, transmissibility, storage coefficient, specific yield, leakage factor, hydraulic resistance under steady and unsteady state conditions in wells dug under different aquifers, well drilling and development methods and equipment design of gravel pack in bore well. Further to make the students to acquire knowledge on various pumps available commercially, their selection, operation and maintenance with due importance to find out the cost of operation.

Outcomes:

Skill development on principles of ground water resources development, different acquaintance and their principles.

Imparting knowledge on theory of open well hydraulics and drilling methods.

Skill development on aquifers characteristics under steady and unsteady state conditions, multiples well systems for coastal areas.

Knowledge development to students on artificial ground water recharge classification of indigenous pumps, solar pumps, wind mill pumps etc.,

Skill development on principles of Centrifugal pumps, principles & characteristics, High lift pumps, mixed flow pumps and vertical turbine pump sets.

Unit – I: Water resources status of India-Occurrence and Movement of ground water and aquifers – Types of water bearing formations – Unconfined, confined, semi confined aquifers – Perched water table condition – diagramatic representation.

Unit – II: Classification of wells – Design of open wells – Ground water replenishment – Ground water exploration – Methods of drilling of wells – Common well drilling difficulties – Gravel packing – well screens – Development of well.

Unit – III: Aquifer characteristics - Influencing yield of wells - Determination of aquifer parameters – Steady state and unsteady state conditions – Well interference and multiple well point systems in coastal areas.

Unit – IV: Surface and subsurface exploitation and estimation of ground water potential – Artificial ground water recharge – Ground water project formulation – Classification of indigenous pumps – Wind powered water lifts – Solar powered and biogas operated water lifts – Reciprocating pumps.

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Unit – V: Centrifugal pumps – Terminology on horse power – Selection of pump installation and trouble shooting of pumps – Performance characteristic curves – Effect of change of impeller dimensions on performance characteristics. Hydraulic ram – Propeller pumps - Mixed flow pumps - Air lift pumps – Priming – Vertical turbine pumps – Submersible pumps – Cost economics

REFERENCES:

1. Ground water and tube wells - Garg S P 1985. Oxford and IBH publish in company limited, New Delhi.
2. Water Well land Pump Engineering – Michael A M and Khepar S T 1989 Tata Mc Graw-Hill Publishing company limited, New Delhi.
3. Irrigation Theory and Practice – Michael A M 2008 Vikas Publishing House Pvt. Ltd, New Delhi.

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II Year - I Semester		L	T	P	C
		3	0	0	3
	PROPERTIES AND STRENGTH OF MATERIALS				

Objective: To enable the students to know about different materials used for engineering constructions like buildings, roads, farm structures and metals and other materials for manufacturing farm equipment, implements, dairy and food processing equipment.

Outcomes:

Skill development on basic properties of engineering materials and their uses, testing of materials.

Knowledge development on properties and application of difference of concrete, varieties, distempers, glass, rubber and plywood, plastics, iron based materials, alloys etc.,

Development of skill on stress – strain analysis of beams under different types of loading patterns.

Acquaintance of skill on Euler's theory and buckling load, analysis on columns & different types of columns.

Skill development on different types of joints (Riveting), welding analysis cantilever, fixed, continuous beams, theory of moments and their analysis.

Unit- I:

Properties of engineering materials, classifications of rocks, sources of stones and natural bed of stones, properties, varieties and uses of stones, properties, composition and uses of bricks, classification and tests of bricks, properties, varieties and uses of tiles, properties, varieties and uses of Lime, Properties, varieties and uses of Cement, Properties, varieties and uses of cement mortar, properties.

Unit - II

Varieties and uses of concrete, properties, varieties and uses of sand, properties, varieties and uses of paints, properties, varieties and uses of varnishes, properties, varieties and uses of distempers. Characteristics and uses of glass, rubber, plywood, plastics. Characteristics and uses of wrought iron, cast iron, steel, aluminium, copper, nickel; Alloys of Aluminium and its properties, Alloys of Copper and its properties, Alloys of Nickel and its properties; Definition and types of timber, seasoning of timber, industrial timber and uses of timber, Methods of heat treatment of steel.

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Unit-III:

Introduction – Stresses, tensile, compressive and shear-strains, units-elastic curv- Elastic limit Poisons ratio, stresses in uniformity tapered circular sections, stresses in bars of composite, sections, thermal stresses and strains in simple bars and composite bars; Elastic constants- Young's modulus, bulk modulus and shear modulus - relation between them; Stresses on oblique planes, Mohr's circle method; Direct stresses in one plane, direct stresses in two planes- accompanied by shear stress. Deflection of beams, relation between slope, deflection and radios of curvature. Methods of finding out slopes and deflections of beams, double integration method. Slope and deflection equations of a simply supported beam with a central point load, simply supported beam with eccentric point load. Simply supported beam with a uniformly distributed load, Columns and struts.

Unit-IV:
Euler's column theory. Assumptions of Euler's column theory; Buckling load-derivations, types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other hinged; Expression for buckling load of a column with one end fixed other free, with one end fixed and other hinged, expression for buckling load of a column with both ends hinged, with both ends. Fixed types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other is hinged and one end fixed and other end is free. Types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other is hinged and one end fixed and other end is free. Limitations of Euler's formula Rankine's formula for columns.

Unit-V:
Riveted joints, types of joint strength of a rivet and riveted joint, efficiency of a riveted joint. Design of riveted joints, eccentric riveted connections, Welded joist, types of welded joints, strength of welded joints, technical terms. Design of welded joints, eccentric welded joints. Dams, forces acting, stressed at the base of dam. Stability of dams, design of base width of dams. Propped cantilever and beams – Deflection and slope equations; Fixed and continuous beams – Deflection and slope equations, Super position theorem – Claypeyron's theorem of three moments, application of Clayperon's theorem of three moments, Moment distribution methods. Analysis of statistically - indeterminate beams.

TEXT BOOKS:
1. Engineering Materials, Rangwala, S.C.1994. Charotar Publishing House, Anand.
2. Strength of Materials by Ramamrutham S. 2003. Dhanapathrai & Sons, Nai Sarak, New Delhi.

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REFERENCES:

1. Material of constructions Deshpande R S 1977. United Book Corporation, Poona.
2. Manufacturing Process. Hazra Choudhury 1985. Media Promoters and Publishers Private Limited, Bombay.
3. Workshop Technology (Part-I) Chapman W.A.J. 1994. Aronold Publishers, New Delhi.
4. Engineering Materials. Rangwala S.C. 1994. Charotar Publishing House, Anand.
5. Mechanics of Structures (Vol.I) Junnarkar S.B. 2001 - Charotar Publishing House, Anand.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
	ELECTRICAL SYSTEMS				

Objective: Imparting skills to the students on principals of electrical theories, circuits, transformer system, voltage regulations (step up and step down), motor winding, power measurement and management.

Outcomes:

Skill development on basic principles of electrical systems.

Acquaintance of skills on electrical theory of forces (EMF), principles of transformer of its applications.

Skll imparting to students on DC generators, principles, winding principles, characteristics of DC motors.

Skill development to students on indication motor principles, characteristics & their construction.

Skill development on power measurement and management in 3 supplies, starters.

Unit- I:

Independent and dependent sources and Kirchoff's Laws, Maxwell's loop current method and its problems; Nodal voltage method and its problems, Thevenin's theorem and its problems, Norton's theorem and its problems, superposition theorem and its problems, reciprocity and Maximum power transfer, star-delta conversion method and its problems. Solution of DC circuit by Network theorems, sinusoidal steady state response of circuits, Instantaneous and average methods, concept of power factor, reactive and apparent power, concept and analysis of balanced polyphase circuits, Laplace transform method of finding step response of DC circuits, series and parallel Resonance.

Unit-II:

Electromotive force, reluctance, magnetic circuit, determination of ampere turn, hysteretic losses and eddy current losses, transformer-working principle, construction of single phase transformer, EMF equation of transfer, core type transformer, shall type and difference between shell and core type transformer, electric circuit, dielectric insulation, leakage reactance in transformer. Voltage regulation, transformer test, open circuit and short circuit tests, losses in a transformer efficiency of transformer, condition for maximum efficiency, equivalent circuit of transformer, theory of an ideal transformer, phaser diagram of an ideal transformer, transformer on non - load, phaser diagram of transformer on load, problems solved.

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Unit – III

DC generator, principle of working construction, field system, armature, commentator, other accessories of DC generator, EMF equation of DC generator, torque equation, DC armature winding, lap winding wave winding terms used in armature winding, armature reaction, demagnetizing and cross magnetizing ampere turns, methods of compensating armature reaction. Excitation of DC generator-Shunt generator, series generator, compound generator; Commutation - Resistance commutation, EMF commutation, characteristics of DC generator - Separately exited, shunt, series, compound generator; DC motor working principle, value of back EMF, voltage equation of DC motor, characteristics of DC motor – Characteristics of series, shunt, compound motor, torque of DC motor, armature torque, shaft torque - efficiency of DC motor.

Unit-IV:

Factors controlling the speed, Flux control and armature control of shunt motors; Motors starters and their necessity, shunt motor and series motor starter; Principle of operation of single phase induction motor, double field revolving theory; Equivalent circuit of single phase induction motor without core loss and with core loss; Single phase – Split induction motor, shaded pole, motor, Power factor, disadvantage low power factor, power factor improvement.

Unit – V

Measurement of power in three-phase system, single watt meter, two watt meter method; Measurement of power in single phase system, using current transformer and voltage transformer; Three phase induction motor – Working principle, production of rotation field; Construction – Starter, rotor, operation, torque equation, starting (DOL, autotransformer, star delta starter) speed control methods.

TEXT BOOKS:

1. A text book of Electrical Technology Vol. II -Theraja BL & Theraja A K 2005. S. Chand & Company Ltd., New Delhi.

REFERENCES:

1. Basic Electrical Engineering, ANWANI M L 1997. Dhanpat Rai & Co. (P) Ltd. New Delhi.
2. Electrical Engineering Fundamentals, Vincent Del Toro 2000. Prentice – Hall of India (P) Ltd., New Delhi

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		0	0	3	1.2
FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS LAB					

Outcomes:

1. Imparting practical skills on determination of metacentric height and Bernouli's theorem.

2. Exposure to practical skills on measurement of discharge with venturimeter and pilot tubes.

3. Acquiring practical skills on determing discharge coefficient of rectangular, triangular and trapezoidal weir and orifices.

4. Imposing practical skills on flow measurement …….. Broad crested weirs and open channels.

5. Imposing practical skills on determination of head losses in pipes, roughness coefficient of open channels.

6. Practical exposes on determination of velocity and pressure in open channels, construction of flownet problems on flownets.

   Practical

   1. Determination of metacentric height
   2. Verification of Bernouli's theorem
   3. Measurement of discharge with a venturimeter
   4. Measurement of velocity with a pilot tube
   5. Determination of coefficient of discharge of rectangular weir
   6. Determination of coefficient of discharge of triangular weir
   7. Determination of coefficient of discharge of trapezoidal weir
   8. Determination of hydraulic coefficient of orifices
   9. Experiment on broad crested weir
   10. Determination of head losses in pipes
   11. Experiments on open channels
   12. Determination of roughness coefficients of open channels
   13. Measurement of velocity and pressure profiles in open channels
   14. Construction of flownet
   15. Problems on construction of flownet

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		0	0	3	1.5
	SOIL SCIENCE AND AGRONOMY FIELD LAB				

PART-A

To impose the knowledge of student on soil gensis, soil farming process structure, soil organic matte and chemical operation etc.,

It is helpful to the student to design farm implement in relation to soil and to maintain in soil health.

It is fine to the students to know the analits of irrigation water, based on quality suitable crops will be selected.

PART-B

1. To enable the students to grow suitable agricultural crops and orchard crops and all farming practices.
2. To understand the soil, crop and machine specific parameters for design and development of forms machinery equipment & implements.
3. Students will be ….. with seed processing equipment, soil and water engineering activating foar efficient water & land producing and upcoming organic farming activity.

PART-A

1. Study of soil profile and collection of soil samples
2. Determination of bulk density ad particle density of soils
3. Determination of soil texture
4. Determination of Proctor moisture content
5. Determination of soil moisture at different tensions
6. Determination of hydraulic conductivity of soil   <u>Choose any six labs</u>

7. Determination of infiltration rate soil
8. Determination of soil strength and soil colour
9. Determination of pH and EC of soils
10. Determination of organic carbon content in soils
11. Estimation of available P & K of soils
12. Determination of anions and cations in irrigation water

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PART-B

1. Visit to college farm
2. Study of meteorological instruments
3. Measurement of rainfall and evaporation
4. Practice of ploughing
5. Practice of pudding
6. Identification of crops and seeds
7. Identification of manures and fertilizers   Choose any six labs
8. Seed bed preparation for nursery
9. Practice of sowing
10. Soil moisture estimation by direct method
11. Practice of fertilizer application
12. Practice of inter cultivation
13. Practice of weeding
14. Practice of harvesting

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	THEORY OF STRUCTURES				

Objective: The Students will have acquired knowledge on the design principles of beams, slabs, columns, foundations and RCC structures.

Outcomes:

Skill development on RCC theory and practice of principles, stress – Strain analysis.

Skill development on single, double reinforced sections, their theory & principles, shear stress analysis.

Acquaintance of knowledge on design principles of shear reinforcement, anchorage of bars & analysis.

Skill development on theory and principles of design of one – way reinforced beams/slabs, two way slabs and columns.

Skill development on principles of auxiliary loaded columns, foundations retaining walls, stability analysis.

Unit-I:

Introduction to loads and BIS codes – Analysis and designing of single reinforced sections – Properties of reinforced concrete, advantages, assumptions, modular ratio, equivalent area of R.C.C., stress and strain diagram, neutral axis, moment of resistance, design of rectangular section.

Unit-II:

Analysis of balanced over reinforced and under reinforced sections – Under reinforced sections, over reinforced sections, problems. Analysis and designing of double reinforced sections – Modular ratio for compression shell equivalent area of steel in compression, neutral axis, moment of resistance, steel beam theory, problems. Shear stresses in beams – Shear stress induced in homogeneous and

R.C. beams, nominal shear stress, varying depth, effect of shear in R.C. beams, failures, shear resistance of concrete without shear reinforcement.

Unit- III:

Design of shear reinforcement, problems. Vertical stirrups and inclined bars – Development of length, development of stress in R.C.C. anchorage for reinforced bars Anchorage for reinforced bars, anchorage bars in tension, anchorage bars in compression. Curtailment of bars – Decision on the curtailment of bars, design considerations for bond, general concept of bond. Design of flanges beams (CT and I beams).

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Unit- IV:

Design of one - way slabs – Loading on slabs, arrangement of reinforcement, Problems on design of one - way slabs. Design of reinforced brick slabs, Design of one - way slabs – Rankine theory, Grashoff theory, shear force on the edges, design, problems, Merco's method. Design of two way slabs – Torsion reinforcement, load and bending moment, problems, slabs with edges fixed. Design of two - way slabs – Provision of torsion reinforcement, Marcor's method, problems. Axially loaded columns – Types of columns, effective length of columns, long and short columns, composite columns.

Unit- V:

Axially loaded columns – Basic rules for design of columns, arrangement of transverse reinforcement, problems. Foundations – Types of foundations, design criteria. Foundations – Problems on design criteria. Retaining walls – Earth pressure on a retaining wall, active earth pressure, passive earth pressure. Stability of walls – Conditions for stability of retaining walls, problems.

TEXT BOOKS:

1. Mechanics of Structures Vol. I, Junarkar,S.B. 2001 – Charotar Publishing Home, Anand.
2. Mechanics of Materials, Dr. B.C. Punmia, Laxmi Publications.

REFERENCES:

1. Strength of materials, R.S. Khumi 2001 – S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi
   – 110055.
2. Treasure of R.C.C. Design, Sushil Kumar 2003 – R.K.Jain – 1705-A, Nai Sarak, Delhi

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	HEAT AND MASS TRANSFER				

Objective: To enable the students to know about the transport phenomenon in materials through heat and mass transfer for applications in unit operations of dairy and food engineering.

Outcomes:

Skill development on principles of heat and mass transfer, steady state heat transfer & its analysis, measurement of thermal conducting of pleasure & composite walls, tubes and spheres, multilayer tubes.

Skill development on conduction principles of different materials in parallel, combined convection and conduction, concept of insulation.

Skill development on conduction, convection and radiation analysis of heat and mass transfer, different laws on radiation theory.

Imparting skills on unsteady state analysis of heat transfer in fins, free & force convection, cooling theories and principles.

Skill development on theory and principles of heat exchanges, their analysis, frick's law of mass transfer coefficients, Reynolds analogy.

Unit – I:

Introductory concepts, application of heat and mass transfer, modes of heat transfer examples, Fourier's law of heat transport. Introduction to steady state heat transfer - One dimensional steady state heat conduction equation. Thermal conductivity of different materials – Measurement - insulation Materials, one dimensional steady state conduction through plane and composite walls, conduction through tubes and spheres with and without heat generation, conduction through multilayer tubes.

Unit – II:

Electrical analogy - Conduction through materials in parallel, combined convection and conduction and overall heat transfer coefficients, problem solving, Concept of critical thickness of insulation for a cylinder, problem solving,

Unit III:

Radiation heat transfer - Introduction, absorptivity, reflectivity and transmissivity. Black body and monochromatic radiation, Plank's law, Stefan-Boltzman law, Krichhoff's law, grey bodies and emissive power, solid angle intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks.

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Unit IV:

Unsteady state heat transfer - Unsteady state system with negligible internal thermal resistance- equation for different geometries, Fins - Heat transfer from extended surfaces, types of fins, numerical, free and force & convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non - dimensional numbers and empirical relationships for free and forced convection.

Unit V:

Equation of laminar boundary layer on flat plate and a tube, laminar forced convection on a flat plate and in a tube, combined free and forced convection, types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units, heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow - Fick's law mass transfer coefficients, Reynold's analogy.

REFERENCES:

1. Transport processes and Unit Operations, Geankoplis C.J. 1992. Allyn and Bacon Inc., Newton, Massachusetts.
2. Heat Transfer, Holman JP 1989. McGraw Hill Book Co., New Delhi.
3. Fundamentals of Heat and Mass Transfer, Incropera F P and De Witt D P 1980 John Wiley and Sons. New York.
4. Engineering Heat Transfer, Gupta CP and Prakash R 1994. Nem Chand and Bros., Roorkee.
5. Heat transfer, Rajput S. Chand & Co, New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	THEORY OF MACHINES				

Objective: To educate the students about the kinematics of machine elements, links and pairs and other systems in different machines for applications in the manufacturing of machines and their elements.

Outcomes:

Skill development on fundamental principles of kinematics of chain & pairs, links and principles of mechanism.

Skill development on gear theory, concepts and mechanisms.

Acquaint with knowledge on flywheel its applications, drives and its concepts, classification and power transmission, friction laws and principles.

Skill acquaintance on governors, speed regulation, concepts and principles, classification and the friction effects.

Skill development on static & dynamic balancing of rotating masses in different names.

Unit–I:

Introduction, element, link, pairs. kinematics of chains and pairs - Types, lower and higher pairs. Mechanism – Types and inversions. Lower and higher pairs. Four bar chain, slider crank chain and their inversions - Determination of velocity and acceleration using graphical (relative velocity and acceleration) methods. Instantaneous center – Lindring.

Unit II

Types of gears, law of gearing. Velocity of sliding between two teeth in mesh Involute and cucloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted and epicyclical gear trains - Determining the velocity ratio by tabular method. Turning moment diagrams, coefficient of fluctuation of speed and energy.

Unit-III:

Weight of fly wheel, flywheel applications. Belt drives, types of drives. Belt materials, length of belt, power transmitted, velocity ratio, belt size for flat and v-belts. Effect of centrifugal tension, creep and slop on power transmission, chain drives. Types of friction, laws of dry fiction, friction of pivots and collars. Single disc, multiple disc and cone clutches. Rolling friction, anti - friction bearings.

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Unit -IV
Types of governors, Constructional details and analysis of Watt, Porter and Proell governors – Spread of governors. Effect of friction, controlling force, curves, sensitiveness, stability, hunting, Isochronism's, 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. Cams and foversees.

TEXT BOOK:
1. Theory of Mechanisms and Machines, Jgdish Lal 1991. Metropolitan Book Co. Pvt. Ltd., 1 Netaji Subash Marg, New Delhi.
2. Theory of Machines, Khurmi R S and Gupta JK 1994. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.

REFERENCES:
1 Theory of Machines, Thomas Bevan 1984. CBS Publishers
2 Theory of Machines, Ballaney P L 1985 Khanna Publishers, 2- B Nath Market, Nai Sarak, New Delhi
3. Mechanisms and Machine Theory, Rao J S and Dukkipatti R V 1990. Wiley Astern Ltd., New Delhi
4. Theory of Machines, Rattan S B 1993. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asf Ali Road, New Delhi

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II Year - II Semester		L	T	P	C
		3	0	0	3
	SOIL MECHANICS				

Objective: Students will be trained on concepts and analysis of soil properties, stress conditions of loaded soil, consolidation and soil failure theories. The knowledge imparted will be used in higher level design considerations for construction of soil and water conservation structures, irrigation and drainage structures.

Outcomes:

Skill development on principles of soil mechanics soil classification, stresses in soils.

Skill development on Bousinesq's analysis for vertical pressure applications & westerguard's analysis for point load applications.

Acquaintance of knowledge on shear stress analysis, mohr's stress circle, measurement of shear strength.

Skill development on soil consolidations theory and principles.

Skill development on earth pressure and its effects on soil stability of slopes.

Unit–I:

Introduction of soil mechanics – Field of soil mechanics. Soil on three phase systems – Physical and index properties of soil. Classification of soils - General, particle size classification. Classification of soils - Textural classification, I.S. classification. Stress condition in soils – Effective and neutral stress.

Unit-II:

Concept on Bousinesq's analysis – Vertical pressure distribution on vertical line, vertical pressure under a uniformly loaded circular area, vertical pressure due to a line load. Concept on Bousinesq's analysis – Vertical pressure under strip load, vertical pressure under a uniformly loaded rectangular area, equivalent point load method. Concept on Westerguard's analysis – Point load pressure distribution, uniformly loaded circular area. Westerguard's analysis – Uniformly loaded rectangular area, comparisons between Bousinesq's and Westerguard's solutions. Newmark's influence chart – Preparation, problems.

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Unit-III:

Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Mohr – Coulomb failure theory, effective stress principle. Measurement of shear strength – Introduction, direct shear test, tri-axial compression test, stress conditions in soil specimen during tri-axial testing. Measurement of shear strength – Advantages of tri-axial test, graphical solutions, unconfined compression test, vane shear test. Problems on shear strength. Compaction of soils – Standard test and modified Proctor test. Abbot compaction test. Jodhpur mini compaction test. Field compaction method and control.

Unit – IV:

Consolidation of soil – One - dimensional analysis spring analogy – Terzaghi's theory. Laboratory consolidation test. Calculation of coefficient of volume change – Coefficient of consolidation.

Unit-V:

Earth pressure – Plastic equilibrium in soils. Active and passive states of earth pressure. Rankine's theory of earth pressure. Earth pressure for cohesive soils. Simple numerical exercises on earth pressure. Stability of slopes – infinite and finite slopes. Friction circle method. Taylor's stability number.

TEXT BOOK:

1. Soil Mechanics and Foundations, Punmia B C, Jain A K and Jain A K, 2005. Laxmi Publications
   (p) LTD. New Delhi

REFERENCES:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and Rao A S R 1993. Willey Eastern Ltd., New Delhi.
2. Soil Engineering Vol.1, Alam Singh 1994. CBS Publishers, and Distributions, Delhi.

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II Year - II Semester		L	T	P	C
		3	0	0	3
	SURFACE WATER HYDROLOGY				

Objective : To enable the students to acquire knowledge and skills on hydrological (rainfall and runoff) measurements in watersheds, hydrological design of structures, prediction of volume and rates of runoff with tools like hydrographs and unit hydrographs, reservoir planning with flood routing techniques for application in natural resources management.

Outcomes:

Skill development on hydrology & its components, rainfall analysis & its measurement, probability analysis of rainfall & return period.

Skill development on rain fall intensity – frequency – duration relations, infiltration indices, rainfall – runoff relations, peak runoff estimation.

Skill development on theory and principles of hydrograph unit hydrograph, concepts, derivation for simple and complex stroms.

Skill development on principles of conversion of unit hydrographs, principles and construction of S curve, synthetic hydrographs and its application, Instantaneous unit hydrographs principles and application, application of hydrology.

Skill acquaintance as flood routing concepts & principles, channel routing, hydrologic and hydraulic routing, applications of hydrology in L –WM and watershed management.

Unit-I:

Hydrology - Definition, hydrology cycle and its components. Forms of precipitation rainfall, characteristics of rainfall in India (types of monsoon). Measurement of rainfall – Recording and non-recording rain gauges - Rain gauge network density for different topographic conditions – Point rainfall analysis. Presentation of rainfall data mass curve and hyetograph, Mean precipitation over an area – Arithmetic mean, Thiessen polygon, Isohyetal methods, DAD relationships and curves. Probability analysis of rainfall – Return period, plotting position by Weibull's method, Rainfall events at different probability levels (20% , 40%, 60%, 80%)

Unit-II:

Intensity-Duration-Frequency relationship, determination of net effective rainfall-infiltration indices - Phi index. Runoff-definition-components of runoff-direct runoff and base flow, overload flow and interflows, pictorial representation of different routes of runoff. Runoff characteristics of streams – Perennial, intermittent and ephemeral streams, measurement of stream flows. Measurement of stage and velocities, staff gauge, wire gauge, automatic stage recorders, current meters (horizontal and vertical

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axis meters), calibration ($V = a\ N_s + b$). Rainfall-Runoff relations ($R = a\ P + b$), curve fitting and determination of 'a' and 'b' and (correlation coefficient), factors affecting runoff. Definition and estimation of peak runoff and design peak runoff rate, rational method and curve number techniques.

Unit-III:

Hydrographs - Definitions and components, factors affecting flood hydrographs, hydrograph separation for simple and complex storms – Method I (straight line method, $N = b\ A^{0.2}$), other Methods II and III. Unit hydrographs - Concept and the three implications of the definitions and the two basic assumptions (linear response and time invariance). Effects of the characteristics of storms (duration of rain, time- intensity pattern, areal distribution of runoff and amount of runoff) on the shape of the resulting hydrographs. Derivation of unit hydrographs, average unit hydrographs from several storms of the same duration (proper procedure of computing average perk flow and time to peak). Derivation of unit hydrographs for complex storms.

Unit-IV:

Conversion of unit hydrograph duration, methods for unit hydrographs of different durations - Method of superposition and S-curve. S-curve method, explanation of concept and application. conversion of unit graph duration by S-curve method, determination of lower duration graph from the given higher duration graph and vice-versa. Synthetic unit hydrograph, concept, Snyder' synthetic unit hydrograph, formulas relating hydrograph features (basin lag, peak flow and time base of the unit hydrograph). Instantaneous unit hydrograph, concept and application, SCS triangular hydrograph - Application of hydrology - Flood control and regulation, flood mitigation, floodplain mapping, retards.

Unit V:

Flood routing - Introduction, two broad categories of flood routing and channel routing, hydrologic routing and hydraulic routing, basic equations. Hydrologic storage routing, Schematic representation of storage routing, modified Pul's method (semi-graphical method). Explanation of the features of the modified Pul's method. Flood routing through a reservoir by modified Pul's method. Applications of hydrology in land and water management, watershed management.

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TEXT BOOKS:

1. Engineering Hydrology. Raghunath H.M. 1986. Willey Eastern Limited, New Delhi.
2. Watershed Hydrology, Suresh R. 1997. Standard Publisher and Distributors, New Delhi.

REFERENCES:

1. Engineering Hydrology. Subramanyam K. 1984. Tata Mc. Graw – Hill Publishing Co., Limited, New Delhi.
2. Hydrology for Engineers Linsley R.K. Kholer A. & Paul Hus J.L.H. 1988, Mc-Graw Hill Book Co. New Delhi.
3. Watershed Management. Dhruvanarayana, VV. 1990. ICAR Publication, New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	FARM POWER AND TRACTOR SYSTEMS				

Objective: To enable the students for acquiring the knowledge pertaining to systems like transmission system clutch, types of clutches, types of Gear, sliding, constant mesh type tractor power out lets like

P. T.O, belt pulley, drawbar, traction theory rolling, resistance, rim pull, crawler tractor.

Outcomes:

Skill development on farm power sources classification I.C engine components & construction, operating systems.

Skill development on fuel supply ignition, cooling & lubrication electrical ignition, fuels & their properties, governing systems of IC engines, power transmission, clutches & its applications.

Acquaintance of knowledge on clutch types, concepts & principles, single & multiple plate clutches, working mechanism, gear theory and principles, differential unit of its functions, final drive & its applications.

Skill development on principles of fluid coupling &torque connector, brakes principles, classification & friction concepts of hydraulic system in factors.

Skill development on tractor powers outlets, P.T.O and its applications, Tractor testing and its main components, CG estimation, Tractor chassis its mechanics.

Unit-I:

Source of farm power – Conventional and non conventional energy sources, classification of tractor and I.C engines, study of I.C engine components and their construction, operating principles and functions, Engine systems and their construction details and adjustment.

Unit-II:

Valves and valve mechanism, fuel and air supply stems, cooling and lubricating systems, electrical and ignition systems, I.C engine fuels and their properties, detonation and knocking in IC engines, Study of properties of coolants, antifreeze and anti corrosion materials, Lubricant types & study of their properties – Engine governing systems. Introduction to transmission system – Power transmission system of tractor – Functions of a power transmission system. Clutch – Necessity of clutch in a tractor, essential features of good clutch, principal working of clutch, clutch repairs and maintenance.

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Unit-III:

Types of clutch – Friction clutch, dog clutch and fluid coupling, friction clutch – Single plate clutch or single disc clutch, multiple plate clutch or multiple disc clutch, cone clutch. Single plate clutch or single disc clutch – Constructional details and principle of working mechanism. Multiple plate clutch, splinted sleeve clutch type – Constructional details and principle of working mechanism ratchet and pawl arrangement mechanism – Constructional details and principle of working mechanism. Gears – Necessity for providing gear box, Selective sliding type, constant mesh type, Mechanical advantage in gears, torque ratio in gears, working of gear box. Differential unit and final drive – Differential, functions of crown wheel, differential lock, functions, final drive – functions of final drive.

Unit-IV:

Fluid coupling and torque connector, brake mechanism, requirements of good braking systems, classification of brakes, Mechanical brake and hydraulic brake – Working mechanism. Steering mechanism – Qualities of steering mechanism, main parts of steering mechanism types of steering boxes, working of hydraulic steering. Hydraulic control system – Working principals, basic components of hydraulic system – Types of hydraulic system, position control, draft control, mixed control, precautions for hydraulic system.

Unit-V:

Tractor power outlets – P.T.O., construction details; Belt pulley constructional details, tractor power out let, draw bar, construction details. Traction - Traction efficiency, method for improving traction, coefficient of traction, rolling resistance, wheel slip or track slip, Rimpul - crawler tractor. Tractor testing – Preparation for tests, types of tests, test at the main power take off, test at varying speeds at full load, test at varying load, belt or pulley shaft test, drawbar test, tractor engine performance. Determination of centre of gravity, Suspension method, balancing method, weighing method. Tractor chassis machines, functions of chassis frame. Tractor chassis – Mechanics of tractor chassis.

TEXT BOOKS:

1. Farm Tractor Maintenance and Repair. Jain. S.C. and Roy C.R. 1984. TMH Publishing Co. Ltd., New Delhi.
2. Tractors and their power units. Lijedhal J.B. Carleton W.M. Turnquist P. K. and Smith D.W. 1984. AVI Publishing Co. Inc., Westport, Connecticut.

REFERENCES:

1. Farm Gas Engines and Tractors. Fred J.R. 1963. Allied Publisher Pvt. Ltd., Bombay.
2. Farm Machines and their Equipment. Nakra C.P., 1986. Dhanpet Rai and Sons. 1982 Nai Sarak, New Delhi.

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II Year - II Semester		L	T	P	C
		0	0	3	1.5
FIELD OPERATION AND MAINTENANCE OF TRACTORS LAB I					

Objectives: To enable the students for acquiring the knowledge pertaining to maintenance of tractors like periodical maintenance (50 to 100 hours, 200 to 250 hours, 480 to 500 engine working hours, 960 to 1000 hours) and trouble shooting and remedial measures of all systems - fuel system, lubrication system, cooling system and ignition system.

Outcomes:

1. Improved practical skills on air kind fuel filtration systems, lubrication system and their maintenance in tractors.
2. Practical skills improvement on maintenance of transmission and radiators cooling systems in tractor.
3. Practical skills development on maintenance of tractor ignition and hydraulic systems.
4. Practical knowledge on periodical maintenance of tractors, emission of smoke, clutch and brake system maintenance.
5. Practical skill development on maintenance of train machinery and implements.
6. Practical knowledge on tractor on-off practice of tractors.

1. Tractor Systems - maintenance of air fuel system – cleaning of air cleaners – frequent troubles and Remedies – process to remove air lock in the diesel engine – precautions in handling diesel fuels in diesel engine.

2. Maintenance of lubrication system – frequent troubles and remedies – troubles in lubrication system excessive oil consumption – care and maintenance of lubrication system.

3. Maintenance of transmission system – general maintenance – differential trouble

   shooting – Frequent troubles and Remedies.

4. Maintenance of cooling system and cleaning of radiators - frequent troubles and

   remedies – cooling system troubles – over heating – slow warm up of the engine – care

   and maintenance of cooling system.

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5   Maintenance of ignition system – care and maintenance of batteries – Frequent troubles and remedies – causes of ignition failure in battery system.

6.   Maintenance of hydraulic system – working principle – basic components of hydraulic system – types of hydraulic system – frequent troubles and remedies – repairs and maintenance of hydraulic system – precautions of hydraulic system.

7.   Periodical maintenance of tractors – at 8 – 10 engine working hours – at 50 – 60 engine working hours and at 100-120 engine working hours

8   Periodical maintenance of tractors – at 200-250 engine working hours, at 480-500 engine working hours and at 960 – 1000 engine working hours.

9.   Emission of smoke – over heating of engines - maintenance of clutch brakes hydraulic problems.

10. Maintenance of agricultural machinery before and after use like primary tillage implements, M.B. plough, disc plough and secondary tillage implements - harrows, seed drills, weeders, cultivators.

11. Starting and stopping practice of the tractor and familiarization with instrumentation

   panel and controls

12. Driving in forward and reverse gears, driving safety sales and study bean trepanned.

REFERENCES:

1.   Elements of Agricultural Engineering. Jasgishwara Sahay 1992. Agro Book Agency, Patna.
2.   Farm Tractor Maintenance and Repair. Jain S.C. and Roy C.R. 1984. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3.   Tractors and their Power units. Liledahi J.B. Carleton W.M. Turnquist P.K. and Smith D.W. 1984. AVI Publishing Co., Inc., Westport, Connecticut.
4.   Farm Machines and their Equipment. Nakra C.P. 1986 Dhanpet Rai and Sons. New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
	MACHINE DRAWING AND COMPUTER GRAPHICS LAB				

Out comes:

1. Practical skills on preparing manual drawings of model isometric view of the objects, machine components, assembly drawings of different joints.
2. Practice on drawing of missing views; principles of dimensions and their methods.
3. Practical skills on sectioning concepts and its drawing & mechanical parts.
4. Practical skills on types of rivet heads & parts, square headed and hexagonal nuts, bolts, different types lock nuts, stands machine screws.
5. Practical knowledge on components of CAD and its hardware requirements, terms & command in Auto CAD software for practice.
6. Practical skills on drawing of riveted joints and thread fasteners, computer graphics in agricultural engineering applications, practice of commands in Auto CAD software.
7. Practical skills on 2-D drawings and projects in Auto CAD.

Course Objectives:

1. Preparation of manual drawings with dimensions from Model and Isometric drawings of objects and machine components
2. Assembly drawings of machine components – Screw jack, knuckle joint, stuffing box and cotter joint
3. Drawing of missing views
4. Dimensioning methods and principles of dimensioning
5. Concept of sectioning, revolved and oblique section (Explanation of full sectioning and half sectioning concepts)
6. Sectional drawing of simple machine parts – Foot step bearing, shaft support, stuffing box
7. Types of rivet heads and riveted joints (Processes for producing leak proof joints, Symbols for different types of welded joints)
8. Square headed and hexagonal nuts and bolts
9. Different types of lock nuts, studs, machine screws
10. CAD System components and computer hardware for CAD
11. Explanation of draw tool bar commands in AutoCAD software
12. Drawing of riveted joints and thread fasteners
13. Computer graphics for agricultural engineering applications
14. Practice in the use of basic and drawing commands on AutoCAD
15. Generating simple 2-D drawings with dimensions using AutoCAD
16. Small projects using CAD

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REFERENCES:

1. Elementary Engineering Drawing. Bhat. N.D. 1995. Charotar Publishing House, Anand.
2. Machine Drawing. Bhatt N.D and Panchal V.M. 1995. Charotar Publishing House, Anand.
3. Machine Drawing. Narayana K.L. Kannaiah P. and Venkata Reddy K. 1996. New Age International Ltd., New Delhi.
4. Mastering CAD / CAM with Engineering Subscription Card. Ibhrahim Zeid, McGraw-Hill Science / Engineering / Math; 1st Edition (May 21, 2004).
5. Principals of CAD / CAM / CAE/ Systems. Kunwoo Lee, Addison – Wesley.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
THERMODYNAMICS AND REFRIGERATION SYSTEMS				

Objective: To enable the students to know about the thermodynamic laws and principles, gas laws and different cycles and their efficiencies for efficient designs of heat engines, Refrigerator systems in general and Farm engines and cold storages in particular.

Outcomes:
1. Explain the thermodynamic system, Principal & laws.
2. Construct the concept, application and working principals of cycleengines.
3. Explain the refrigeration concept, working principle and it application.
4. Importing knowledge on refrigeration agents with special focus on vapor.
5. Apply refrigeration technology for agro based products strategy structures.

Unit – I: Thermodynamics
Introduction to Thermodynamic & it's fundamental concepts. Classification of Thermodynamic system, Closed system-open system-isolated system, Laws of conservation of energy, heat & work. Laws of thermodynamic – first law, second law and zeroth law, Gas laws; Boyless' law Charles law Guy–Iussac law, Thermodynamic properties of perfect gases. Application of first law in heating and expansion of gases, Cycles-introduction-Applications, Carnot theorem-Carnot cycle,

Unit – II:
Entropy-introduction-physical concept of entropy, Change of entropy of gases in thermodynamics. Heat engines, Classification, Components, Working principles- Working cycle of 4-stoke and 2-stroke diesel and Petrol Engines, Air standard cycle-efficiencies, Explanation of Otto cycle-thermal efficiency equations, diesel cycle and dual cycle, Calculation of efficiencies, Mean effective pressure and their comparison, Measurement of indicated horse power, brake horse power, Heat balance calculations, Problems on IP, BP, Engine efficiencies and performances

Unit-III:
Refrigeration: Definition of refrigeration, second law of thermodynamics, major uses and applications, Principles of refrigeration – Room air conditioner, domestic refrigerator, working substances in refrigeration machines, unit of refrigerating capacity, coefficient of performance, problems on refrigeration capacity, Production low temperatures- Expansion of a liquid with flashing, reversible adiabatic expansion of a gas, irreversible adiabatic expansion (throttling) of a real gas, thermoelectric cooling, adiabatic demagnetization.
Refrigeration machine, heat engines, Air refrigerators working & Numericals on reverse Carnot cycle- selection of operating temperatures & Numericals. Air refrigerators working on Bell Coleman cycle- Reversed Brayton or joule or Bell Coleman Cycle. Analysis of gas cycle, polytropic and multistage compression.

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Unit –IV:

Vapour refrigeration – Vapor as a refrigerant in reversed Carnot cycle with P-V. and T-s diagrams, problems on reversed Carnot cycle with vapour, gas as a refrigerant in reversed Carnot cycle, limitations of reversed Carnot cycle, Vapour compression systems –Modifications in reverse Carnot cycle with vapour as refrigerant (dry vs. wet compression, throttling Vs isentropic expansion), Vapor compression cycle, vapor compression system calculations, Vapor compression cycle – Representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling, problems on vapour compression cycle, Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heating, sub cooling, problems on vapour compression cycle, Vapour-absorption refrigeration system – Process, calculation, maximum coefficient of performance of a heat operated refrigerating machine, problems on vapour absorption refrigerating system, common, refrigerant-absorbent systems.

Unit-V:

Common refrigeration and their properties, Cold storage, controlled atmosphere storage, factor affecting refrigerated cold storage, hypobaric storage, Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, ideal gas law, Amagat's law, Dalton's law, Psychometric chart –Saturation pressure, absolute humidity, percentage humidity, humid volume, total heat, enthalpy, adiabatic processes, wet bulb temperature and its measurement, psychometric chart and its use. Psychometric processes- state factor, cooling, heating, mixtures, dehumidifying, drying, air conditioning.

TEXT BOOKS:

1. Engineering Thermodynamics, Nag PK 1995, Tata Mc Graw Hill Publishing Co., Ltd., 12/4 Asaf Ali Road, New Delhi.
2. Refrigeration and Air conditioning, C P Arora.

REFERENCES:

1. A Course in Thermodynamics and Heat Engines, Kothandaraman C.P Khajuria PR and Arora SC 1992.Dhanpat Rai and Sons, 1682 Nai Sarak, New Delhi
2. Engineering Thermodynamics, Khurmi R S 1992 S Chand and Co. Ltd Ram Nagar, New Delhi.
3. Thermodynamics and Heat Power Engineering, Mathur ML and Mehata fs 1992 Dhanpat Rai and Sons 1682 Nai Sarak, New Delhi
4. Thermal Engineering, Ballaney PL 1994, Khanna Publishers, New Delhi
5. A text book of Refrigeration and Air Conditioning, R. S. Khurmi and J.K. Gupta – 2008, S. Chand & Company Ltd, New Delhi

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
SOIL AND WATER CONSERVATION ENGINEERING				

Objective: To enable the students to acquire knowledge on different soil laws estimation models, run off estimation by rational, curve number, cook's etc. Land use, capability classification, soil conservation measures like contour bunding, terracing, bench terraces, contour trenches and their types and complete design calculations. Also to enrich the students and familiarize the students in the design of various gully control structures, temporary and permanent, their designs with a due importance to hydrologic, hydraulic and structural phases of design.

Outcomes:
1. Acquiring knowledge on Runoff estimation methos, potential of runoff, factors influenciry runoff.
2. Social development on SWC research in India & its sub centers, process of erosion & classification, gully erosin & its stages, soil loss estimation procedures, erosin control measures.
3. Skill development on wind erosin, its process and control measures, sand dumer and their control.
4. Skill development on design of engineering measures for erosin control (Conform bunds, graded hunds, terraces etc.,), conservation ditaches design and application.
5. Skill development on principles of design if vegerafive water ways, manniry's forula & its application in design, sedimentation analysis in the reservoirs, on farm water harvertism structures, types, design methodology cost economics for critical irrigation and ground water recharge.

Unit – I
Runoff – Factors affecting runoff – Peak Runoff and design peak runoff – its estimation - Rational method – Time of concentration & its estimation – Curve number method – Cook's method. Land use capability classification based on different criteria with a special reference to slope.

Unit- II:
Introduction – Soil and water conservation research in India–Its sub-centers–Soil erosion–Geologic, Types & erosion procedures Accelerated types. Causes and agents of erosion – Factors affecting erosion – Water Erosion–Forms of water erosion–Mechanics of Erosion - Different stages of erosion – Rill – Sheet – Gully and Ravines—Gully erosion of classification, stages of gully development. Soil Loss estimation–Universal Soil Loss equation and modified soil loss equation, Explanation of various terms – Estimation of their various parameters. Erosion control measures – Agronomic and mechanical or engineering measures.

Unit–III:
Wind Erosion – Factors affecting wind erosion, mechanics of wind erosion, Wind erosion control measures – Vegetative, mechanical measures, wind blades and shelter belts, sand dunes stabilization – Wind erosion and its control.

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Unit-IV:
Contour bunds – Design of contour bunds – Horizontal interval – Vertical interval – Cross section of the contour bunds – Seepage line consideration. Determination height of bund – Loss of area due to bunding. Design of waste weir – Construction of contour bunds in fields. Graded bunds – Design of graded bunds. Introduction to Conservation Ditching. Contour trenching – Staggered and continuous trenche – Adaptability and types. Terraces – Classification of terraces-Design of narrow based and broad based terraces. Bench Terraces – Types of bench terraces – Derivation of an equation for finding of vertical interval –Design of bench terraces.

Unit V: Vegetated water ways – Types of water ways based on shapes – Expression for wetted perimeter – C/S areas – Hydraulic radiis – types of vegetation – roughness of different grasses – Design of vegetated water ways. Sedimentation – Sedimentation in reservoirs in streams, estimation and measurement, sediment delivery ratio, trap efficiency – Estimation of useful life of reservoir based on sedimentation. Characteristics of contours and preparation of contour maps for water area estimation, Volume ealentation – Stage –Volume relationship structures for water harvessing, Analysis of toposheets.

Introduction to water harvesting techniques – Earthen dams etc. Design of WH Structures, - Farm Pond, Percolation tanks, Check dams, Earthen dams etc. – Introduction to Stream water quality and pollution. Temporary gully control structures – Design – Types like Brush wood dams – Wire Mesh – Dams etc. – Introduction to permanent gully control structures – Design phases – Components of permanent structures. Machining used in earthwork – Estimate preparation for all structures. Goud Shemes or NRM activities & their objectives.

TEXT BOOKS:
1. Soil and Water Conservation Engineering. Scwab G.O. Frevert R.K. Edminster T.W. and Barnes K.K. 1981 John Wiley and Sons New York.
2. Manual of Soil and Water Conservation Practicals. Gurmel Singh. Venkataramanam C. Sastry G and Joshi BP. 1994.Oxford and IBH Publishing Co. Ltd., New Delhi.

REFERENCES:
1. Land and Water Management Engineering. Murthy VVN 2004. Kalyani Publishers, New Delhi.
2. Introduction to Soil and Water Conservation Engineering. Mal B.S. 1995 Kalyani Publishers, Rajinder Nagar, Ludhiana.
3. Reddy, K.S. Mannal on "Farm Ponds: A climate pesilient technology in Rainfed Agriculture: Design Planning and construction. ICAR, CRIDA Publications; www.crida.in.

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
AGRICULTURAL PROCESS ENGINEERING				

Objective: To train students on unit operations of agricultural process engineering to acquaint with preliminary operations such as clearing, size reduction, mixing, separation, filtration and materials handling equipment.

Outcomes:
1. Imparting skills to student on Agricultural produce handling and their concepts, crushing of agri produce.
2. Acquittance of skills by students on agriculture procedure misery principles and technologies.
3. Skills development on understating of aerodynamic preferences of agriculture produce for separation and grading of the material.
4. Skill development on essential produce dynamic principals types of dryers and their design methodologies.
5. Skill development on rice, oil seeds pulses processing technologies with emphasis in milling and filtration mechanism.

Unit-I:
Scope and importance of material handling devices, study of different material handling systems–Classification, principles of operation, conveyor systems selection/design. Belt Conveyor–Inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper, Chain conveyor–Principle of operation, advantages, disadvantages, capacity and speed, conveying chain, Screw conveyor – Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors. Bucket elevator–Principle, classification, operation, advantages, disadvantages, capacity, speed, Bucket discharge, relationship between belt speed, pickup and bucket discharge, bucket types, Pneumatic conveying system- capacity and power requirement, types, selection of pneumatic conveying system, Gravity conveyor design considerations – capacity and power requirement. Scope and importance crop processing – principles and methods of food processing cleaning and grading of cereals. pulses & oilseeds – Principles. Size reduction –principle of comminution/ size reduction, mechanisms of comminution of food, particle shape, average particle size, Characteristics of comminuted products, crushing efficiency. determination and designation of the fineness of ground material, screen analysis, empirical relationships (Rittinger's Kick's and Bond's equations), work index, energy utilization, methods of operating crushers, classification based on particle size, nature of the material to be crushed. Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, burr mill, tumbling mills, action in tumbling mills, Size reduction equipment –Ultra fine grinders (classification hammer mills, colloid mill), cutting machines (slicing, dicing, shredding, pulping), energy requirement of size deduction.

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Unit –II:

Mixing –introduction, theory of solids mixing, criteria of mixer effectiveness and mixing index for granular solids, mixing indices, criteria of mixer effectiveness and mixing index for pastes and semi solid masses, mixing index at zero time, rate of mixing, theory of liquid mixing, power requirement for liquids mixing. Mixing equipment – Mixers for low or medium viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices), mixers for high viscosity liquids and pastes, mixers for dry powders and particulates solids.

Unit-III:

Aerodynamics of agricultural products – drag coefficient – frictional drag and profile drag or pressure drag – and terminal velocity. Theory of separation, types of separators, cyclone separators, size of screens applications, separator based on length, width, and shape of the grains, specific gravity, density. Air-screen grain cleaner: principle and types, design considerations of air-screen grain cleaners, sieve analysis-particle size determination, ideal screen and actual screen– effectiveness of separation and related problems, pneumatic separator, threshing, winnowing, cleaning and separation equipment.

Unit –IV:

Moisture content and methods for determination in grains, moisture content representation, wet basis, dry basis, direct and indirect methods of moisture content determination, problems, Importance of EMC and method of determination, static-dynamic methods, EMC curve and EMC models, hysteresis effect, bound, unbound and free moisture. Principles of drying, theory of diffusion, mechanism of drying, falling rate, constant rate period, Thin layer, deep bed dying methods, Effect of different factors on the drying process, different types of dryers, LSU dryer, flat bed batch dryer, fluidized bed dryer, rotary dryer, solar dryer.

Unit –V:

Rice milling, principles and equipments, paddy parboiling methods and equipment, wheat milling, milling of pulses and oilseeds. Theory of filtration, rate of filtration, pressure drop during filtration, applications, Constant-rate filtration and constant–pressure filtration derivation of equation, Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters.

REFERENCES:

1   Transport Processes and separation Process Principle, Geankoplis C J 2003 Prentice-Hall Inc., New Jersey.
2   Unit operations in Food processing, Earle R L 1983. Pergamon Press, New York
3   Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
4   Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott P 1993 Mc Graw-Hill Book Co., Boston.
5   Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
FARM MACHINERY AND EQUIPMENT -I				

Objective: Primary and Secondary tillage implements along with earth moving machinery, seeding and plant protection equipment will be discussed to get awareness on the mechanical area of the agricultural engineering.

Outcomes:
1. Reports knowledge on form mechanisation and its role in sustainable agriculture.
2. Explains the various form operation for craft cultivation and adaptability with scientific understanding.
3. Imports knowledge on earth moving equipments and usability.
4. Explains various seeding methods plant production equipments and adaptability.
5. Apply transplanting method fertiliser methods and calibration.

Unit – I:
Objectives of Farm Mechanization, sources of farm power, classification of farm machines. Materials of construction and heat treatment. Principles of operation and selection of machines used for production of crops - Field capacities of different implements and their economics. Problems on field capacities and cost of cultivation.

Unit – II
Classification and types of tillage, Primary tillage implements-Mould board plough and its parts, Disc plough, and other ploughs, Secondary tillage equipments- Disc harrows, implements-Cultivators, and intercultural implements. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipments, Draft and unit draft related problems.

Unit - III
Earth moving equipment-terminology, Earth moving equipments, construction and their working principles, Earth moving equipment- shovels, Bulldozers, Earth moving equipments- Trenches and elevators.

Unit-IV:
Seeding methods, Different types of seed metering mechanism, different types of furrow openers. Calibration of Seed drills. Adjustment of Seed Drills - Objectives and uses of plant protection equipment. Types of sprayers and dusters. Sprayers calibration and selection. Constructional features of different components of sprayers and dusters and their adjustments.

Unit-V:
Transplanting methods, different types of Transplanting machinery and their working principle, adjustments in Transplanting equipment. Fertilizer application equipment – fertilizer meeting mechanism calibration of fertilizer equipment.

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REFERENCES:

1. Farm Machinery, Stone A A 1958. John wiley and sons, New York.
2. Farm Machinery and Equipment, Smith H P 1971. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Principals of Agricultural Engineering, Michael A M and OJha T P 1985 Vol.I, Jain Brothers, New Delhi.
4. Principals of Farm Machinery, Kepner R A, Bainer R and Barger E L 1987. CBS Publishers and Distributors, Delhi.
5. Elements of Agricultural Engineering, Jagadeshwar Sahay 1992. Agro Book Agency, Patna.
6. Land Reclamation Machinery, Borshahov Mansurov Sergecv 1988. Mir Publishers, Moscow.

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

Course Objectives:
- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I
Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:
Theories of Production and Cost Analyses:
Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:
Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:
Introduction to Accounting & Financing Analysis:
Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

Unit – V:
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

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Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

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		-	-/3	1.5
AGRICULTURAL PROCESS ENGINEERING LAB				

Objective:

       To train the student to get hand on expose to conduct experiments and evaluate performance of various agricultural food process.

Outcomes:
1. Conducts the procedure, calculation of uniformity and mining indical.
2. Design the procedural calculation of cyclone and pneumatic separation.
3. Solve the problems on psychometric chart, definition and various loss on site reduction.
4. Conduct the performance evaluation of hammer and attribution mills.

Practical:

1   Preparation of flow charts and layout of a food processing plant
2   Determination of fineness modulus and uniformity index
3   Determination of mixing index of a feed mixer
4   Determination of the efficiency of cyclone separator
5   Tutorial on extraction by McCabe and Thiele plot
6   Tutorial on use of psychrometry chart
7   Tutorial Problems on distillation
8   Tutorial on power requirement in size reduction of grain using Rittinger's law, Kick's law and Bond's law
9   Performance evaluation of hammer mill and attribution mill.
10   Separation behavior in pneumatic separation
11   Evaluation of performance of indented cylinder and screen pre cleaner
12   Mixing index and study of mixers

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		-	-/2	1
SOIL AND WATER ENGINEERING LAB				

Objective:

To enable the student to underrated the procedure for estimation of soil lan, discharge, evaporation, sediment, accumulation, water movement therough layers.

Outcomes:

1. Estimate the soil losses and sediment concentration.
2. Describes the procedure for planning and construction of soil conservation measures.
3. Estimate the water discharge rate and evaporation and separation rate.
4. Design the soil conversion measures and structures.

1. Estimation of Soil Loss from using Cushocton Silt sampler and multi slot divisor.
2. Determination of sediment concentration through Oven Dry method.
3. Soil loss estimation using erosivity index and erodibility index.
4. Determination of rate of sedimentation and storage loss in reservoir.
5. Field planning for implantation of soil conservation measures.
6. Field visit to study different soil conservation structures
7. Field visit to study different gully control structures
8. Determination in filtration characteristics of soils.
9. Measurement of irrigation water with H-Flume.
10. Measurement of evapo-transpiration.
11. Visit to nearby irrigation projects
12. Use of current meter and water meter.

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III Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		-	-/3	1.5
FARM MACHINERY LAB I				

Objective:

To enable the student to get the practical knowledge on various operation in agricultural field for crop production.

Course Outcomes:
1. Study of various implements and functional element.
2. Evaluation of field efficiencies and fuel efficiencies.
3. Evaluate performance of various agricultural implements and machines.
4. Design and calibration of seed drills and matching mechanism.

1. Study of various Farm Machinery, equipment.
2. Visit to machinery Production industry and ICAR, SAU'S research station. Determination of Field capacity and Field efficiency of primary tillage implements.
3. Draft and Fuel consumption measurement for different implements.
4. Study of different types of plough bottoms and shares of M.B. Plough.
5. Determination of disc angle, tilt angle, concavity of a disc plough.
6. Calculation of draft and horse power.
7. Study of seed-cum-ferti drill and seed metering mechanisms.
8. Calibration of seed drill and problems.
9. Study of sprayers, dusters and measurement of nozzle discharge and field capacity.
10. Study of earth moving equipment through exposure Visit. .
11. Construction and working of rotovators and weeding equipment
12. Practical Examination.

Text Books:

1. Principles of Farm Machinery. Kepner R.A., Bainer, R and Barger E.L., 1987. CBS Publishers and Distributors, Delhi.
2. Elements of Agricultural Engineering. Jagadeshwar Sahay. 1992. Agro Book Agency, Patna.

References:

1. Farm Machinery. Stone A.A. 1958. John Wiley and Sons. New York.
2. Farm Machinery and Equipment. Smith H.P. 1971. Tata Mc Graw-Hills. Publishing Co. Ltd., New Delhi.
3. Principals of Agricultural Engineering, Vol. I. Michael A.M. and Ohja T.P. 1985. Jain Brothers, New Delhi.
4. Land Reclamation Machinery. Borshahov Mansurov Sergecv 1988 Mir Publishers, Moscow.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
IRRIGATION AND DRAINAGE ENGINEERING				

Objective: To impose skills to students on surface and sub – surface drainage system, their concepts of design & keynotes for problem soils in irrigated agriculture.

Outcomes:
1. Acquaintance of Skills on basis of irrigation engineering principles and concepts, development of irrigation in the country.
2. Skill development on gravity flow irrigation systems and their hydraulics in the field.
3. Skill development of students on water distribution systems through efficient conveyance systems & their principles of design.
4. Imparting skills on surface and subsurface drainage systems their concepts, design and keynotes in the field.
5. Skill development of students on subsurface drainage systems, reclamation of saline and alkaline soils.

Unit –I:
Introduction irrigation Engineering, advantages of irrigation, necessity and development of irrigation in India and AP and classification of irrigation projects, Irrigation terminology-GCA,CCA, Base period, crop period, Delta, Duty, Relationship between Duty and Delta, Introduction to soil-water plant relationships, soil physical properties such as soil texture, soil structure, capillary conductivity, soil consistency-volume-mass relationships of soil constituents, Water relations with soil - kinds of soil water-hygroscopic, capillary and gravitational movement of water into soils, Infiltration, factors affecting infiltration, procedure for measurement of infiltration rate and development of infiltration equations (Kostia-Kov equations Huston equations -curve fitting), Soil moisture characteristic curves, difference between soil moisture stress and soil moisture tension, soil moisture constants such as saturation capacity, field capacity moisture equivalent and permanent wilting point. Terminology related with movement of water within soils-water intake, percolation, interflow, seepage, permeability, hydraulic conductivity and hydraulic gradient- Measurement of soil moisture by different methods, evaporation, transpiration and evapo-transpiration-Estimation by Blaney-Criddle, Thornthwaite, Penman and modified Penman equations only-Potential ET. Water requirements of crops importance of water in plant growth, procedures net irrigation requirement (depth of irrigation), gross irrigation requirement, irrigation frequency and Irrigation efficiency (conveyance, application, storage, distribution, water use efficiency) with few numerical examples,

Unit-II:
Gravity Water application methods-classification, border irrigation, components of border irrigation-Width, Length and Slope for different soils for different soils, Hydraulics of border irrigation (Advance curve, Recession Curve and Opportunity time through time and distance curve) design of border irrigation. Derivation of Israelson's equation for the width of the border Furrow irrigation system advantages and disadvantages, determination of infiltration depth in furrows by inflow-outflow method (Steam size, Distance Advance time, CS area and Wetted Perimeter data problem on computation of infiltration depth), Check basin irrigation–advantages and disadvantages, estimation of infiltration under check basin conditions, adaptability and design

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considerations. Surge irrigation: concepts, parameters, infiltration, hydraulics, efficiency & distribution uniformity.

Unit-III:
Conveyance of irrigation water- methods assessment of design capacity of irrigation channels. Design of irrigation canals using Lacey's and Kennedy's theories and problems, Measurement of irrigation water-units of measurements, methods of measurement, direct and indirect methods, measurement of velocity using current meter-indirect methods such as area velocity method and coordinate method for measuring discharges form pipes, dethridge meter, tracer method, Direct methods of measurement of discharges; different devices such as weirs, flumes and notches and their installation procedures, equations for rectangular triangular and trapezoidal notches, explanation on RBC flumes (critical flow flumes). Underground pipe lines for irrigation water distribution, types of pipes used for underground pipe lines, testing of pipes for its water absorption and pressure requirements, estimating the discharge capacity of pipe lines, installation procedures of underground pipe lines and study of different structures associated with underground pipe lines.

Unit-IV:
Drainage-definition, objective and types, familiarization with the drainage problems (twin problems of water logging and salinity) and extent of areas in irrigated areas in the state, Surface drainage: effects of poor drainage, areas requiring drainage, factors affecting drainage requirement, drainage coefficient, determination of drainage coefficient based on different criteria, Types of surface drainage: random field drain system, bedding system, parallel field drain, parallel lateral open ditch, cross slope drain system interception system, design of open drainage channels using Manning's equation and alignment of open ditches (radius of curvature), investigations on design parameters, hydraulic conductivity, drainable porosity fluctuations of depts., to water table in the areas, methods of determining hydraulic conductivity-single auger hole method and inverse auger hole: Sub-surface drainage systems, purpose and benefits, types of sub surface systems, tile drains, mole drains, drainage wells, deep open drains and combinations and their suitability for different conditions and limitations.

Unit-V:
Components of Sub-surface drainage system: layouts and types –Random type herring bone, grid iron cutoff or interceptor drains, depth and spacing of drains, size of the pipe drains using Manning's equation, drain materials of burnt clay. Perforated corrugated and solid PVC and cement concrete, slope/grade for the drains, Envelope materials for sub-surface drains and selection criteria for uniform soils and graded soils, geo-textile and nylon mesh, outlets for sub surface drainage, gravity and pumped outlets. Design of sub surface drains under steady state (equilibrium) conditions and derivation of Hooghoudt's equation for spacing, the Ernst's derivation for drain spacing, Glover-Dumm equation (only) for spacing under non-steady state conditions of water table, drainage structures, loads on conduits, ditch conduit conditions and projecting conduit conditions, construction and installation of drains, bio-drainage, vertical drainage and drainage of irrigated and humid areas, Salt balance, classification and reclamation of saline and alkaline soils, soil amendments, leaching requirement-leaching ratio, Economic aspects of drainage with a typical example for total cost estimation of SSD system and benefit – cost ratio.

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TEXT BOOKS:

1. Irrigation Engineering, Muzumdar S K, 1983, Tat-McGraw Hill Publishing's. Co. Ltd., New Delhi.
2. Irrigation Theory & Practice, Michael A M, 2008, Vikas Publishing House, New Delhi.
3. Drainage Engineering, Luthin J M, 1970, Wiley Eastern Ltd., New Delhi.
4. Soil and Water Conservation Engineering, Schwab G O, Frevert R K, Edminister T w and Barner K K, 1981, John-Wiley and Sons, New Delhi.

REFERENCES:

1. Land & Water management Engineering, Murthy V V N, 2004, Kalyani Publishers, New Delhi.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS				

Objective: To enable the students to understand the principles and concepts of various properties of biological materials to design various processing equipment to insure food quality and safety. They are the basis for measuring instruments and sensors.

Outcomes:

To acquire the skill by the students and basic principals and properties of biological materials.

Skill development to the students on different models of estimating biological material properties.

To develop the skills of the students on aerodynamic properties of grains, design of storage structures.

To acquire knowledge by the students on food quality standards, concepts estimation procedures of food quality.

Impart skills to students and food quality standards, trade mark design, hazard analysis in food industry.

Unit –I:

Physical characteristics of different food grains, fruits and vegetables – importance. Shape and size – criteria for describing shape and size. Roundness and sphericity – Volume and density – Specific gravity – Bulk density. Porosity – surface area – measurement of the same. Rheology – basic concepts – ASTM standard definition of terms. Rheological Properties – Force deformation behavior, stress and strain behavior. Visco – elasticity – time effects –

Unit –II:

Rheological models. Kelvin and Maxwell models – electrical equivalence of mechanical models. Rheological equations – Maxwell model and generalized Maxwell model. Kelvin model – generalized Kelvin model creep – stress relaxation. Friction – basic concepts – effect of load sliding velocity. Friction in agricultural materials – measurement – rolling resistance – angle of internal friction and angle of repose.

Unit-III:

Aerodynamics of agricultural products – drag coefficient – frictional drag and profit drag or pressure drag -and terminal velocity. Electrical properties – Di electrical properties. Thermal Properties – specific heat – thermal conductivity-thermal diffusivity. Application of engineering properties in handling and processing equipment and also storage structures.

Unit-IV:

Food quality – Concept, objectives and importance. Food quality, control – methods of quality control sampling – purpose. Quality control – sampling techniques. Sampling

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procedures for liquid, powdered and granular materials. Sensory evaluation or organoleptic evaluation of food quality, methods. Interpretation of sensory results in statistical quality control. Total quality management (TQM – parameters evolution quality control principles consumer preference and acceptance for a total quality management.

Unit –V:

Food laws and regulations in India. Food grade and standards – BIS, AGMARK, PFA, FPO, CAC (Codex alimantarious Commission). Sanitation in food industry – GMP. ISO 9000 series of standards. Hazard analysis and critical control point (HACCP) – objectives – principles – Steps involved in implementation of HACCP. Application of HACCP concept to milk and milk products – problems in implementing HACCP.

TEXT BOOKS:

Physical properties of plant and animal materials, Mohsenin N N 1986. Gordon and Breach Science Publishers, New York.

REFERENCES:

1   Food and Process Engineering Technology, Wilhelm LR, Suler W A and Brusewitz, G H 2004. American Society of Agricultural Engineers (ASAE), St. Joseph, Ml.
2   Engineering Properties of Foods, Rao M A, Syed S H Rizvi and Ashim K Datta 2005. CRC Press – Taylor & Francis Group, Boca Raton, FL.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
FARM MACHINERY AND EQUIPEMNT - II				

Objective: To enable the students to understand the basic principles of cutting mechanisms and to know the various available harvesting machines. To know the working principle and functions of various machine parts of mowers, reapers, windrowers, forage harvesters, threshers, combine harvesters, cotton strippers, cotton pickers, groundnut and potato and sugarcane harvesters. Students can also understand the importance of testing and evaluation of agricultural machines and different standard codes (BIS Codes) available in India for testing of machinery.

Outcomes:

Impart the basic concepts harvesting operations and mechanisms

Explain the importance, Mechanism and parameters of conveying systems in harvesting machinery.

Explain the principals, methods, components of various threshing operations.

Apply the knowledge of harvesting components in the design of root crops.

Apply the knowledge of harvesting components in the design of fruit crops.

Unit – I:

Harvesting – Crop harvesting machinery, history of development, manual harvesting and its classification. Principles and types of cutting mechanisms – principle of cutting mechanism, impact cutting, types of impact cutting, shear cutting Construction and adjustments of shear and impact type cutting mechanisms. Mowers – history and development, tractor mounted mowers,Trail behind tractor mower, integral Rear mounted mowers, side or central mounted tractor mower, semi-mounted mowers, safety precautions in operation and adjustments of mowers, Knife drives, cutter bar and its parts – inside and outside shoes. Cutter Bar – Guards, Ledger plates, wearing plates, knife clips, grass board and various parts of cutter bar assembly, alignment and registration of cutter bar. Windrowing – Methods of windrowing, Self propelled windrows, effects on yields and quality of Reapers, Animal drawn reaper, Tractor mounted Vertical conveyer reaper Repairs & maintenance of Harvesting equipment.

Unit-II:

Power operated vertical conveyer reapers – Reaper binders – Care and maintenance, types Forage harvesting equipment – row forage harvesting equipment, field forage harvesters, types of field forage harvesters. Field chopper harvesters, forage wagons and boxes, field flail forage harvesters, theself propelled forage harvester, silo forage blowers, silo un loaders.

Unit – III:

Threshing – Principal of threshing, threshing methods, threshing by manual, threshing by animals, threshing by machines, olpad threshers, Power thresher – types of power threshers, hammer mill type, rasp bar, spike tooth, syndicator, Classification threshers based on feeding type, components of Rasp thresher, Cleaning unit- Aspirator, blower,

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winnower, winnowing fan, cylinder adjustment, wheat thresher, groundnut thresher, and terminology connected with power thresher. Development of the binder and development of the combine.

Unit – IV:

Harvester, advantages and disadvantages of combines, types of combines – Tractor drawn and self propelled combines. Functions performed by a combine, cutting mechanism, threshing mechanism, separating mechanism, cleaning mechanism, attachments for combine. Combine harvesting equipment- types of corn pickers, snappers, picker husker, Picker Sheller, power transmission, gathering and snapping mechanism, conveying and elevating mechanism. Husking mechanism, shelling mechanism, factors affecting performance of corn pickers, safety rules for operating corn pickers - Root crop harvesting equipment – groundnut harvester, groundnut diggers, digger operation and adjustments – groundnut shakers, groundnut threshers and pickers, groundnut combines different units and its operation. Potato harvesters – harvesting methods and equipment, one row harvester, two rowharvester, digging and soil separation, vine removal by harvesters, separation of stones and clods.

Unit-V:

Cotton harvesting equipment – cotton stripper, types of cotton strippers, factors affecting the performance of the cotton strippers, plant characteristics – thickness of plants – conveying system. Cotton pickers – types of pickers, drum type and chain belt spindle arrangements in cotton pickers, methods of mounting spindles, doffing of the cotton, conveying systems, working, factors affecting performance of cotton pickers. Sugar cane harvesters – self propelled sugar cane harvester, cleaning and special sugar cane wagon. Sugar cane harvesters – Self propelled sugar cane harvester, conveying and special sugar cane wagon. Principles of fruit harvesting tools and machines – Harvesting methods – manual harvesters – hold on and twist type – Horticultural tools and gadgets. Testing of farm machine- Introduction, Standardization efforts, Testingprogramme and Procedure, Type of testing systems, national testing, prototype testing, testing for quality marketing.

TEXT BOOKS:

1. Principals of Farm Machinery. Kepner R.A., Bainer R and Barger E.L, 1987. CBS Publishers and Distributors, Delhi.
2. Engineering principles of Agricultural machines, Ajith k Srivatsava, Carrol E. Goering, Roger P. Rohrbach, 1993, ASAE Publishers.
3. Pesticide Application Equipment. Bindra O S and Hari Charansingh 1971. Oxford and IBH Publishing Co. Ltd., New Delhi.

REFERENCE BOOKS:

1. Farm Machinery and Equipment. Smith H.P. 1971. Tata McGraw-Hills Publishing Co., Ltd., New Delhi.
2. Testing and Evaluation of Agricultural Machinery. Mehta M.L., Verma S.R. Misra S.K. and Sharma V.K. Daya Publishing House, New Delhi.

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		3	0/0	3
DAIRY AND FOOD ENGINEERING				

Objective   Knowledge on milk processing and unit operations in dairy processing including offer strength to students to handle pasteurization, sterilization, packaging, etc. of dairy products and control spoilage   through process operations such as evaporation, freezing, membrane processing etc.,

Outcomes:
1. Students will have an understanding on various unit operations in dairy processing industries
2. Will have knowledge on different processing and packages methods of milk and dairy products.
3. Will have an idea about requirements of diary plant design and layout.
4. Gives an insight in composition and quality of milk and dairy products.
5. Will have knowledge on spoilage, storage and preservative methods of dairy products.

Unit – I:
Dairy development in India - Indian dairy industry products concentrated whole mile products, – Composition, physic-chemical properties of milk, water content, acidity, pH, developed acidity, natural acidity, total acidity, density, specific gravity, freezing point colour and flavor of milk, Unit operations of various diary and food processing systems- centrifugation, separation, separation by cyclone (application of separation in the dairy industry, velocity of particles in a gravitational field, distribution of fat globule diameters in milk, velocity of particles in a centrifugal field, strength of centrifugal bowl, disc bowl centrifuge, design of centrifuges and methods of application, decanting centrifuge for lactose and casein, cyclones for separation from gas phase).

Unit – II:
Milk receiving – quantity determination, quality evaluation, clearing and disinfection of transport facilities, milk returns, procedures for reception and returns, process flow charts for product manufacture – pasteurized milk, process steps, person method and mass balance method for making balance of cream and fat in making whole milk, butter, cheese, ice cream manufacture, process steps, over run. Pasteurization- purpose, microorganisms and enzymes and their reaction to temperature and other influences, bacteria in milk, effect of temperature. Pasteurization – methods of heating, design and mode of operation heating equipment (vat, tubular heat exchanger, plate heat exchanger), Sterilization – UHT method (direct and indirect heating), sterilization in the package (temperature and pressure patterns), equipment for sterilizing goods in the package (batch autoclaves, continuously operating sterilizers). Freezing – Introduction, freezing point curve for food and water, freezing points of common food materials, freezing time calculation by using Plank's equation, types of freezing equipment types of equipment of leaching. Filtration - ultra-filtration, processing variables, applications or ultra-filtration in milk processing, reverse osmosis, Membrane separation – Membrane separation methods, gel filtration and on exchange, Thermal processing -

Unit – III:
Homogenization – emulsifying, types of emulsions, emulsifiers, homogenizing (application, mode of operation, technical execution, effect of the product), filling and packaging – packaging of milk, cultured milk, cheese, butter, concentrated milk, products, dried milk products and packaging materials, filling and metering, packaging methods. Butter manufacture – principle, treatment of

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cream, churning, overrun, factors affecting churn ability, methods (butter churn, continuous butter making), butter oil and special butter products (Composition, methods of manufacturing ,direct evaporation method, decantation, centrifugal separation, vacuum method). Thermal death time curve, reaction kinetics of the heat treatment of milk and its use for the assessment of UHT treatment methods, change in milk produced by heating, Plant utilities requirement – Electricity, water, power.

Dairy plant design and layout – factors in planning, importance of site selection, location of building, size and type of dairy building, advantages of good plant layout, functional design, operating schedule and layout, process selection, floor space, walls and ceiling ventilation, doors, windows, lighting, flooring and drainage.

Unit-IV:

Composition and proximate analysis of food products- carbohydrates, protein, lipids, minerals, vitamins, Deterioration in products and their controls – food as a substitute to microorganisms, food preservation methods, principles of food preservation, causes of food spoilage and classification of food with respect to spoilage and consumption, Principles of food preservation, effects of pH and water content on growth of microorganisms, methods of controlling water content, effect of water activity, methods of measuring a oxidation-reduction potential effect on microorganisms, effect of nutrient content and effect of inhibitory substances, biological structures, physical, chemical, and biological methods of food preservation, change undergone by food components during processing –Changes during heating, evaporation, drying, freezing, juice extraction, filtration and separation.

Unit – V:

Evaporation – applications, functions, factors affecting rate of evaporation, basic evaporator construction, factors affecting liquid boiling point, thermodynamics of evaporation (phase change, boiling point elevation, duhring plot,   factor influencing the overall heat transfer coefficient, influence of feed liquor properties on evaporation, factors influencing the economy of evaporation, types of evaporation equipment. Natural circulation evaporators – batch type, horizontal short tube, vertical short tube, natural circulation with external calendria, long tube, forced circulation (general forced circulation, plate, expanding flow, mechanical /agitated thin film), drying – Drying methods (radiation, dielectric, spray, foam, spray, roller, fluidized bed, freeze).

Text Books:

1   Food Engineering and Dairy Technology, Kessler H G 1981. Veriag A. Kessler, Freising.
2   Outlines of Dairy Technology,   Sukumar De 2005. Oxford University Press, New Delhi
3   Principles of Food Science, Fennema O R 2006. Marcel Dekkar Inc., New York.
4   Food Science, Chemistry and Experimental Foods, Swaminathan M 2006. The Bangalore Printing & Publishing Co., Ltd., Bangalore

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		3	0/0	3
SEED PROCESSING AND STORAGE ENGINEERING **(Professional Elective-I)**				

Objective: To enable the students to understand the principles and acquire the knowledge on moisture content determination methods, EMC models, principles and methods of drying and their analysis, study of different driers, dehydration and functional requirements, storage of grains, CAP storage, MAP storage, and to study the conveying equipment.

Outcomes:
 1. Enable students to understand the principles and acquire the knowledge on moisture content determination methods and EMC models.
 2. Gets knowledge on principles and methods of drying and analysis grains.
 3. Learns the type all causes of spoilage of grains.
 4. Gets knowledge on storage and storage structure of grains.
 5. Will have an idea bout different grain handling equipment.

Unit-I:
Moisture contents and methods for determination: representation, wet basis, dry basis, direct and indirect methods of moisture content determination, problems. Importance of EMC and methods of its determination: static method, dynamic methods: desortation method and isotenoscopic method. EMC curve and EMC model: Henderson equation, hysteresis effect, bound moisture, unbound moisture, free moisture. Deep bed drying and their analysis, time of advance of drying front, decreasing rate period – remarks on the deep bed, problems on drying. Critical moisture content, drying models, rate of drying curves for constant drying conditions, calculation methods for falling rate drying period.

Unit-II:
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: convective drying, radiation drying, dielectric drying, chemical drying, sack drying, puff drying, foam mat drying, freeze drying etc. Study of different types of dryers: unheated air driers: air distribution systems, heated air driers: flat bed type batch dryers, reciprocating batch drier. Study of LSU dryer, baffle dryer, rotary dryer, performance, energy utilization pattern and efficiency.

Unit – III:
Types and causes of spoilage in storage. Functional requirements of seed storage, control of temperature and relative humidity inside storage. Calculation of refrigeration load, 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 natural ventilation. Conditioning of environment inside storage through mechanical ventilation, artificial drying.

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Unit-IV:

Grain storage structures : Storage of cereal grains and their products. Storage of seeds – terminology and treatments. Principles of grain storage – parameters – effecting the grain storage. Changes occurring during storage, nutritive changes, minerals, carbohydrates, proteins and vitamins. Moisture migration, storage insects, pests and their control. bag storage of grains: different types of storage, classification planning for a bag storage complex, constructional features and basic specifications of typical bag storage structures, design aspects of bag storage structures. Bulk storage of grains: advantages of bulk handling system, types of bulk storage traditional storage structures, moral, bhukari, kothari type storage structures. Bulk storage of grains, pusa bin, brick and cement bin, bunker storage, vertical silos.

Unit-V:

Grain handling equipment-bucket elevator: types of bucket elevators, components of bucket elevators, head section, boot section, elevator legs, elevator belt, buckets, drive mechanism and power requirement problems. Belt conveyors: salient features, design considerations, belt tension, power, design problems. Screw conveyors: Salient features, Conveyor elements, selection of screw conveyors and power requirements–problems. pneumatic conveyor, essential components, description of typical plant, limitations of pneumatic conveyor. Hermetically sealed and air cooled storage. Controlled Atmosphere storage of grains. Modified Atmosphere storage of grains. Tutorial problems on drying.

TEXT BOOKS:
1. Unit Operations of Agricultural Processing Sahay K M and Singh K K 1994 Vikas Publishing House Pvt. Ltd., New Delhi.
2. Grain Storage Engineering and Technology, Vijaya Raghavan, S. 1993. Batre Bale Service New Delhi.
3. Drying and Storage of Grains and Oilseeds   CBS Publishers & distributions, New Delhi.

REFERENCES:
1. Transport Processes and Unit Operations, Geankoplis C J 1978. Aliyn and Bacon Inc., Newton, Massachusetts.
2. Unit operations in Food Processing, Earle R L 1983. Pergamon Press, New York.
3. Post Harvest Technology of Cereals, Pulses and Oil seeds, Chakravarthy A. 1988 Oxford and IBH Publishing Co. Ltd., Calcutta.
4. Unit Operations of Chemical Engineering, McCabe W L and Smith J C 1993 McGraw Hill Book Co., New Delhi.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
	GREEN HOUSE TECHNOLOGY **(Professional Elective-I)**			

Objective: Constructional and operational details of greenhouses will lead the students to grow crops with profits and also to use the greenhouses for offseason usage and also to manage them commercially.

Outcomes:

It helps to the students to grow crops under controlled conditions and to become entrepreneur.

It is helpful to grow different crops under various climatic conditions.

Students will learn construction of green houses with different materials and used to grow the crops under different seasons.

Student will learn types of heat loses, heating systems and different types of watering.

Utilization of Green houses in off seasons effectively to increase the income.

Unit - I:

Greenhouses – Introduction, history, definition, greenhouse effect, advantages of greenhouses. Classification of greenhouses – Greenhouse types based on shape, utility, construction and covering material. Plant response to greenhouse environment – light, temperature, relative humidity, ventilation and carbon dioxide.

Unit- II:

Environmental requirement for crops – Temperature requirement of horticultural crops, light requirement of crops and lighting control methods, Greenhouse shading methods, Greenhouse supplemental lighting systems. Environmental control inside greenhouse – Manual controlling, thermostats, microprocessors and computerized control systems.

Unit- III:

Natural and forced ventilation summer and winter cooling systems, carbon dioxide enrichment method. Planning of greenhouse facility – Site selection and orientation, structural design, Materials used for construction of greenhouses – Wood, Galvanized iron pipe and glass. Greenhouse covering materials – Polyethylene film, PVC, Polyester, Tefzel T2 film, Polyvinyl chloride rigid panel, fiber glass reinforced plastic rigid panel, Acrylic and polycarbonate rigid panel. Design criteria and construction details of glass and pipe framed greenhouses – Material requirement and procedure for erection.

Unit-IV:

Greenhouse heating and energy storage – Type of heat loss, heating systems, heat distribution systems, water and rock storage, heat conservation practice. Greenhouse irrigation systems – Rules of watering, Hand Watering, perimeter watering, overhead sprinklers, Boom watering, Drip irrigation.

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Unit-V:

Greenhouse utilization in off season – Drying of agricultural produce. Protected Agriculture Techniques – row covers. Economics of greenhouse production – Capital requirements. Economics of production and conditions influencing returns.

TEXT BOOKS:

1. Greenhouse technology and Application, Vilas M. Salone and Ajay K. Sharma Agrotech Publishers, New Delhi, 2012
2. Greenhouse Technology for controlled Environment, Tiwari, G.N. Narsoa Publishing house Pvt. Ltd.
3. Greenhouse Technology- Management, Operation and Maintenance, N.N Patil, Universal Prakashan Publisher.

REFERENCES:

1. Greenhouse technology and management, Radha Manohar, K and Igathinathane. C. 2nd Edition, BS Publication.
2. Advances in protected cultivation, Singh Brahma and Balraj Singh, New India Publishing Company, 2014.
3. Greenhouse Management of Horticulture crops, S. Prasad and U. Kumar, second edition, Agrobios New Delhi, 2012.
4. Greenhouse: Advanced Technology for Protected Horticulture, J. Hanan, CRC Press, LLC, Florida, 1998.

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		3	0/0	3
	Tractor Design and Testing **(Professional Elective-I)**			

Objects:

To enable the students to know the development of agricultural tractors and different operations performed by the tractors. To know the different trouble shootings and remedies, design of different parts. To get knowledge on different tests performed on tractors.

Outcomes:

1. Skill development on design and building of tractor concepts, principals of stability, traction theory, hydraulic system and hitching procedure.

2. Acquiring skills on drive train, transmission design of mechanical power transmission, types of clutches & their principals & construction, rolling friction and run friction bearings.

3. Skill development on principles & law's of steering and its types, design feature of steering, design of seat and controls in tractor

4. Skill development on problem solving on design of clutches, deferent drives, selection of types, design of governors, hydraulic pumps, engine testing as per IS Code.

5. Skill development on draw bar performance and its power measurement, turning dynamics of tractor, testing of breaks and hydraulics pumps, cleaning system, noise measurement.

Unit –I
Procedure for design and development of agricultural tractor, classification, selection. Study of parameters for balanced design of tractor for stability & weight distribution, traction theory, hydraulic lift and hitch systems design.

Unit-II
Complete drive train, transmission. Design of mechanical power transmission in agricultural tractors: single disc, multi disc and cone clutches. Rolling friction and anti-friction bearings.

Unit-III
Design of Ackerman Steering and tractor hydraulic steering. Study of special design features of tractor engines and their selection viz. cylinder, piston, piston pin, crankshaft, etc. Design of seat and controls of an agricultural tractor. Tractor Testing.

Unit-IV
Design problem of tractor clutch – (Single/Multiple disc clutch). Design of gear box (synchromesh/constant mesh), variable speed constant mesh drive; Selection of tractor tyres – Problem solving. Problem on design of governor. Design and selection of hydraulic pump. Engine testing as per BIS code.

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Unit-V

Drawbar performance in the lab; PTO test and measure the tractor power in the lab/field; Determining the turning space, turning radius and brake test, hydraulic pump performance test and air cleaner and noise measurement test; Visit to tractor testing centre//industry

Textbooks:

1. Maleev V.L., 1964. Internal Combustion Engines, Tata McGraw-Hill, USA
2. Richey C.B. 1991. Agricultural Engineering Handbook. McGraw-Hill, USA

References:

1. Liljedahl J.B., Carleton W.M., Turnquist P.K. and Smith D.W. 1984. Tractors and their Power Units. AVI Publishing Co. Inc., Westport, Connecticut.
2. Raymond N, Yong E.A. and Nicolas S.1984. Vehicle Traction Mechanics, Elsevier Scitific Publications, USA.
3. Kirpal Singh. 2012. Automobile Engineering –n Vol I and Vol II. Standard Publishers Delhi.
4. Mehta M.L., Verma, S.R., Mishra, S.K., Sharma V.K. 2005. Testing & Evaluation of Agricultural Machinery, Daya Publishing House, New Delhi.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
	OPERATIONS RESEARCH (Open Elective-I)			

Course Objectives:

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

Course Outcomes:

1. After completion of the course, the student will be able to:
2. To solve the LP and DP problems
3. To solve the Transportation, assignment, game, inventory, replacement, sequencing, queuing problems

UNIT – I

Development – definition– characteristics and phases – operation research models – applications.

Linear programming: problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV

THEORY OF GAMES: Introduction to decision theory – mini. max (max. mini) – criterion and optimal strategy– solution of games with saddle points – rectangular games without saddle points – 2 x 2 games– dominance principle – m x 2 & 2 x n games -graphical method.

WAITING LINES: Introduction to Kendallis notation–classification of queuing models, single channel – with infinite population and finite population models– multichannel – with infinite population.

UNIT – V

Network Analysis: Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resourse levelling – updating.

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TEXT BOOKS:

    1.Operations Research-An Introduction/Hamdy A Taha/Pearson publishers

    2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

REFERENCES:

    1. Introduction to O.R/Hiller & Libermann/TMH

    2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.

    3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence   Friedman/Wiley

    4. Operations Research / R.Pannerselvam/ PHI Publications.

    5. Operations Research / Wagner/ PHI Publications.

    6. Operation Research /J.K.Sharma/MacMilan Publ.

    7. Operations Research/ Pai/ Oxford Publications

    8. Operations Research/S Kalavathy / Vikas Publishers

    9. Operations Research / DS Cheema/University Science Press

    10.Operations Research / Ravindran, Philips, Solberg / Wiley publishers

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		3	0/0	3
	Robotics and Automation **(Open Elective-I)**			

Course Objectives:

1. The student will be exposed to the concepts of automation
2. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators and their applications
5. The student will be exposed to the applications of robotics in manufacturing.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Identify various robot configuration and components,
2. Select appropriate actuators and sensors for a robot based on specific application
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains
4. Perform trajectory planning for a manipulator by avoiding obstacles.
5. Use knowledge of robotics for automation in manufacturing applications.

UNIT-I
INTRODUCTION: Automation and Robotics, types of automation, assembly automation equipment, material handling systems, feed systems, Automated Guided Vehicles, Automated storage and retrieval systems, Flexible Manufacturing Systems, Computer Aided Process Planning Systems, Computer Aided manufacturing. CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – II
MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – III
Differential transformation and manipulators, Jacobians – problems
Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

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UNIT IV

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT V

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1.   Industrial Robotics / Groover M P /Pearson Edu.
2.   Robotics and Control / Mittal R K & Nagrath I J / TMH.

References:

1.   Robotics / Fu K S/ McGraw Hill.
2.   Robotic Engineering / Richard D. Klafter, Prentice Hall
3.   Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.
4.   Introduction to Robotics / John J Craig / Pearson Edu.

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FINITE ELEMENTMETHODS **(Open Elective-I)**				

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal and dynamic problems.
4. Learn to model complex geometry problems and solution techniques.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and isoperimetric elements, and 3-D element .
3. Develop element characteristic equation procedure and generate global equations.
4. Able to apply Suitable boundary conditions to global equations, and reduce it to a solvable form.
5. Able to apply the FE procedure to field problems like heat transfer.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress   – strain relations, plane stress and plane strain conditions, variational and weighted residual   methods, concept of potential energy, one dimensional problems. Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – II

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global   stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress,   strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector   for concentrated and UDL, simple problems on beams.

UNIT – III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-IV

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

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UNIT – V

Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

Text Books:

1.The Finite Element Methods in Engineering / SS Rao / Pergamon.

2. Introduction to Finite Elements in Engineering/ Tirupathi R. Chandrupatla, Ashok D. Belegundu, Pearson Publishers.

References:

1.Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2.An introduction to Finite Element Method / JN Reddy / McGraw Hill
3.The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		0	0/3	1.5
FIELD OPERATION AND MAINTENANCE OF TRACTORS LAB II				

Objective: To impart practical skills on principles of fuel, lubrication, cooling, Electrical, power transmission hydraulic and final drive systems of a tractor, hitching of farm supplements, traffic rules & signals, tools for maintenance of tractor.

Outcomes:

Practical skills development on tractor fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive systems, tractor stopping operation.

Practical skills on tractor hitching systems for farm equipment and four wheel tractor types & different manufactures with models, traffic rules & regulations.

Practical skill on tractor driving with trailer and its principals

Practical skills on hitching and dehitching of farm equipment/implements, tools for maintenance & servicing of tractors.

Practice on assembly and dismantling of engine parts and visit to tractor workshop.

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. 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. Familiarization with tools and equipment used for maintaining and servicing of tractors
11. Dismantling and assembling of major engine parts.
12. Visit to tractor/ engine repair workshop, injection pump injector repair shop

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, JohnWiley & 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

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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.

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III Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		0	0/3	1.5
DAIRY AND FOOD ENGINEERIG LAB				

Objective:

To import practical knowledge on milk and food processing unit operations of dairy products and control spoilage through process operations.

Course out comes:

1.   Best Practical knowledge on processing milk and milk products
2. Have practical skills on unit operating of dairy products
3. Best Methods to present and control spoilage in milk and dairy products through process operations.

Practical

1. To study composite pilot milk processing plant &equipments
2. To study various parts of Pasteurizer and its working
3. To study various parts of Sterilizer and its working
4. To study various parts of Homogenizer and its working
5. To study various parts of Cream Separator and its working
6. To study various parts of Butter Churner and its working
7. To study various parts of Evaporator and its working
8. To study various parts of milk dyer and its working
9. To study various parts of freezer and its working
10. Design and layout of dairy plant
11. To determine various physical properties of Food Products
12. To estimate steam requirement for various operations in dairy plant
13. Visit to food industry/ dairy plant.

REFERENCES:

1. Food Engineering and Dairy Technology, Kessler H G 1981. Verlag A. Kessler, Freising
2. Outlines of Dairy Technology, Sukumar De 2005. Oxford University Press, New Delhi
3. Principles of Food Science, Fennema O R 2006. The Bangalore Printing & Publishing Co., Ltd., Bangalore

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IV Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
MICRO IRRIGATION ENGINEERING				

Objective: To impart knowledge and skills to students to design micro irrigation systems to improve water productivity of different crops and to perform economic analysis and to prepare project proposals and cost estimates of Micro – Irrigation Systems.

Outcomes:

Skill development on historical development of sprinkler irrigation in India & AP; components of sprinkler irrigation system.

Knowledge Acquiring on type of sprinkler irrigation systems, preaprtitation profiles & its distribution, its distribution due to wind, estimation of different uniformity, crop suitability under sprinkler systems.

Skill development on the design and layout of sprinkler irrigation systems, its hydraulic and pump selection principles.

Skill development on history of design of drip irrigation in India & AP, components of the drip[system, friction losses in pipe lines.

Skill development on the principles of emitting deices & their principles, construction details, hydraulic pressure variables along with principles, design of drip irrigation system, layout and automation of DIS & principles.

Unit – I:

Sprinkler Irrigation Historical development, Scenario in the World, Country and State, adoptability and limitations, Components of the sprinkler system, pump set, (Centrifugal, turbines and Submersible), Main lines, Lateral lines, Sprinkler heads, Debris screens, Desalting basins, booster pumps, Take-off valves, Flow control valves (individual sprinkler).

Unit-II:

Types of sprinkler Irrigation systems: A. Based on mechanism: i) Rotating head system, ii) Perforated pipe system, B. Based on portability: i) Portable systems, ii) Semi-portable systems, iii) Semi-permanent systems, iv) Permanent systems and v)Solid set systems. Precipitation profiles and Moisture distribution patterns, Recommended sprinkler spacings, Effects of wind speed on working of the system, Importance of distribution uniformity, Christiansen Uniformity coefficient, Distribution uniformity. Suitability of crops under sprinkler irrigation.

Unit-III:

Design of Sprinkler system, layout, laterals and mains: i) Inventory of Resources and Conditions, ii) Types of system and Layout, iii)Sprinkler Selection and Spacing, iv) Capacity of Sprinkler Systems, v) Hydraulic Design of Sprinkler Systems, vi) Selection of pump, Operation and maintenance of system, Field evaluation of the system, Cost analysis.

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Unit – IV:

Drip Irrigation, Historical development, Scenario in the World, Country and State, Advantages and Limitations, Components of drip irrigation: A. Head Control- Non return valve, Air release & Vacuum breaker, Filter, Fertigation Tank, Throttle valve, Pressure gauge, other fittings, venturi type Fertilizer injection pumps. B. Wayer carrier systems-PVC pipeline, Control valve, Flush valve, other fittings, C. Water distribution systems-Drip lateral, Drippers, Emitting pie, Grommet, Start connector, Nipple, End cap, Micro tube, Barbed connector, Drip Hydraulics, Pipe section, Water flow in pipes, Velocity recommended pressure, Pressure and Hydrostatic, Pressure due to gravity, Friction and pressure losses, Coefficient of friction.

Unit –V:

Types of Emitters: A) Based on Floe regime (Reynolds number): i) Laminar Flow, ii)Partially turbulent flow, iii) Fully turbulent flow and B) Based on Lateral connection: i) in-line and ii)on-line, Emitter flow equation, Emitter constants, Pressure variations (%) for different emitter flow variations and x-values, Emission uniformity (EU), Distribution Uniformity and Irrigation efficiency.

Planning and design of drip system- Collection of primary data, Layout, crop water requirements, hydraulic design, selection of components, Economic pipe size selection, Pressure variation Along drip Irrigation and design criteria of lateral, sub-main and mail lines, Pai-wu I design charts. Installation, operation and Maintenance of drip irrigation systems, testing and field evaluation of the system, Computer Software programs for design of drip irrigation systems, Automation of drip irrigation systems – i) Volume based, ii) time based and iii) Soil moisture bases systems.

BOOKS:
1. Drip Irrigation & Sprinkler Irrigation, Sivanappan R K Padma Kumari O and Kumar V 1997, Keerthi Publishing House Pvt. Ltd., Coimbatore.
2. Drip and Sprinkler Irrigation Systems. Nakayama and Prucks.

REFERENCES:
1. Micro-Irrigation for Crop Production, Design, Operation and Management, Freddie R. Lamm, James E. Ayars and Francis S, Nakayama, 2006, Elsevier Publications, Singapore.
2. Land and Water Management Principles, R. Suresh, 2008, Standard Publishers Distributors, Delhi.

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IV Year B.Tech. Ag. Engg I Sem.		**L**	**T/P**	**C**
		3	**-/-**	**3**
POST HARVEST ENGINEERING AND HORTICULTURAL PRODUCE				

Objective:
To enable the students to acquaint with processing of fruits and vegetables, methos of handling processing, transport, storage, preservation and packing to minimize pre and post harvest losses of fruits and vegetables and their products.

Outcomes:
1. Will have knowledge on pre and post harvest quality of fruits and vegetables.
2. Gives an insight on handling and transportation of fruits and vegetables.
3. Will have knowledge on post-harvest processing and storage of fruits and vegetables.
4. Gets knowledge on methods of preparation of fruit and vegetable products.
5. Enable the student to learn the procedure for preservation and packaging of fruits and vegetables and their products.

Unit – I:
Factors affecting fruit and vegetable quality, pre-harvest factors, environmental factors, cultural factors, post harvest factors, Engineering properties of fruits and vegetables, physical properties, chemical properties, dry coefficient terminal velocity rheological properties, screen stain, mechanical properties, comprehension strength, tensile strength, shear resistance, electrical properties, optical properties, dielectric properties- light transmittance and light reflectance,

Unit-II:
Handling and transportation of fruits and vegetables. Harvesting indices of different fruits and vegetables, determination of maturity standards for fruits and vegetable- size, shapes, aroma, Fruit ripening, leaf changes, firmness, juice content, sugar content, skin colour, total soluble solid, modern techniques for determination of harvesting indices/ and grading of fruits, electrical property, near infrared reflectance (NIR), radiation, optical method, light reflectance, machine vision. Cleaning & washing- by agitator, by spraying water, wet and dry brushing, chemical washing, factors affecting effectiveness of a sprayer.

Unit – III:
Post harvest management of Fruits and vegetables, procurement centers, washing and grading, pre-cooling, room cooling, hydro cooling, transportation by refrigerated trucks, centralized cold storage centers etc, Controlled atmospheric storage, effects of CA, additional benefits, limitations, maintaining CA system, modified atmosphere storage, maintenance of MAP, active modification, passive modification, Requirements of fresh fruits package under CAS or MAS.

Unit – IV:
Canning of fruits & vegetables: soaking, rinsing, grading, washing, peeling, cutting, blanching, cooling, filling, brining, exhausting, sealing, heat processing, cooling to room temp, storage, labeling, making of cans for canning, causes of spoilage of canned foods, hydrogen swell, flipper, soft swell, hard swell, buckling, principles of preservation of fruits & vegetables, asepsis packaging, preservation by high temperature. pasteurization, flash

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pasteurization, sterilization, chemical preservation with sulphur dioxide, advantages, disadvantages, preservation with benzoic acid, concentration and reverse osmosis technique applied to fruits & vegetables, drying and dehydration of fruits & vegetables (Flow chart), types of dryers, cabinet dryer, tray dryers, tunnel dryer, reconstitution test and rehydration, ratio of rehydration coefficient, freeze drying, methods of freezing, slow freezing, quick freezing method, advantages and disadvantages, direct immersion, indirect contact with refrigerant, air blast freezing, cryogenic freezing, de-hydro freezing, freeze-drying (flow chart).

Fermented beverages, wine, flow sheet for processing of grape wine, selection of fruit, crushing, addition of sugar, adjustment of PH, addition of preservative addition of wine yeast, fermentation, firing & filtration, aging, packaging, preparation of vinegar, alcoholic fermentation, acetic acid fermentation, quality characteristics of fruits and vegetable for processing, sensory, hidden and quantitative characteristics, oleoresin and essential oil extraction, turmeric oleoresin, extraction of chilli oleoresin, factors responsible, Solvents used for oleoresin extraction, advantages and disadvantages, Extraction of essential oil from spices by steam distillation, flow chart.

Unit-V:

Packaging of fruits and vegetables, packaging of fresh fruits, advantages of fresh packaging, packaging materials, cello pave, poly vinyl chloride, polyethylene, ethyl vinyl alcohol, packaging of apples, oranges, mangoes, bananas etc, preparation of preservation of unfermented fruit beverages, selection of fruit, sorting and washing, juice extraction, de-aeration, filtration, clarification, addition of sugar, fortification, preservation, baffling, unfermented beverages, apple juice, grape juice, pineapple juice, citrus juice, mango juice, with all flow charts.

TEXT BOOKS:
1. Food Science by Potter, N. CBS Publishers.
2. Fruits and Vegetable Preservation. Principles and practices by srivastava R P & Kumar S International book distributy C.

REFERENCE BOOK:
1. Fruits: Tropical and subtropical by Bose T. K &Mitre, SK Naya Prakash.
2. Fruits and Vegetable processing by Bhatti, S and varma U CBS Publishers.
3. Technology of food preservation by Defroshier and Defrossier CBS Publications.

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IV Year B.Tech. Ag. Engg I Sem.		**L**	**T/P**	**C**
		3	**-/-**	**3**
MECHANICAL MEASUREMENTS AND INSTRUMENTATION **(Open Elective-II)**				

Objective To enable the students to understand the principles and to acquire the knowledge on measuring systems, different types of instruments used for measuring the parameters like pressure, force, strain, temperature, sound, acceleration and displacement etc. and also to study practically using instruments for carrying out the experiments related to the concerned fields.

Course Outcome:

1. Explains the measurements for various types of instruments cited
2. Apply the knowledge of transducer in measuring Instruments.
3. Apply the knowledge of various instruments in measuring pressure.
4. Measures the strain and temperature using various instruments.
5. Apply the knowledge of instruments in measuring pressure and sound

Unit- I:

Measurement and its significance, methods of measurement – direct methods and indirect methods and classification of measurements – primary measurements, secondary measurements and tertiary measurements. Instruments and measuring systems, their classification – according to history of instruments, according to mode of measurement and according to the functional requirement and principles of operation. Their principles of operation. Functional elements of a generalized measurement system–basic functional elements – transducer element, signal conditioning element and data precision elements and auxiliary elements. Examples of instruments for identification of basic and auxiliary elements – bourdon tube pressure gauge with out and with electrical read out, spring balance and proving ring etc. Inaccuracy in measurement and it analysis – types of errors or limiting errors – propagation of error or uncertainty.

Unit-II:

Detector transducer elements – introduction, classification and their principles – primary and secondary transducers, mechanical transducer, pressure transducers and active, passive transducers, analogue transducers and digital transducers. Signal conditioning elements and their principles of operation, data presentation elements and types – visual display type, graphical recording type, magnetic type and digital type. Static performance characteristics of instruments: static sensitivity, independent and proportional linearity, hysteresis, threshold, resolution and drift – zero and sensitivity drifts.

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Unit- III:

Measurement of pressure: Introduction, types of pressure – atmospheric pressure, gauge pressure and absolute pressure, units of measurement and conversion of units form one system or another system. Types of pressure measuring devices with examples–mechanical devices, electromechanical devices. Manometers – types: simple U tube manometer. Well type manometer and inclined well manometer – ranges and their application – fluids used in manometer – desirable properties of manometric fluids – micro manometer for measuring very low pressures. Low pressure measurement devices – basic methods of measuring low pressures –study of McLeod pressure gauge used for measuring vacuum pressures: principles, construction, range and limitations. Electrical methods of measuring pressure – pressure sensitivity of resistance gauge – study of Bridgman pressure gauge used for measuring very high pressures: construction, principle, range and applications.

Unit- IV:

Measurement of strain – introduction, strain gauge principle, metals used for manufacturing strain gauges – strain gauge theory and gauge factor. Strain gauge circuits – Wheatstone bridge circuit and unbalanced bridge. Measurement of change of resistance. Cross sensitivity and temperature compensation using dummy gauge and more than one active gauge – advantages and applications of strain gauges.

Strain gauge arrangements – measurement of axial force applied to simple beams by the arrangement of one active gauge, using two active gauges and suing of active gauges. Measurement of force applied to a cantilever by using four active gauges–simple arrangement method and Poisson arrangement method. Measurement of pressure using strain gauges – diaphragm type strain gauge pressure transducer.

 Measurement of temperature – introduction and classification of temperature measuring gases along

with examples – bimetallic, mercury and vapor pressure thermometer. Bimetallic thermometers – principles – types: materials of construction – advantages of measurement and applications. Liquid in glass thermometers – type of liquids used – desirable properties of liquids – complete immersion and partial immersion type measurement – ranges – disadvantages. Liquid in metal thermometer. Thermometers based on expansion of gases – vapor pressure thermometer; construction, principles, gases used , range, merits and limitations.

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Unit- IV:

Electrical methods of measuring pressure – electrical resistance thermometers – conductor type and semiconductors type – metals used – platinum resistance thermometer. Thermister – principle – metals used – types based on shape – range of measurement – advantages – limitations. Comparison between thermometer and thermister. Thermometer – principle – thermocouple laws – base metal type and rear metal type thermocouples – thermocouple materials and characteristics. Comparison between resistance thermometer and thermocouple. Thermopile – principle.

Measurement of sound – introduction – noise and loudness, sound pressure level, sound power level, variation of intensity of sound with distance and combination of sounds. Sound measuring system. Microphone

– principle, types: capacitor type, carbon granule type, piezo electrical crystal type and electrodynamics type- fields of application. Study of speed measuring instruments-stroboscope and tachometer-principles-construction- range. Study of proving ring for force measurement and study of linear variable differentiation transformer (LVDT) for displacement measurement-principles and construction.

TEXT BOOKS:

1. Mechanical Measurements, Sirohi RS and Radhakrishna HC 1983, Wiley Eastern Ltd., 4835/24 Ansari Road, New Delhi
2. Instrumentation, Measurement and Analysis   Nakra BC and choudhary KK 1987. Tata McGraw Hill publishing co Ltd., 12/ 4 Asaf Ali Road, New Delhi
3. A course in Mechanical Measurements and Instrumentation, Shawhney A K, 1989, Dhanpat Rai and Sons, 1682, NaiSarak, New Delhi.

REFERENCES:

1. Engineering Measurements and Instrumentation, Adams L F,1981, The English Language Book Society and Hodder and Stoughton, London.
2. Mechanical Measurements, Thomas G B and Buck N L,1969, Oxford and IBH Publishing Co. Ltd., 66, Janpath, New Delhi.

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IV Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
Artificial Intelligence in Agricultural Engineering **(Open Elective-II)**				

Objects:

This helps the students to write the language programme; deferens reasoning application to robotics and current trends in intelligent system.

Course Outcome:

1. It is use full in language programming and different reasoning
2. It is helpful to the student to learn different algorithms and language programming.
3. Knowledge helpful in interpreting different rules
4. It is helpful in learning & Planning
5. It is helpful to learn about robotics and current trends in intelligent system

UNIT I:

Foundation and history of artificial intelligent, Problems and Techniques, Artificial Intelligence programming languages, Introduction to LISP and to PROLOG. Problem spaces and searches - Blind search strategies, Breadth first and Depth first, Heuristic search techniques Hill climbing.

UNIT II:

Best first-A*algorithm and AO* algorithm Game tree Minimum maximum algorithms, Game playing, Alpha beta pruning, Knowledge representation issues, Predicate logic, Logic programming, Semantic nets, Frames and inheritance, Constraint propagation.

UNIT III:

Representing knowledge using rules, Rules based deduction systems, Reasoning under uncertainty, Review of probability, Baye's probabilistic interferences, Dempster Shafer theory, Heuristic methods.

UNIT IV:

Symbolic reasoning under uncertainty, Statistical reasoning, Fuzzy reasoning. Temporal reasoning, Non monotonic reasoning, Planning and planning in situational calculus, Representation for planning, Partial order planning algorithm, Learning from examples, Discovery as learning, Learning by analogy, Explanation based learning, Neural nets, Genetic algorithms.

UNIT V:

Principles of Natural language processing, Rule based systems architecture, Expert systems, Knowledge acquisition concepts, Artificial Intelligence application to robotics, Current trends in intelligent system.

TEXT BOOKS:

1 Russell, S. and P. Norvig. 1998. Artificial Intelligence: A Modern Approach. Prentice Hall, USA
2 Rich. Elain and Kevin Knight. 1991. Artifical Intelligence. TMH. New Delhi.

REFERENCES:

1. Patrik Henry Winston. 1992. Artificial Intelligence. Norsa Publishing House, New Delhi.

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IV Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
	Photovoltaic Technology and Systems **(Open Elective-II)**			

Objectives: To enable the students to acquire knowledge on solar photovoltaic system, types of solar cell, solar photovoltaic module, battery classification, types of charge controller, converters and applications of solar photovoltaic system.

Course Outcomes:
1. Explain the photovoltaic technology and various materials used for PV cell.
2. Describe the solar photovoltaic modules in PV technology.
3. Apply the knowledge of various batteries for balance of solar PV system.
4. Adopt the knowledge of converters in various applications of solar PV technology.
5. Apply the knowledge of various characteristics of solar PV system design.

UNIT I:

Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphaous silicon cell Thin Cadmium telluride (CdTe) Cell, Copper Indium Gallium Selenide (CiGS) Cell, Thin film crystalline silicon solar cell.

UNIT II:

Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell, mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module.

UNIT III:

Balance of Solar PV system: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters, Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller.

UNIT IV:

Converters: DC to DC converter and DC to AC type converter. Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid.

UNIT V:

Study of V-I characteristics of solar PV system, smart grid technology and application, manufacturing technique of solar array, different DC to DC and DC to AC converter, domestic solar lighting system, various solar module technologies, Study of Map, Safe measurement of PV modules electrical characteristics and Commissioning of complete solar PV system.

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TEXT BOOKS:

1. Rai G.D. 1998. Non-conventional Sources of Energy. Khanna Publishers, New Delhi.
2. Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy:Theory & Practice, Himanshu Publications, New Delhi.
3. Solanki C.S. 2011. Solar Photovoltci: Fundamentals, Technologies and Appliations, PH1Learning Private Ltd., New Delhi.

REFERENCES:

1. Meinel & Meinel. 1976. Applied Solar Energy, Addison-Wesley Educational Publishers Inc., USA.
2. Derrick, Francis and Bookalders. 1991. Solar Photo-voltaic Products, ITDG Publishing, UK.

IV Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3
FOOD PACKAGING TECHNOLOGY **(Professional Elective-II)**				

Objective:

To provide knowledge on factors influencing spoilage of foods, packaging systes, different packaging materials, packaging equipments and packaging technology.

Course Outcomes:

Gains an insight about need and importance of packing.

Equipped with knowledge on factors influencing foods and foods and food products and packaging laws and regulations for prevention of spoilage of packed foods.

Provided an insight in different packaging material used for packs foods and food products.

Gives information about packing of different foods.

Gets knowledge on container making process for packing food and food products.

UNIT I

Introduction to food packaging – packaging situation in world and in India – definition of packaging - package, packaging, packing - need of packaging food – logistics – merchandising outlets – handling – transportation – packaging machinery – technology up gradation – public distribution – cost effective packaging - levels of packaging – functions of packaging –packaging environments – functions/ environment grid.

UNIT II

Shelf life of processed foods: Factors influencing shelf life of food products – package –
Environment, hazards of distribution – mechanical, elimatic and other hazards and general
principles of control of spoilage agents, packaging laws and regulations – FSSAI packaging and
labeling regulations.

UNIT III

Packaging materials – classification of packages – paper as packaging material –types of paper - kraft paper - bleached paper - grease proof paper – glassine - paper - vegetable parchment waxed paper - paper boards - paper board grades - folding cartons - kinds of carton boxes – beverage cartons - molded pulp containers - printing and varnishing - die cutting and creasing - gluing and sealing. Glass as package material - Composition of Glass - Parts of Glass container - Closures - Parts of Closures - Types of Closures - Properties of glass – Internal pressure resistance - Vertical load Strength- Resistance to impact - Resistance to Scratches and Abrasions Glass manufacture - Press and Blow (P&B) - Narrow Neck Press and Blow (NNPB) - Shape of glass Container Improvements in glass manufacturing - Hot and Cold end treatment of surface – Inspection of Glass Bottles - Advantages and Disadvantages Metal as Packaging material - Introduction - Manufacture of Tin Plate - Tin plating Manufacture of ECCS- Manufacture of Aluminium - Advantages and Disadvantages.

UNIT IV

Packaging of milk and milk products - Packaging of fruits and vegetables – Meat, fish and poultry – Bakery and

confectionary products – Protein rich foods - Packaging of Edible starches and starch products – Oils and Fats – Food grains - and food grain products – Sugar and Honey - stimulant foods – Alcoholic drinks and carbonated beverages –Spices and Condiments. Packaging of biscuits, , milk powder, coffee - carbonated soft drink- fried snack foods package testing - thickness – paper density - basis weight – grammage - burst strength - tear resistance - tensile strength - grease resistance – gas transmission rate (GTR) - water vapour transmission rate (WVTR).

UNIT V

Container Making Processes - End Manufacture - Three Piece Can Manufacture - Welded Side seams -Soldered Side seams - Double Seaming - Two Piece Can Manufacture D&I Cans - DRD Cans - Protective and Decorative coatings - Aluminium foils and Containers - Tube - Retort Pouch Plastic Consumption in India and World - Plastic packaging material - Classification of Plastics – Advantages and disadvantages Polyethylene - Low Density Polyethylene - Linear Low Density Polyethylene - High Density Polyethylene - Polypropylene - Polystyrene - Polycarbonate – Polyvinyl Chloride – Polyvinylidene Chloride – Ethylenvinyl Alcohol- Polyethylene terephthalate Coating - Laminating - Coating process – Laminating Processes.

TEXT BOOKS:

4. Food Packing Technology by Richard Coles and Mark J. Kirwan, Wiley Blackwell Publishing. 2nd

Edition. 2011

5. In – Pack Processed Food by P. Richardson, Woolhead Publishing, 1st Edition, 2008.
6. Food Packaging Principles and Practices by Gordon L. Robertson, CRC Press, 3rd Edition, 2013.

REFERENCES:

3. Recent Innovation in Barrier Technology for Plastic packaging , A review by Jacob L. Packaging Technology and Sciences, 2003.
4. New Concept in Dairy Packaging byVarghes S. and Goyal G.K , Beverages and Food world.

		L	T/P	C
IV Year B.Tech. Ag. Engg I Sem.		3	-/-	3
	WATERSHED MANAGEMENT **(Professional Elective-II)**			

Objectives:

        To train the students in the multi disciplinary subject of watershed management for effective conservation of land, using engineering and agronomic practices, control of soil loss in watershed participatory management teams in small as well as large watersheds for increasing the productivity and preparation of necessary proposals.

Course Outcomes:

1. Skill development on basic principles of water development and various steps involved.
2. Skill acquiring on principles, concepts of watershed management, watershed planning, codification, priorization of watersheds, sediment yield indese and water budgeting.
3. Skills development on rain water conservation technologies, their concepts, principles for planning and design, Dryland techniques, integrated watershed management for arable, suni arid and with agriculture & horticulture, non arable technologies with fureshy, fishery and animal husbandry.
4. Skills development on watershed cropping systems & their diversification, its effects on hydrology suspense's, programme execution, monitoring & evaluation & watersheds.
5. Skills development in participatory watershed development and management, farmer institutions, formulation of watershed projects, socio economics.

UNIT – I

Watershed – introduction and characteristics. Watershed development – problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

UNIT – II

Watershed management – concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds, sediment yield index. Water budgeting in a watershed.

UNIT – III

Management measures – rainwater conservation technologies – in-situ and ec-situ storage, water harvesting and recycling. Dry farming techniques – inter-terrace and inter-bund land management. Integrated watershed management – concept, components, arable lands – agriculture and horticulture, non-arable lands – forestry, fishery and animal husbandry.

UNIT – IV

Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme – execution, follow-up practices, maintenance, monitoring and evaluation.

UNIT – V

Participatory watershed management – role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

		L	**T/P**	**C**
IV Year B.Tech. Ag. Engg I Sem.		**3**	**-/-**	**3**

HUMAN ENGINEERING AND SAFETY
(Professional Elective-III)

Objective: To enable the students to study of human relation with environmental factors, study of anthropometry study of safety gadgets for spraying, chaff cutting and tractor & trailer operator.

Outcomes:

Gets information on relationship among human, environment and machine factors for human safety.

Gives knowledge on functions of skeletal and muscular systems for human body equilibrium.

Gets information on biometric tools for handling physical works.

Enables knowledge on factors influencing physical work capacity for human safety.

Gives an insight on development of agricultural tools which reduces sound and air pollution.

UNIT-I

Introduction to Human Engineering and Safety: Human factors, machine factors, environmental factors, relationship between the three; study of human machine model, human performance, effectors and senses, importance of FMJ (Fitting Man Job) and FJM (Fitting Job Man).

Study of Anthropometrics in designs: Workspace design for standing and seated workers, Tasks requirements – visual requirements and postural requirements.

UNIT – II

Functions of the skeletal and muscular systems: Conditions for the static equilibrium for the human body, the muscle function and types of muscle fatigue and discomfort; Factors influencing the work posture.

Unit- III

Design of Hand Tools: Biometrics and energy for muscle contraction, oxygen dependent and oxygen independent system. CO_2 consumption, importance of cardio muscular system and respiratory system in physical work handling; difference between static and dynamic works.

UNIT – IV

Physical work capacity: Factors affecting the work capacity - introduction, work capacity- personal factors- age and sex. Environmental factors: light and climate. Indirect measures of energy expenditure, calculation of rest periods in manual work.

Safety: Different machines and measures taken for the protection, vision- importance of vision, measures taken for the protection of the vision, guidelines for using colour combinations.

UNIT-V

Noise and Vibration- Measurement of sound, the nature of sound, damages due to noise, preventive measures, Displacer, types of displace, visual displace, audio signals, communication, noise communication, audio warning cues.

Advance Effects of Air Pollution: Safety regulation acts during field operations, safety measures. rehabilitation and compensation to accident victims, human information processing, skill and performance, general model of human information processing, memory storage, short term and long term storages, feedback information, design of hand tools for agricultural operations.

Text Books:

1. Work study and Ergonomics, Dalela S and Saurabh 1995, Standard Publishers and Distributors, NewDelhi.
2. New Horizons I Human Factor Design, Huckingson 1992. McGraw-Hill Book Co., New Delhi.
3. Human Factors Engineering, McCormick E J 1992. McGraw-Hill Book Co., NewDelhi.

Reference books:

1. Human Factors in Engineering and Design, Sanders M S and McCormick E J 1992. McGraw-Hill Book Co., NewDelhi.
2. Anthropometric Methods: Designing to Fit the Human Body by John A. Roebuck Jr. 1996. HFES.Publications.
3. Anthropometric Sourcebook (1978). NASA Reference Publication No. 1024, Houston TX: NASA (NTIS, Springfield, VA 22161, Order No. 79 11734).

		L	**T/P**	**C**
IV Year B.Tech. Ag. Engg I Sem.		**3**	**-/-**	**3**
	GIS AND REMOTE SENSING **(Professional Elective-III)**			

Objective:

To equip the students with the knowledge on techniques of Remote Sensing and GIS applications for land and water resources management with projections on yield response to irrigation water, mapping of salt affected and waterlogged lands and techniques of image processing for various applications in efficient natural resources management.

Course Outcome:

1. Student will learn about the remote sensing date data acquisition and analysis also the impartment of IRS Satellites
2. Student will know about image interpretation visuals
3. Student will learn the digital image processing
4. Student learn the application of RS in agricultural, geology and soil mapping

Student will learn the data base management system using various GIS package

UNIT-I

Remote sensing: Introduction to Remote Sensing, types of remote sensing, Data acquisition and analysis, Sensors- Remote sensing sensors and applications, important features of Indian Remote Sensing Satellites, **Electromagnetic spectrum**: Different bands, Resolution, Spectral response Pattern-multi spectral data use, modern remote sensing technology versus conventional aerial photography.

UNIT – II

Visual image interpretation: Image interpretation, Basic principles of image interpretation and techniques, Factors governing the quality of an image, Factors governing interpretability, visibility of objects, Elements of image interpretation.

Unit III

Digital image processing- Digital image, pixel, resolution, Image processing overview; Image restoration- Radiometric correction-DN (Digital Number value) – Noise removal and correction, Atmospheric error and correction, Geometric Error and correction. **Image enhancement** -Contrast manipulation-gray level thresholding-level slicing-contrast stretching, Digital image processing-spatial Feature Manipulation-spatial filtering- convolution edge enhancement.
Vegetation Indices: Digital image processing, vegetation components, supervised and unsupervised image classification and output stage data merging,

Unit – IV

Remote sensing in agriculture: Progress and prospects of yield assessment, remote sensing application in water resources development, remote sensing in soil conservation, aerial photo interpretation for water resources development and soil conservation survey. Remote sensing in geology and soil mapping.

Unit – V

Geographical Information System: History & development of GIS: Definition, Basic components and standard GIS packages. Date entry, storage and maintenance, Data types – spatial, non-spatial (attribute-date), Data structure, data format, point line vector-raster polygon, Object structural model, files, files organization, Data base management, systems (DBMS), Entering data in computer-digitizer-scanner data compression.

TEXT BOOKS:
1. Remote sensing and Geographical information system, BS publications, sultan Bazaar, Hyderabad – 3
2. Introduction to Remote sensing, James B and Compell, Published by Taylor & Francis Limited.

REFERENCES:
1. Basics of remote Sensing and GIS, University Science Persons.
2. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Persons, New Delhi.

		L	**T/P**	**C**
IV Year B.Tech. Ag. Engg I Sem.		**3**	**-/-**	**3**
PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY **(Professional Elective-III)**				

Objective: To enable the students to understand the different processes and machinery involved in manufacturing the agricultural machines and to acquire knowledge on CNC tooling, turning tools, milling tools, drilling tools, finishing tools. To know the industrial lay out, planning, organization, administration and management.

Course Outcome:

1. Explain the essential elements, components and forces among them in designing of agricultural machinery.
2. Explain the various tools and componential turning centers in machinery
3. Use the power metallurgy characteristics, preparation and process to design the elements in machinery.
4. Design the jigs, fixtures and machine control tools

Apply the knowledge of control units using the programming skills.

Unit-I:
Critical appraisal in production of agricultural machinery-Stresses in machine elements working stresses-stress analysis of machine parts by using standard software. Cutting tools including CNC tools and finishing tools-High speed steel cutting tools, cemented carbides, coated carbides, ceramics, drilling tools, types of drill bits, milling cutters.

Unit-II:
CNC tooling-turning tools, milling tools, drilling tools, finishing tools associated with tool turrets, different types of tools used in CNC machining centers – vertical anis machining centers – twin turret tuning centre. CNC Turning centers – Multiple spindle turning centers – integrated material handling.

Unit-III:
Powder metallurgy-introduction, powder metallurgy process, preparation of metal powders. Characteristics of metal powders – mixing compacting – sintering – hot pressing – applications of powder metallurgy. Limits, fits & tolerances – limits and fits compound tolerances – conditions for the success of any system of limits & fits, Terms & definitions.

Unit-IV:

Jigs & fixtures – Jigs, fixtures, differences between jigs & fixtures – advantages of jigs & fixtures – essential features of jigs & fixtures. General rules for designing jigs & fixtures – Different types of jigs – Types of fixtures. Controllers – CNC controlling for machine tools – motion control systems – Point to point control system – continuous path control system. CNC controlling for machine tools absolute incremental control system

– open loop and closed loop system.

Unit-V:

Machine control unit – introduction – configuration of machine control unit. Distributed numerical control – introduction and configuration. CNC part programming – Part programming fundamentals – manual part programming methods. CNC part programming – interpretation of G-codes, computer Assisted part programming types-quality of good industrial management. Advantages of good organization – economic order quantity – site selection of a factory – general location of a factory – plant lay out. Selection of stander and critical components for manufacturing agricultural machines. Case studies of manufacturing of agricultural machinery.

Reference:

1. CAD/CAM : Principles and Applications, Rao P.N, 2004, McGraw Hill Education India, New Delhi.
2. Engineering Metrology, Jain R.K., Khanna Publishers, New Delhi.
3. Industrial Organization and Engineering, Banga T.R. and SharamS.C., 2004, Khanna Publishers, New Delhi.
4. Mechanisms and Machine Theory, Rao J.S. and Dukkipatti R.V., 1990, Wiley Astern Ltd., New Delhi.
5. Theory of Mechanisms and Machines, Jagdish La, 191, Metropolitan Book Co. Pvt. Ltd., New Delhi.

IV Year B.Tech. Ag. Engg I Sem.		L	T/P	C
		3	-/-	3

FOOD PLANT DESIGN AND MANAGEMENT
(Professional Elective-III)

Objective: Students will be trained in organization of food and agricultural processing plant machinery as per process flow, site selection, layout procedures, project design concepts, etc. will be explained for bringing the talent to establish an engineering industry.

Course Outcomes:

Gets trained in organization of food and agricultural processing machinery as per process flow.

Will have knowledge on types and salient features of different plant layouts such as rice, maize, horticultural pulses, oil seeds, milk and milk products, poultry, meat & fish.

Will have an understanding of site selection, layout procedures and project design concepts and considerations.

Gets knowledge on principles and types, requirements of food processing industries includingmachinery etc,.

Will learn te environmental protection from food plant sanitation and economic sepects, record |& report maintenance of food plants.

Unit –I:

Plant layout – Definition, and principles, factors in planning layouts. Methods of layout planning – Unit areas concept, two – dimensional layouts, scale models. Principles of plant layout – Storage layout, equipment layout, safety, plant expansion, floor space, utilities servicing, building, materials handling equipment, rail roads and roads.

Unit-II:

Types of plant layout – sailent features of horticultural, rice, maize, pulses, oil seeds, poultry, fish, meat, milk and milk product plants.

Unit-III:

Location selection criteria – Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout. Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity – Equipment design and specifications, scale – up in design, safety factors, specifications, materials of construction. Project design – Process design development, general overall design considerations, cost estimation, factors affecting profitability of investments, optimum design (economic and operation). Project design – Practical considerations in design, approach. Project design – Types of designrans, feasibility survey, process development, design, construction and operation, design information from the literature.

Unit –IV:

Flow diagrams-qualitative and quantitative flow diagrams. Selection of equipments - Preliminary design, problem statement, literature survey, material and energy balance, equipment design and selection, problems, economics. Process and controls-Control systems, instrumentation control, maintenance, computer aided design. Handling equipments - Selection, factors, pumps, piping, fittings, solid feeders, plant layout. Plant elevation - Requirement of plant building and its components, foundation for equipment and dynamic loading, flooring, walls, roof, illumination, air-conditioning. Labor requirement for processing plant - Labor costs, maintenance and repairs, common denominator, plant installation, power and power transmission - systems.

Unit –V:

Food plant sanitation-Environmental protection, regulations, pollution control, air pollution abatement, particulate removal, noxious gas removal, thermal pollution control, recycling, CIP. Cost analysis cost indexes - Cash flow for industrial operations, factors affecting investment and production costs, capital investment, and estimation of capital investment. Cost analysis - Cost indexes, cost factors in capital investment, estimation of total product cost. Preparation of feasibility report -Types of repots, organization of reports, organization of a design report, preparing the report, rhetoric, checklist for the final report.

TEXT BOOK:

Dairy and Food Engineering, Farall F W 1992. John Wiley & Sons, New York.

REFERENCES:

1. Plant Layout and Design, James M Moor, Macmillan, New York.
2. Milk Plant Layout, Hall H S and Y. Rosen, FAO publications, Rome.
3. Principles of Food Sanitation, Marriott N G 1985. Van Nostrand Reinhold Company, New York.
4. Food Technology Processing and Aylward F 2001. Allied Scientific Publishers, Bikaner. Laboratory Control.

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FARM MACHINERY LAB II

Objects:

To enable the students to know the development of different agricultural machinery and tools for production and pre harvesting of different crops.

Course Outcomes:

1. Student will have knowledge on requirement of different materials and parts for development of farm machinery and tools.
2. Yets practical knowledge on development of farm machinery for production and pre har veeting of various crops.
3. Students gets knowledge on safely rules in operating farm implements based on IS standards

Practical

1. To study the various types of mowers, constructional details, materials and working.
2. To practice the alignment and registration of mower.
3. To study the various types of reaper, constructional details, materials used, working and performance
4. To measure the different losses in thresher and threshing efficiency of a thresher.
5. To study about the various types of chaff cutters and their capacity.
6. To study about constructional details, materials used and working of potato harvesters.
7. To study about constructional details, materials used and working of groundnut harvesters
8. To study the various types of cotton strippers, constructional details, materials used and working
9. To study about safety rules for operating the harvesters, threshers and combiners based on IS standards.
10. To study about different horticultural tools.
11. To visit the machinery production industry and ICAR SAU'S Research Station.

REFERENCE BOOKS:

1. Farm Machinery, Stone A A 1958. John wiley and sons, NewYork.
2. Farm Machinery and Equipment. Smith H.P. 1971. TataMcGraw-HillsPublishing Co., Ltd., NewDelhi.
3. Testing and Evaluation of Agricultural Machinery. Mehta M.L., Verma S.R.MisraS.K. and Sharma

V.K. Daya Publishing House, New Delhi.

4. Farm Machinery and Equipment, Smith H P 1971. Tata McGraw HillPublishing Co. Ltd., New Delhi

IV Year B.Tech. Ag. Engg I Sem www.FirstRanker.com	L 0 www.FirstRanker.com	T/P 0/2	C 1

SUMMER IN-PLANT TRAINNING/INTERNSHIP
(After 6th Semester) for four weeks

IV Year B.Tech. Ag. Engg I Sem www.FirstRanker.com	L 0	T/P 0/3	C 1.5
RESEARCH PROJECT – PART -I			

IV Year B.Tech. Ag. Engg II Sem www.FirstRanker.com

| L | T/P | C |
| 3 | 0/0 | 3 |

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DESIGN OF AGRICULTURAL MACHINERY
(Open Elective –III)

Objective: To enable the students to understand the general procedure for designing any machine parts. To know the design of cotter and knuckle joints, leavers, springs, various types of shafts, couplings bearings and various IC engine parts.

Outcomes:
Imports knowledge on various moving and non-moving elements of agricultural machinery.
Explains the laws, forces, stress, storm and factors involved in agricultural machines.
Explain the levers, springs, material and construction procedure.
Imports knowledge on designing of various types of shatts and keys.
Apply the knowledge for designing of agricultural machines.

Unit-I:

Machine Design – Definition, Classification of machine design, General considerations in machine design, General procedure in machine design. Fundamental units, Mass and Weight, inertia, laws of motion, force, moment of force, couple mass density, torque, work, power and energy. Simple stress in machine parts – Introduction, load, stress, strain, tensile stress and strain, compressive stress and strain, Young's modulus, shear stress and strain, shear modulus, bearing stress.

Unit-II:

Stress strain diagram, working stress, Factor of safety and selection, stresses in composite bars, thermal stress, linear and lateral strain, Poisson's ratio, volumetric strain, bulk modulus and relations, impact stress, resilience. Principal stresses and principal planes – Theories of failure under static load, Rankine's theory, Guest's theory, maximum distortion theory, stress concentration, notch sensitivity - Important terms used in Limit System, fits, types of cotter joints, design of socket and spigot cotter joint. Knuckle joint, Dimensions of various parts of knuckles joint, methods of failure of knuckle joint, design procedure of knuckle joint.

Unit-III:

Levers – Introduction, application of levers in engineering practice, design of lever hand levers, foot lever, cranked lever. Springs – Introduction, types of springs, material for helical springs, spring wire, terminology, springs in series and parallel, flat spiral springs, leaf springs, construction of leaf springs.

Unit-IV:

Shafts – Material used for shafts, types and sizes of shafts, stresses in shafts, maximum working stresses. Design of shafts, for twisting moment, bending moments, fluctuating loads, axial load in addition to combined twisting and bending loads, design of shafts on the basis of rigidity. Keys and coupling – Introduction, types of keys, sunk keys, saddle keys, tangent keys, round keys, splines, forces acting on sunk keys, strength of sunk key. Effect of key ways, shaft couplings, types of shaft couplings, muff coupling, design of flange coupling.

Unit-V:

Design of Machinery: Design of Tillage equipment –a. Cultivator (Manually Drawn and Power Operated); b. Rotavator (Power Operated); c. M.B Plough (Manually Drawn and Power Operated). Design of Sowing Machinery – Tractor Operated seed cum Fertilize drill. Design of harvesting equipment: a. Reaper, b. Mower. Design of Thresher: Power operated thresher (Spike tooth and Raspbar), Design of spraying equipment – Tractor mounted Boom sprayer.

TEXT BOOK:

1. Machine Design – Khurmi R.S. and Gupta J.K. 1996, Eurasia Publishing House Pvt. Ltd., New Delhi.

REFERENCES:

1. Machine Design – Jain R.K. 1991. Khanna Publishers, New Delhi.

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DEPARTMENT OF AGRICUTURAL ENGINEERING

IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
	Food Quality and Control			
	(Open Elective –III)			

Objectives: To enable the students to understand the basics of food science, different quality parameters of food, laws and regulations governing food quality.

Course Outcomes:

1. Able to understand the basic of food science and food quality.
2. Helps in learning sampling techniques for testing of food products.
3. Gets an insight on subjective and objective methods of food quality testing.
4. Help in detection of food adulterants in food and food products for meeting quality standards and specifications.
5. Gives knowledge on food safety and sanitation management systems for food quality control.

UNIT I

Basics of Food Science and Food Analysis, Concept, objectives and need and scope of food quality – general concepts of quality control, major quality control functions. Measurement of colour, flavor, consistency, viscosity, texture and their relationship with food quality and composition.

UNIT II

Sampling: purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials, Quality control: Quality control tools, Statistical considerations in sampling and quality control.

UNIT III

Sensory evaluation methods, panel selection methods, Interpretation of sensory results. Instrumental method for testing quality.

UNIT IV

Sources of contaminant and a septic handling of foods. Food adulteration and food safety. TQM and TQC consumer preferences and acceptance, Detection of adulteration and examination of various food products – ghee, spices, milk and milk products, fruit products (jams, jelly, marmalades) for quality standards and specifications.

UNIT V

Food Safety Management Systems GAP, GHP, GMP, Hazards and HACCP (Hazard analysis and critical control point), Sanitation in food industries. Sanitations and phytosanitory procedures in food industries. Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, PFA, FPO, ISO 9000, 22000 Series. CAC (Codex Alimantarious Commission). Food processing laws – maintenance of records and reports – traceability and Quality Assurance system in a process plant. Food laws – Role of voluntary agencies and legal aspects of consumer protection.

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DEPARTMENT OF AGRICUTURAL ENGINEERING

Text Book:

2. Ranganna S. 1986. Hand book of Analysis and Quality Control for Fruit and Vegetable Products. TMH, New Delhi.
3. Sharma Avanthi. 2006. A text book of Food Science and Technology, CBS Publishers, New Delhi.
4. The Food Safety and Standards Act along with Rules & Regulations. Commercial Law Publishers (India) Pvt. Ltd. New Delhi.

Reference Books:

1. Mumbai Sumati R., Rao Shalini M. and Rajagopal M.V.2006. Food Science, New Age, International, Hyderabad.
2. Potter N. N. and Hotchkiss J. H. 1995 Food Science, Springer, U.S.A.
3. Dev Raj, Rakesh Sharma and Joshi V. K. 2001. Quality Control for Value Addition in Food Processing. New India Publishing Agencies, Delhi.

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DEPARTMENT OF AGRICUTURAL ENGINEERING

IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
INDUSTRIAL POLLUTION CONTROL ENGINEERING				
(Open Elective –III)				

Learning objective:

The student is acquainted with the various control methods and equipment required for control has been discussed for suitably designing the appropriate process and equipment for a given industrial pollutant.

Outcomes:

1. Student can learn about the effects of different emissions from chemical industries on environment.
2. It is helpful in knowing the methods of I ry & III ry treatment disposal.
3. Students will learn about the biological bacterial treatments to waste water.
4. It is useful in pollution sampling and measurement.
5. Students can be well acquitted with air pollution control method, cycle separation and different methods.

UNIT-I:

Types of emissions from chemical industries and effects of environment, environment legislation, type of pollution and their sources, effluent guidelines and standards. Characterization of effluent streams, Oxygen demands and their determination (BOD, COD, and TOC), oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self-purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

UNIT-II:

Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. Brief studies of Carbon absorption, Ion exchange, Reverse osmosis, Ultra filtration, Chlorination, Ozonation, treatment and disposal

UNIT-III:

Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, attached growth processes, trickling filters, rotary drum filters, and anaerobic processes.

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DEPARTMENT OF AGRICUTURAL ENGINEERING

UNIT-IV:

Air pollution sampling and measurement: Types of pollutant sampling and measurement, ambient air sampling: collection of gaseous particulate air pollutants. Stack sampling: sampling system, particulate and gaseous sampling.

UNIT-V:

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Collection efficiency, control equipment like gravitational settling chambers, cyclone separators, fabric filters, ESP. scrubbers and absorption equipment

Text Book:

5. Environmental Pollution and Control Engineering, Rao C. S., Wiley Eastern Limited, India, 1993.

Reference Books:

4. Pollution Control in Process Industries, S.P. Mahajan, TMH., 1985.
5. Waste Water Treatment, M.Narayana Rao and A.K.Datta, 3rd Edition, Oxford and IHB, 2008.
6. Industrial Pollution Control and Engineering, Swamy AVN, Galgotia publications, 2005.

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DEPARTMENT OF AGRICUTURAL ENGINEERING

IV Year B.Tech. Ag. Engg II Sem.		**L**	**T/P**	**C**
		3	**0/0**	**3**
AGRO INDUSTRIES AND BI-PRODUCT UTILIZATION **(Open Elective –IV)**				

Objective: Processes to convert low value byproducts from agricultural and food processing industries will be explained in detail to produce economically viable value added products. Knowledge on treatment techniques of waste water from agricultural/food industry and animal sheds for safe disposal will be imparted to the students.

Course Outcomes:

Will have an idea about need and necessity of utilization of agro industries by products.

Gets knowledge on processes to convert low value by products from agricultural and food industries to value added products.

Gets information on utilization of agro industries waste for reverse such as feed, paper and briquests.

Understand the properties of agricultural waste.

Will get knowledge on treatment techniques of water waste from agricultural food industries and animal sheds for safe disposal.

Unit –I

Agro-industries-Definition, classification, factors responsible for establishment. By-products utilization-Rice husk-Introduction, characteristics, uses, production of pure silica and silicon, uses of amorphous silica, grades of silicon, structure of rice husk silica. Burning of rice husk for production of white ash, production of high purity silicon (calcium reduction process). Ceramic materials from rice husk – Classification of ceramics, advantages of rice husk white ash, raw materials for ceramics, production process, merits of process. Rice husk combustion – Furnace design calculation, efficiency of furnace, problems on rice husk combustion, design of inclined grate furnace.

Unit-II:

Rice husk – Alcoholic fermentation – Introduction, processes for manufacture of alcohol, production of ethyl alcohol by SSF process. Furfural – Chemistry, products properties of furfural, synthesis, production of furfural and xylose from corn cobs, furfural through RRL process. Rice bran – Oil extraction, food and chemical products processing. Coconut coir and shell utilization – Introduction. Commercial products – Edible copra, milling copra, oil milling, quality of copra and oil. Fresh kernel based products and product diversification – Desiccated coconut, canned coconut cream, coconut water. Coconut toddy production. Coir – Brown fiber milling, manufacture of white fiber. Coconut shell products.

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Unit –III:

Waste for Revsa: Mango stone and peel utilization – Mango vinegar, mango leather, mango flour-Cashew nut- Harvesting, processing. Cashew products – Nuts, testa, apple, cashew nut shell liquid, extraction of CNSL. Banana pseudo stem – Pseudo stem, banana stem candy, banana starch from pseudo stem, banana cheese from peel, banana pectin from peel, banana vinegar from pulp and peel, banana peel as cattle feed. Sugarcane bagasse – Molasses, bagasse, filter mud, sugarcane wax. Paper board Paper making from agricultural wastes – paper processing – Manufacture of pulp and paper. Raw materials for paper production. Feed processing plants – Introduction, feedstuffs from cereals, classification of feeds, specialized feeding requirements, feed manufacturing processes, forms of feed. Equipment for unit operations in feed processing – Liquid feed blenders, flaking, milling, mixing, pelleting and extruding. Formulating feeds, layout of feed mills for commercial production.

Unit-IV:

Properice of agricultural waste: Properties of agricultural waste – characteristics of solid and liquid wastes, parameter importance, determination of DO, COD, total organic carbon, BOD. BOD analysis of industrial waste waters, determination of BOD with seed material, problems on BOD. Waste collection, storage and handling – Collection, components of waste collection systems, storage of manures and slurries, factors affecting choice of storage facility. Waste handling and transport, pumping liquid manure, sumps and mixing, mixing and agitation. Industrial waste treatment – Physical treatment of waste – Solid-liquid separation – Settling, problems on solid-liquid separation, screening, drying, incineration and pyrolysis.

Unit –V:

Agricultural waste management: Biological treatment – Introduction. Anaerobic decomposition, lagoons, advantages and disadvantages, designing problems lagoon sludge. Aerobic treatment – Introduction, reactions, processes advantages and disadvantages types of aeration systems - Natural aeration mechanical aeration – Film reactors – Tricking filters, rotating biological contactors, problems on tricking filters. Floc reactors – Mechanically aerated lagoons, diffused air systems, Waste for reuse. Briquetting – Introduction, principle, briquetting machines. Processing – Direct compaction, carbonization and extrusion.

Text Books:

1. Modern Abattoir Practices and Animal by Products, Sharma, B.D, Jaypee Brothers medical Publishers.
2. Food from Wastes, Ervan, international Publishers,Delhi.

Reference Books:

1. Food Agricultural Waste Manual, Vandersholm D H, NewZealand.
2. Agricultural Waste Management Field Hand Book, USDA: New York,USA.
3. Manure Production and Characteristics. Standards, ASAE: Am. Soc. of Agricultural Engineers, New York.

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		3	0/0	3
Hydraulic Devices and Controls				
(Open Elective –IV)				

Objectives: To train the students in usage an operation of hydraulic and pneumatics controls required for automation of different engineering interventions in agriculture.

Outcomes:

1. Skill development on basic hydraulic laws, concets and filteration systems.

2. Skill development on Accumulators, Pressure genger, hydraulic circuits, different principles of sumps, construction and operation.

3. Skill development on hydraulic actuators & their principles & concepts, flow control values & their installations, circuit diagrams & trouble shooting.

4. Skill development on USCSI graphical symbols, tractor hydraulics, ADDC, pneumatic air services, logistic frameworl, hydraulic systems & pneumatic drivers and use of PLC in drivers' control.

5. Skill development on hydraulic systems, pumps & actuators, hydraulic circuits, pneumatic devices and their use in robotics.

UNIT I:
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 an volume meters, hydraulic circuit, fittings and connectors. Pumps, pump classifications, operation, performance, displacement, design of gear pumps, vane pumps, piston pumps.

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, valve assemble, troubleshooting of valves hydraulic circuit diagrams and troubleshooting.

UNIT IV:
United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC. Pneumatic: Air services, logic units, fail safe and safety systems robotics: application of hydraulics and pneumatics drives in agricultural systems, Programmable Logic Controls (PLCs).

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UNIT V:

Introduction to hydraulic systems. Study of hydraulic pumps, hydraulic actuators. Study of hydraulic motors, hydraulic valves, colour codes and circuits. Building simple hydraulic circuits, hydraulics in tractors. Introduction to pneumatics, pneumatics devices, pneumatics in agriculture; Use of hydraulics and pneumatics for robotics.

TEXT BOOKS:

1. Liljedahl J.B., Carleton W.M., Turnquist P.K. and Smith D.W. 1984. Tractors and their Power Units. AVI Publishing Co. Inc., Westport, Connecticut.
2. Majumdar. 2001. Oil Hydraulic System. Tata Mc-Graw Hill, New Delhi.
3. Parr A.2005. Hydraulics and Pneumatics. Jaico Publishing House, Mumbai.

REFERENCES:

1. Esposoto Anthony. 2003 Hydraulic System. Tata Mc-Graw Hill, New Delhi.
2. Herbert E. Merritt. 1967. Hydraulic control Systems. John Wiley & Sons, New York.
3. John Deere. 1967. Fundamentals of Service Hydraulics.

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		3	0/0	3

WATER RESOURCES SYSTEM PLANNING AND MANAGEMENT
(Open Elective –IV)

Course Learning Objectives:

The course is designed to

1. Introduce the concepts of system analysis in the planning, design, and operation of water resources.
2. Appropriate mathematical optimization methods and models.
3. Learn and apply basic economic analysis tools to water resources projects.
4. Understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning and design problems.
5. Appropriate simulation and management techniques in water resources systems.

Course Outcomes

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

a. Apply optimization methods to solve problems related to water resource systems.
b. Perform basic economic analysis to evaluate the economic feasibility of water resources projects
c. Formulate optimization models for decision making in water resources systems.
d. Use simulation models for planning and design of water resources systems.

UNIT – I

Introduction: Concepts of systems analysis, definition, systems approach to water resources planning and management, role of optimization models, objective function and constraints, types of optimization techniques.

UNIT – II

Simulation and management: Application of simulation techniques in water resources, planning of reservoir system, optimal operation of single reservoir system, allocation of water resources, optimal cropping pattern, conjunctive use of surface and ground water resources.

Linear programming: Formulation of linear programming models, graphical method, simplex method, application of linear programming in water resources, revised simplex method, duality in linear programming, sensitivity analysis.

UNIT – III

Dynamic programming: Principles of optimality, forward and backward recursive dynamic programming, curse of dimensionality, application for resource allocation.

UNIT – VI

Non-linear optimization techniques: Classical optimization techniques, lagrange methods, Kuhn-Tucker conditions, search techniques, overview of genetic algorithm

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UNIT – V
Water resources economics: Basics of engineering economics, economic analysis, conditions of project optimality, benefit and cost analysis

TEXT BOOKS:
1. 'Water Resources System Analysis' by Vedula S and P P Mujumdar, McGraw Hill Company Ltd, 2005.
2. 'Water Resources Economics' by James D and R. Lee, Oxford Publishers, 2005.

REFERENCES:
1. 'Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications' by Loucks D P and E V Bee, UNESCO Publications, 2005 (http://ecommons.cornell.edu/bitstream/1813/2804/21/00_intro.pdf)
2. 'Optimal design of water distribution networks' by Bhave, P. R, Narosa Publishing house, 2003.

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IV Year B.Tech. Ag. Engg II Sem.		**L**	**T/P**	**C**
		3	**0/0**	**3**
DESIGN OF SOIL, WATER CONSERVATION AND FORM SYSTEMS (**Professional Elective –IV**)				

Objective: To enable the students to design and execute the structures for controlling soil erosion due to water, irrigation in fields and prepare cost estimates for the structures.

Outcomes:

1. Skill development on principles of hydraulics of open channel flow, their design and construction in the field, critical energy concepts, froud number and its application in hydraulics.
2. Skill development in the principles of hydrologic, hydraulic of runoff measuring structures in the stream flow, seepage dynamic across the structures.
3. Acquaintance with knowledge on principles of design and construction of climate spills ways, inlet drop structures, pipe spill way etc., irrigation structures and their design & construction.
4. Skill acquiring in structures used in the aerial water conveying system, their principles, design and constructions & cross draining works.
5. Skill development on principles of irrigation outlets, their design and construction, diversion head works, different weirs and barrages.

Unit-I:

Flow in open channels – types of flow, state of flow, regimes of flow, energy and momentum – principles, specific energy and specific force – critical depth concept–stage discharge relationship–sequent depths. Hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy – Froude number and its significance in the design of hydraulic structures.

Unit-II:

Runoff measuring structures–parshall flume, H-Flume and weirs, water stage recorders, straight drop spill way-general description, functional use, advantages and disadvantages, structural parts and functions, components of spillway. Three design phases – hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow. 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 of triangular load diagram for various flow conditions. Creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension.

Unit III :

Chute spillway- general description and its components, hydraulic design, energy dissipaters – uplift pressure diagram – analysis of various forces etc. Design criteria of a SAF stilling basic and its limitations. Drop inlet spillway – general description, types of possible flow conditions, pipe flow, orifice flow, functional use, design criteria.

Irrigation Engineering structures – Various types and their purposes. Differences between soil conservation and irrigation structures.

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Unit-IV:

Canal falls – types of canal falls with line diagrams (elevations). Design of trapezoidal notch fall. Design of syphon well drop type of canal falls. Cross drainage works – locations needing cross drainage works – aqueduct – super passage – inverted siphon aqueduct – inlets and outlets – different types of cross drainage works with line diagrams. Design principles of various cross drainage works – design of an aqueduct.

Unit–V:

Irrigation outlets – non modular, semi modular rigid modular outlets battle sluice irrigation modules. Diversion head works – Different components of diversions head works – head regulator and cross regulator. Different types of weirs and barrages – Difference between a weir and barrage with example locations. Operation of gates in controlling water in irrigation structures.

TEXT BOOKS:
1. Soil and Water Conservation Engineering. Schwab G.O., Frevert R.K. Edminister T.W. and Barnes K.K. 1981. John Wiley and Sons, New York.
2. Irrigation Engineering and Hydraulic Structures. Garg S.K. 1986. Khanna Publications. New Delhi.

REFERENCES:
1. Irrigation Engineering. Mazumdar. S.K. 1983. TMH Publishing Co. Ltd., New Delhi.
2. Irrigation Water Resources. Modi P.N. 1990. Standard Book House. Post Box No. 1074. New Delhi.
3. Hydrology and Soil Conservation Engineering. Ghanshyam Das 2009 PHI Learning Private Limited, New Delhi.

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IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
	PROCESS EQUIPMENT DESIGN **(Professional Elective –IV)**			

Objectives:

To evaluate students to understand the general procedure of designing different food processing equipment and optimizing the design with respect to process efficiency, energy and cost.

Course Outcomes:

1. Students gains knowledge on need ad factors to be considered in designing different food processing equipments.
2. Gets an idea about different types of materials specifications and design codes used for designing food process equipments.
3. Students gains information on designing of different types of supporting and accessory requirements food processing equipments.
4. Students will enable to design different types process equipment suitable for different foods.
5. Will enable the students how to calculate efficiency, energy and cost in designing of food process equipment.

UNIT I:
introduction on process equipment design - factors influencing the design of vessels criteria in vessel design – application of design engineering for processing equipments, design parameters and general design procedure.

UNIT II:
Material specification – types of material for process equipment, design procedure, material specification, types of material for process equipments design of shells and roofs – proporting, head selection, supporters, pressure and stress considerations in different process equipments – Design codes: design of different food process equipments to code specifications.

UNIT III:
Design of different food processing equipment – pressure vessel design, design of vessels with closures operating under extended pressure, design pressure vessels to code specifications, design of high pressure monobolic and multilayer vessels, cleaners, tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger.

UNIT IV:
Design of belt conveyer, screw conveyer and bucket elevator – Design of dryers – fluidized bed, rotary, rolling bed, conduction convection, spray and freege drivers. Design of milling equipments – pulverizers, flour mills – hand operated and mechanical mills – disc mills, rotary mills, dry and wet mills.

UNIT V:
Optimization design of food process equipments – factors to be considered in optimization of design of different food processing equipments – process efficiency, energy utilization, cost – computer aided design.

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Text Book:

1. Geankoplis C.J. 2003. Transport Processes and Unit Operations, Prentice-Hall, New York.

2. Bhattacharyya, B.C.2008. Introduction to Chemical Equipment Design, CBS Publishers and Distributors, New Delhi.

Reference Books:

1. Mahajani, V.V. and Umarji, S.B.2009. Process Equipment design, Macmillan, U.K.

2. Rao, D.G.2010. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.

3. Groover, M. and Zimmers, E. CAD/CAM Computer-aided design and manufacturing person Education, Inc., New Delhi.

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IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
	DIGITAL CONTROL SYSTEMS **(Professional Elective –IV)**			

Objective:

In recent years digital controllers have become popular due to their capability of accurately performing complex computations at high speeds and versatility in leading non linear control systems. In this context, this course focuses on the analysis and design of digital control systems.

Course Outcomes:

1. The students learn the advantages of discrete time control systems and the "know how" of various associated accessories.
2. The learner understand z–transformations and their role in the mathematical analysis of different systems(like laplace transforms in analog systems).
3. The stability criterion for digital systems and methods adopted for testing the same are explained.
4. Finally, the conventional and state–space methods of design are also introduced.

UNIT – I:

Introduction and signal processing
Introduction to analog and digital control systems – advantages of digital systems – typical examples – signals and processing – sample and hold devices – sampling theorem and data reconstruction – frequency domain characteristics of zero order hold.

UNIT–II:

Z–transformations
Z–Transforms – theorems – finding inverse z–transforms – formulation of difference equations and solving – block diagram representation – pulse transfer functions and finding open loop and closed loop responses.

UNIT–III:

State space analysis and the concepts of controllability and observability
State space representation of discrete time systems – state transition matrix and methods of evaluation – discretization of continuous – time state equations – concepts of controllability and observability – tests(without proof).

UNIT – IV:

Stability analysis
Mapping between the S–Plane and the Z–Plane – primary strips and complementary strips – stability criterion – modified routh's stability criterion and jury's stability test.

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UNIT – V:

Design of discrete–time control systems by conventional methods and State feedback controllers:

Transient and steady state specifications – Design using frequency response in the w–plane for lag and led compensators – Root locus technique in the z–plane. Design of state feedback controller through pole placement – necessary and sufficient conditions – Ackerman's formula.

Text Book:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition

Reference Books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control and State Variable Methods by M.Gopal, TMH

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IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		3	0/0	3
AGRICULTURAL EXTENSION TECHNIQUES AND BUSINESS MANAGEMENT				

Objective:
To develop the communication skills of student through various extension and management techniques. To improve the confident levels of the student by learning the international trade WTO and trade related intellectual property right (Trips) etc.

Course Outcomes:

1. Student can improve the improper the communication skills through various extension and management techniques.
2. It is useful to the student to know the various extension services through which the technologies are communicated to the farmers.
3. Student can be well admitted with management such an decision making, importance, planning, organization, control & co-relational etc.
4. It is useful for the students to start Agro based industries.
5. Students can be well acquainted with different trading system like international trade WTO and export & import policy.

Unit-I:

Describe the meaning of communication, explain models of communication process along with elements and their characteristics. Classify the methods and explain the meaning, objectives, procedure involved in carrying out various individual, group and mass contact methods and describe the factors influencing selection of extension methods.

Discuss about the various information tools and sources like internet, cyber cafes, kiosks, video and teleconferencing, Parishkaram (Farmers call Center) in A.P. and kisan call centers and agri-clinics including agricultural journalism.

Unit-II:

Discuss about the adoption and diffusion process and explain the models of adoption process and innovation- decision process, classify adopter categories and enlist the characteristics and explain the factors affecting adoption process. Describe the importance of capacity building of extension personnel and farmers and explain the meaning of training and discuss different types of training to farmers and enumerate the objectives of Farmer's Training Centre (FTC), mandate of Krishi Vignan Kendra (KVK) and objectives of District Agricultural Advisory and Transfer of Technology Centres (DAATTC).

Unit-III:

Management – Definition, decision management, importance of management, concepts, functions of management. Management – Management cycle, planning, organization, direction, control, co – ordination, communication. Agri – business management – Meaning, definition, concept, distinctive features of agribusiness management, application of management principles in agri – business.

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Unit-IV:

Agro – based industries – Importance, need, procedure to be followed to setup agro – based industries, constraints in establishing agro – based industries. Project analysis – Project meaning, project cycle, identification, formulation, appraisal, Implementation, monitoring and evaluation. Project appraisal techniques – Undisounted techniques, pay back method, rate of return/return on investment, etc. Discounted techniques – NPV, BCR, IRR, sensitivity analysis.

Unit-V:

International trade – Definition, comparison between international trade and interregional trade, free trade vs. protectionism, methods of protectionism. India's contribution to international trade in food and agricultural commodities, share of agricultural products in total imports/exports of India, export – import policy. General agreement on trade and tariff (GATT), WTO, objectives, functions and structure of WTO, why WTO, ten benefits of WTO. Principles of WTO trading systems, MFN, national treatment, predictability, promoting fair competition, encouraging development and economic reform. WTO agreements – Provisions relate to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto – sanitary (SPS) measures, Trade related intellectual propert5y rights (TRIPS).

References:

1. Education and Communication for Development, Dahama O.P. and Bhatnagar O.P 1980 – Ofxford& IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Reaching the Unreached – Basics of Extension Education, Ganesh R., Mohammad Iqbal I. and Anandaraja N., Associated Publishing Company, New Delhi.
3. Essentials of Management, Joseph L Massie 1995. Prentice – Hall of India, New Delhi.
4. Agricultural Economics and Agri–business, Omri Rawlins N 1980. Prentice – Hall Inc., New Jersey.

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IV Year B.Tech. Ag. Engg II Sem.		L	T/P	C
		0	0/11	5.5
Research Project – Part -II				