



SIDDHARTH INSTITUTE OF ENGINEERING &amp; TECHNOLOGY::PUTTUR

(AUTONOMOUS)

DEPARTMENT OF AGRICULTURAL ENGINEERING

Course Structure

Bachelor of Technology

Agricultural Engineering (AGE)

**I YEAR – I SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1	18HS0848	Physics	3	1	-	4
2	18HS0830	Mathematics – I	3	-	-	3
3	18CS0501	Programming for problem solving	3	-	-	3
4	18CE0101	Engineering Mechanics	2	1	-	3
5	18HS0852	Physics Lab	-	-	3	1.5
6	18CS0503	Programming for problem solving Lab	-	-	3	1.5
7	18ME0301	Workshop practice lab	-	-	4	2
8	Induction Program (3 weeks)		-	-	-	-
Contact periods / week			11	2	10	18
			Total/Week			

**I YEAR – II SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1	18HS0801	Chemistry	3	1	-	4
2	18HS0831	Mathematics – II	3	1	-	4
3	18EE0240	Basic Electrical and Electronics Engineering	3	-	-	3
4	18HS0810	English	3	-	-	3
5	18ME0302	Engineering Graphics & Design	1	-	4	3
6	18HS0802	Chemistry Lab	-	-	3	1.5
7	18HS0811	English Lab	-	-	3	1.5
<b>NON - CREDIT COURSE</b>						
8	18HS0816	India Constitution	3	-	-	-
Contact periods / week			16	2	10	20
			Total/Week			

**II YEAR – I SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1	18HS0803	Biology for Engineers	3	-	-	3
2	18HS0832	Transform & Discrete Mathematics	3	1	-	4
3	18AG0701	Principles of Agricultural Engineering	3	-	-	3
4	18CE0151	Strength of Materials	3	-	-	3
5	18CE0104	Introduction to Fluid Mechanics	3	-	-	3
6	18CE0105	Solid Mechanics Lab	-	-	3	1.5
7	18CE0106	Fluid Mechanics Lab	-	-	2	1
8	18CE0107	Computer Aided Building Drawing	-	-	3	1.5
<b>NON- CREDIT COURSE</b>						
9	18HS0804	Environmental Science	3	-	-	-
<b>Contact Periods / Week</b>			18	1	8	<b>20</b>
			Total/Week		<b>27</b>	

**II YEAR – II SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1	18AG0702	Principles of Soil Science	3	-	-	3
2	18AG0703	Hydrology, Ground Water & Well Engineering	3	1	-	4
3	18CE0109	Surveying & Geomatics	3	-	-	3
4	18ME0346	Mechanical Engineering	3	-	-	3
5	18ME0350	Thermodynamics & Heat Engines	3	-	-	3
6	18AG0704	Principles of Soil Science Lab	-	-	3	1.5
7	18CE0113	Surveying Lab – I	-	-	3	1.5
<b>CREDIT – COURSE</b>						
8	COE-I	Comprehensive Online Examination-I	-	-	-	1
<b>NON - CREDIT COURSE</b>						
9	18HS0817	Essence of Indian Traditional Knowledge	3	-	-	-
<b>Contact Periods / Week</b>			18	1	6	<b>20</b>
			Total/Week		<b>25</b>	

**III YEAR – I SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/Drg	C
1	18ME0310	Theory of Machines	3	-	-	3
2	18CE0154	Soil Mechanics	3	-	-	3
3	18ME0335	Refrigeration & Air Conditioning	2	1	-	3
4	18AG0705	Agricultural Process Engineering	3	1	-	4
5	18AG0706	Farm machinery and Equipment-I	3	-	-	3
6	18CE0155	Soil Mechanics Lab	-	-	3	1.5
7	18AG0707	Agricultural Process Engineering Lab	-	-	3	1.5
8	18AG0708	Farm machinery and Equipment-I Lab	-	-	2	1
<b>NON - CREDIT COURSE</b>						
9	18HS0842	Aptitude Practices	3	-	-	-
<b>Contact Periods / Week</b>			18	1	8	<b>20</b>
			Total/Week		<b>27</b>	

**III YEAR – II SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1	18ME0320	Heat & Mass Transfer	2	1	-	3
2	18AG0709	Irrigation & Drainage Engineering	3	-	-	3
3	18AG0710	Farm machinery and Equipment-II	3	-	-	3
<b>PROFESSIONAL ELECTIVE COURSE (PEC) – I</b>						
4	18AG0718	Agricultural Engineering Structures	3	-	-	3
	18AG0719	Dairy & Food Engineering				
	18AG0720	Solid Waste & By-Product Utilization				
<b>OPEN ELECTIVE – I</b>						
5	18CE0127	Elements of Road Traffic Safety	3	-	-	3
	18EE0234	Industrial Instrumentation				
	18ME0307	Non-Conventional Energy Resources				
	18EC0449	Introduction to IOT				
	18CS0517	Python Programming				
	18HS0814	Intellectual Property Rights				
6	18AG0711	Irrigation & Drainage Engineering Lab	-	-	2	1
7	18AG0712	Farm machinery and Equipment-II Lab	-	-	2	1
8	18AG0715	Internship (60 Hours)	-	-	-	2
<b>CREDIT COURSE</b>						
9	COE-II	Comprehensive Online Examination – II	-	-	-	1
<b>NON-CREDIT COURSE</b>						
10	18HS0859	English for Corporate Communication Skills Lab	-	-	2	-
<b>Contact Periods / Week</b>			18	-	4	<b>20</b>
			<b>Total/Week 22</b>			

**IV YEAR – I SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/Drg	C
1	18HS0860	Supply Chain Management	3	-	-	3
2	18AG0721	Greenhouse Technology	3	-	-	3
3	<b>PROFESSIONAL ELECTIVE COURSE (PEC) – II</b>		3	-	-	3
	18AG0722	Food Processing Plant Design and Layout				
	18AG0723	Food Packaging Technology				
	18AG0724	Food Quality and Control				
4	<b>PROFESSIONAL ELECTIVE COURSE (PEC) – III</b>		3	-	-	3
	18AG0725	Tractor Systems & Controls				
	18AG0726	Design of Agricultural Machinery				
	18AG0727	Precision Agriculture and System Management				
5	<b>PROFESSIONAL ELECTIVE COURSE (PEC) – IV</b>		3	-	-	3
	18AG0728	Information Technology for Land and Water Management				
	18AG0729	Watershed Development				
	18AG0730	Soil and Water Conservation Engineering				
6	<b>OPEN ELECTIVE – II</b>		3	-	-	3
	18CE0146	Project Planning and Control				
	18EE0236	Solar Photovoltaic Systems				
	18ME0353	Computer Aided Process Planning				
	18EC0450	MATLAB Programming				
	18CS0544	Software Development & Testing				
	18HS0815	Entrepreneurship Development				
6	18AG0713	Remote sensing & GIS Applications in Agricultural Engineering Lab	-	-	3	1.5
7	18AG0714	Agricultural Engineering Lab (Virtual Lab)	-	-	3	1.5
8	18AG0716	Project Phase-I	-	-	4	2
<b>Contact Periods / Week</b>			18	-	10	<b>23</b>
			Total/Week			

**IV YEAR – II SEMESTER**

S No.	COURSE CODE	SUBJECT	L	T	P/ Drg	C
1		MOOC-I	3	-	-	3
2		MOOC-II	3	-	-	3
3	18AG0717	Project Phase-II	-	-	22	11
4	18AG0731	Comprehensive Viva Voce	-	-	-	2
<b>Contact Periods / Week</b>			6		22	<b>19</b>
			Total/Week		<b>28</b>	

**Note:** L – Lecture hours, T – Tutorial, P – Practical, Drg. – Drawing, C – Credit Total  
Credits: 160

Year	I Year		II Year		III Year		IV Year		Total
Semester	I Sem	II Sem	I Sem	II Sem	I Sem	II Sem	I Sem	II Sem	
Credits	18	20	20	20	20	20	23	19	160

**List of Subjects**  
Bachelor of Technology  
**Agricultural Engineering**  
(AGE)

S. No	Course Code	Subject/Lab/Internship/Seminar/Comprehensive Viva Voce/Project Phase – I/ Project Phase - II
1	18AG0701	Principles of Agricultural Engineering
2	18AG0702	Principles of Soil Science
3	18AG0703	Hydrology, Ground Water & Well Engineering
4	18AG0704	Principles of Soil Science Lab
5	18AG0705	Agricultural Process Engineering
6	18AG0706	Farm machinery and Equipment-I
7	18AG0707	Agricultural Process Engineering Lab
8	18AG0708	Farm machinery and Equipment-I Lab
9	18AG0709	Irrigation & Drainage Engineering
10	18AG0710	Farm machinery and Equipment-II
11	18AG0711	Irrigation & Drainage Engineering Lab
12	18AG0712	Farm machinery and Equipment-II Lab
13	18AG0713	Remote sensing & GIS Applications in Agricultural Engineering Lab
14	18AG0714	Agricultural Engineering Lab (Virtual Lab)
15	18AG0715	Mini Project
16	18AG0716	Project Phase-I
17	18AG0717	Project Phase-II
18	18AG0731	Comprehensive Viva Voce
<b>Professional Elective Courses</b>		
19	18AG0718	Agricultural Engineering Structures
20	18AG0719	Dairy & Food Technology
21	18AG0720	Solid Waste & By-Product Utilization
22	18AG0721	Greenhouse Technology
23	18AG0722	Food processing plant design and layout
24	18AG0723	Food packaging technology
25	18AG0724	Food quality and control
26	18AG0725	Tractor system and controls
27	18AG0726	Design of agricultural machinery
28	18AG0727	Precision agriculture and system management
29	18AG0728	Information technology for land and water management
30	18AG0729	Watershed development
31	18AG0730	Soil and Water Conservation Engineering

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L	T	P	C
3	1	-	4

**(18HS0848) PHYSICS**

**Course objectives:**

- *Basic concepts of related to vectors & Scalars and Newton's laws of motion.*
- *Key points related to forces.*
- *Basic concepts related to Mechanical Vibrations.*
- *Key points related to Mechanics of Solids.*
- *To understand the fundamentals of Nano materials.*

**Course outcomes:**

*Studies will be familiar with*

- *Various basic terms related to Vectors & Scalars and Newton's laws of motion.*
- *Some of the basic concepts related to forces.*
- *Simple terms related to Mechanical Vibrations.*
- *Recognize importance of various mechanical properties of materials.*
- *Understand the importance of Nanotechnology.*

**UNIT – I:**

**MOTION OF PARTICLES:** Scalars and Vectors – Types of Forces in Nature-Newton's laws and its completeness in describing particle motion – Motion of a variable mass system, motion of a rocket.

**UNIT – II:**

**FRAMES OF REFERENCES:** Inertial & Non-inertial frames of reference; Rotating coordinate system – Inertial forces and Properties - Centripetal and Coriolis forces– Effect of Coriolis force due to the rotation of the Earth - Applications of Centrifugal and Coriolis forces - Weather systems.

**UNIT – III:**

**HARMONIC OSCILLATORS:** Simple Harmonic oscillator and solution of differential equation, damped harmonic motion and solution of differential equation – over damped, critically damped and lightly damped oscillators- Forced oscillations and resonance (qualitative treatment).

**UNIT – IV:**

**MECHANICS OF SOLIDS:** Elasticity and isotropic materials, stress, strain and Hooke's Law- Elastic constants of Isotropic solids. Internal energy due to strain – longitudinal strain, volume strain and shearing strain - Beams- classification-types of support.



**UNIT-V:**

**PHYSICS OF NANOMATERIALS:** Introduction, significance of nano scale – Surface area and Quantum confinement- Quantum dot, Quantum well, Quantum wire -Synthesis of nanomaterials- Top Down Process- Ball Milling; Bottom Up Process: Sol-Gel method– CNT- Properties of Graphene- Applications.

**Text / Reference books:**

1. Engineering Mechanics, 2nd ed. — MK Harbola.
2. Introduction to Mechanics — MK Verma.
3. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam.
4. An Introduction to the Mechanics of Solids, 2nd ed. with SI Units — SH Crandall, NC Dahl & TJ Lardner.
5. Engineering Mechanics of Solids — EP Popov.
6. B.E.A. Saleh and M.C, Tech, Fundamentals of photonics, John Wiley & Sons.
7. Mechanics and Properties of Matter – J.C. Upadhyaya, Himalaya Publishing House.
8. Waves & Oscillations – D.V. Bhrahmaji and A. Srinivasa Rao, Vivek Publications
9. Engineering Physics – K. Thyagarajan, McGraw-Hill Education Private Ltd, New Delhi.

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	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>

**(18HS0830) MATHEMATICS – I**

**Course Objectives:**

*The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:*

- *To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.*
- *To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.*
- *To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.*
- *To familiarize the student with functions of several variables that is essential in most branches of engineering.*
- *To develop the essential tool of matrices and linear algebra in a comprehensive manner.*

**Course Outcomes:**

*The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.*

**UNIT – I**

**MATRICES:** Inverse and rank of a matrix; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

**UNIT – II**

**CALCULUS:** Evaluation of definite and improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions; Beta and Gamma functions and their properties. Rolle's Theorem, Mean value theorems (without proof) Taylor's and Maclaurin's theorems.

**UNIT – III**

**MULTIVARIABLE CALCULUS:** Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, directional derivatives, curl and divergence.

**UNIT – IV**

**SEQUENCES AND SERIES:** Convergence of sequence and series, tests for convergence (Geometric test, P- test, limit comparison test, D\_ Alembert ratio test, Cauchy\_ s nth root test); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

**UNIT-V**

**FOURIER SERIES:** Determination of Fourier coefficients- Fourier series- Even and odd functions, Fourier Series in an arbitrary interval, Periodic function, Half range sine and cosine series,

**Text Books:**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna publishers-42<sup>nd</sup> Edition (2012)
2. Engineering Mathematics Volume-I, by T.K.V. Iyengar, S. Chand publication-12<sup>th</sup> Edition
3. A Text book of B.Sc. mathematics volume-II, V. Venkateswara Rao S. Chand Publications

**References:**

1. Ramana B.V. Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.
2. Engineering mathematics, volume-I&II, E. Rukmangadachari & E. Keshava Reddy Pearson Publishers.
3. D. Poole, Linear Algebra: A Modern Introduction, 2<sup>nd</sup> Edition, Brooks/Cole, 2005.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Bhavanari Satyanarayana, T.V. Pradeepkumar & D. Srinivasulu -Linear Algebra & Vector Calculus, Studera Press, New Delhi.

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L	T	P	C
3	-	-	3

**(18CS0501) PROGRAMMING FOR PROBLEM SOLVING**

**Course Objectives:**

- To understand the core aspects of computer problem solving techniques
- To understand the programming language constructs
- To understand the programming paradigms

**Course Outcomes:**

- Able to design the flowchart and algorithm for real world problems
- Able to learn and understand new programming languages
- Able to construct modular and readable programs
- Able to write C programs for real world problems using simple and compound data types

**UNIT I**

**OVERVIEW OF COMPUTERS AND C-PROGRAMMING:** Description of Computer Hardware & Software.

**INTRODUCTION TO C:** overview of C, executing a `_c_` program, c-character set, constants, variables, data types, declaration of variables, assigning values to variables, managing input & output operations, operators and expressions, basics of algorithm and flow chart

**UNIT II**

**DECISION&LOOPCONTROL STATEMENTS:** Introduction, If Statement, If-else Statement, Nested- If-else Statement, Else if Ladder, Switch case – break – continue – go to Statement, for loop, nested for loop, while loop, do-while, do-while statement with while loop

**UNIT III**

**ARRAYS:** Introduction, one-dimensional (1D)-Arrays, declaration and initialization of one-dimensional (1D)-Arrays, Two- dimensional (2D)-Arrays, initialization of Two-dimensional (2D)-Arrays, Multi-dimensional Arrays

**FUNCTIONS:** Introduction, need for user-defined functions, a multi-function program, elements of user-defined functions, definition of functions, return values and types, category of functions, recursion, scope and life time of variables, preprocessor commands: `#define`, `#include`, multi file programs

**UNIT IV**

**POINTERS:** Introduction, understanding pointers, accessing address of a variable, declaring and initialization of pointer variables, accessing variable through pointers, chain of pointers, pointer expressions, pointer increment and scale factor, pointers and arrays, passing arrays to functions, array of pointers, pointers as function arguments, functions returning pointers.

**STRINGS:** Introduction, declaring and initializing string variables, reading and writing strings, arithmetic operations on characters, putting strings together, comparison of two strings, string handling functions, table of strings (array of strings)

**UNIT V**

**STRUCTURES:** Introduction, defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members, arrays of structures, arrays within structures, structures within structures, structures and functions, unions, typedef, enum

**File Management in C:** Introduction, Types of Files, Defining and Opening a File, Closing a File, Input / Output Operations on Files, Error handling during IO Operations, Random access to files, Command line arguments.

**Text Books:**

1. C and Data Structures – Ashok Kamthane Pearson education
2. Programming in C and Data Structures – E Balagurusamy – Mc GrawHill.

**References:**

1. Computer Fundamentals and C Programming - Dr. P. Chenna Reddy, ISBN: 9789351045885, Publisher: Pothi.com
2. Programming in C, Second Edition – Pradip Dey, Manas Ghosh, and Oxford University Press.
3. -C from Theory to Practicell- George S. Tselikis- Nikolaos D. Tselikas- CRC Press.
4. -Programming with C||- R S Bichkar- University Press.
5. Programming in C and Data Structures, J.R. Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education. (UNIT-I)

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	<b>2</b>	<b>1</b>	<b>-</b>	<b>3</b>

**(18CE0101) ENGINEERING MECHANICS**

**Course Objectives:**

- *To learn about forces and force systems and their applications.*
- *To learn about friction and to use the concept of Friction.*
- *To learn how to find centroid of different objects using Mathematical formula.*
- *To learn how to find Moments of Inertia of different objects using Mathematical formula.*

**Course Outcomes:**

*On completion of this course, the student will be able to*

- *Construct free body diagrams and develop appropriate equilibrium equations.*
- *Understand the concepts of friction and to apply in real life problems.*
- *Determine the centroid for composite sections.*
- *Determine the Moment of Inertia for composite sections.*

**UNIT-I**

**FORCES & FORCE SYSTEMS:** Fundamental Principles – Resolution and Composition of Forces and Equilibrium of Particles – Lami's Theorem - Principle of Transmissibility – Principles of Continuum - Types of Force Systems – Resultant of Coplanar, Concurrent and Non-Concurrent Force Systems -Varignon's Theorem - Equilibrium of Coplanar Force Systems – Types of Beams and Supports – Support Reactions.

**UNIT-II**

**FRICTION:** Types of Friction– Laws of Friction–Limiting Friction–Cone of Limiting Friction - Ladder Friction - Wedge, Screw jack and differential Screw Jack

**UNIT-III**

**CENTROID:** Centroids of Simple Figures (From Basic Principles) – Centroids of Composite Figures

**CENTRE OF GRAVITY:** Centre of Gravity of Simple Body-Centre of Gravity of Composite Bodies- Pappus Theorem

**UNIT-IV**

**MOMENT OF INERTIA:** Definition – Parallel Axis Theorem and Perpendicular Axis Theorem – Polar Moment of Inertia – Radius of Gyration – Moment of Inertia of Basic Shapes - Composite Sections - Simple Solids.

**UNIT-V**

**ANALYSIS OF PERFECT TRUSSES:** Types of Trusses – Perfect, Deficient and Redundant Trusses - Cantilever Trusses and Simply Supported Trusses – Analysis of Trusses using Method of Joints and Methods of Sections.

**Text Books:**

1. A Textbook of Engineering Mechanics, 3rd Edition, Bhavikatti S, NewAge International, 2016.
2. Engineering Mechanics, Dr. R. K. Bansal, 4th Edition, Laxmi Publications, 2011.

**References:**

1. Engineering Mechanics, D.S. Kumar, 3rd Edition, S.K. KATARIA & SONS
2. Singer\_s Engineering Mechanics: Statics and Dynamics, 3rd Edition, K. Vijaya Kumar Reddy, J. Suresh Kumar, B.S. Publications, 2011.
3. Engineering Mechanics: Statics, 6th Edition, J L Meriam, L G Kraige, Wiley India Pvt. Ltd, 2001.
4. Engineering Mechanics: Dynamics, 6th Edition, J L Meriam, L G Kraige, WileyIndia Pvt. Ltd, 2010.

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L	T	P	C
-	-	3	1.5

**(18HS0852) PHYSICS LAB**

**Course Description:**

*Physics practical course is meant for making the students to gain practical knowledge to correlate with the theoretical studies. It covers experiments on principle of Mechanics and Optics, measurement of magnetic field and studying resonance using LCR circuit.*

**Course Objectives:**

- *To explore the application of Interference and Diffraction by doing concerned experiments.*
- *Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.*
- *To understand the concept of energy gap, B-H curve and resonance phenomena in LCR circuits.*
- *Develop an ability to apply the knowledge of physics experiments in the later studies.*

**Suggested list of experiments from the following: (Perform any EIGHT experiments from the following)**

1. Determination of wavelengths of various colors of Mercury spectrum using Diffraction Grating – Normal Incidence method.
2. Determination of Dispersive power of prism.
3. Rigidity Modulus – Torsional Pendulum
4. Study of Resonance effect in Series and Parallel LCR circuit.
5. Determination of thickness of thin object by wedge method.
6. Determination of radius of curvature of Plano convex lens – Newton's Rings.
7. Determination of wavelength of a given laser source by using diffraction grating.
8. Determination of particle size using laser source.
9. Determination of energy gap of a semiconductor using p – n junction diode.
10. B- H curve.
11. Magnetic field along the axis of current carrying coil – Stewart & Gee's Method.
12. Determination of frequency of tuning fork - Melde's Apparatus.
13. Determination of spring constant – Coupled Oscillator.
14. Study of Characteristics of Solar Cell.
15. Determination of Numerical Aperture of an Optical fiber.

**Reference books:**

1. Engineering Physics practical – NU Age Publishing House, Hyderabad.
2. Engineering Practical Physics – Cengage Learning, Delhi.



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-	-	3	1.5

**(18CS0503) PROGRAMMING FOR PROBLEM SOLVING LAB****Course Objectives:**

- To make the student learn C Programming language.
- To make the student solve problems, implement those using C & C++ programming languages.
- To strengthen the ability to identify and apply the suitable data structure for the given real-world problem.

**Course Outcomes:**

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

- Apply problem solving techniques of C to find solution.
- Use C language features effectively to implement solutions.
- Use C++ language features effectively to solve problems.
- Identify and develop apt searching and sorting technique for a given problem.
- Identity, design and develop the appropriate data structure for a given problem or application.

**Experiments List:**

1. a) Acquainting students to –c|| programming environment and DOS commands  
b) Calculate sum of three numbers using c-program
2. a) swap(exchange) values of two integer variables using c-program  
b) Read an integer, a character and a float values through keyboard and display  
c) Check operator\_s precedence and associativity using c-program  
d) Write a c-program using all basic data types of c language
3. a) Read 3 integer values through keyboard and display largest among them  
b) Read marks of 5 subjects obtained by a student through keyboard and display –fail|| or –pass|| message on console  
c) Using switch () statement implement arithmetic operations
4. a) Check whether entered number is prime number  
b) Display factorial of entered number  
c) Display all multiples of an entered number up to given value (n)
5. a) Generate Fibonacci series up to entered number(n)  
b) Find out sum of the digits of a number
6. a) Find the binary equivalent of entered decimal number  
b) Generation multiplication table of entered number(n)
7. a) Calculate sum of two integer matrices

- b) Calculate product of two integer matrices
- 8. a) Create your header file by including 2 user(your) defined functions and include them in a c-program student
  - b) Find out factorial of a number using recursive function
  - c) Find square of an entered number using –call by address (reference) technique
  - d) A program that tells us purpose of few predefined functions in –math\_s header file
- 9. a) check whether entered string is palindrome
  - b) Write a program to sort the entered set of strings using structure concept
- 10. a) Count number of vowels, consonants, digits, white spaces and special characters in entered string (a line of text)
  - b) Swap (exchange) values of two integer variables using pointers
- 11. a) For 3 students with 3 subjects, calculate total marks and grade obtained by each
  - b) Read data from a file (text) and display it on the monitor
- 12. a) Copy contents of one file(text) to another created file
  - b) Merge contents of two files (text) and store it in another created file

**References:**

1. How to Solve it by Computer, R.G. Dromey, Pearson.
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. Let us C Yeswant Kanetkar, BPB publications
4. Pointers in C, Yeswant Kanetkar, BPB publications.
5. Programming in C and Data Structures, J.R. Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education

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**(18ME0301) WORKSHOP PRACTICE LAB**

**Course Objectives:**

- *The course provides hands-on training in the trades of Carpentry, Fitting, House-wiring, Tin Smithy, and Foundry. Overview of metal cutting processes, plumbing and welding is provided through live demonstrations.*

**Course Outcomes:**

*After completion of this course, a successful student will be able to:*

- *Utilize workshop tools for engineering practice.*
- *Employ skills for the production a component for real time applications.*
- *Appreciate the hard work and intuitive knowledge of the manual workers.*

**LIST OF EXPERIMENTS:**

**1. TRADES FOR EXERCISES**

- a. Carpentry shop:** Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, Cross lap joint, Mortise and tenon T joint, Bridle T joint from soft wood stock.
- b. Fitting shop:** Two joints (exercises) from: Square joint, V joint, half round joint or Dovetail joint out of 100 x 50 x 5 mm M.S. stock.
- c. Sheet metal shop:** Two jobs (exercises) from: Tray, Cylinder, Hopper or Funnel from out of 22 or 20-gauge G.I. sheet.
- d. House-wiring:** Two jobs (exercises) from: Wiring for ceiling rose and two lamps (bulbs)with independent switch, two-way switch, controls with or without looping, wiring for stair case lamp, wiring for water pump with single phase starter.
- e. Foundry:** Preparation of two moulds (exercises): for a single pattern and a double pattern.
- f. Welding:** Preparation of two welds (exercises): Single V butt joint, Lap joint, Double V butt joint or T fillet joint.

**2. TRADES FOR DEMONSTRATION:**

- a. Plumbing**
- b. Machine Shop**
- c. Metal Cutting**

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, first aid, shop safetyetc. (though they may not be used for the exercises but they give

valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

**References:**

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
2. Work shop Manual, P. Kannaiah & K.L. Narayana, SciTech Publishers.
3. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.

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**(18HS0801) CHEMISTRY**

**Course Objectives:**

- Developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools
- Technology is being increasingly based on the electronic, atomic and molecular level modifications.
- Quantum theory is more than 100 years old and to understand phenomena at Nanometer levels, one has to base the description of all chemical processes at molecular levels.

**Course Outcomes:**

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Able to design the flowchart and algorithm for real world problems
- Able to learn and understand new programming languages
- Able to construct modular and readable programs Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

**UNIT-I**

**ATOMIC, MOLECULAR STRUCTURE AND PERIODIC PROPERTIES:** Schrodinger wave equation, Molecular orbitals of diatomic molecules. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Effective Nuclear charge, variations of s, p, d and f orbital energies of atoms in the periodic table, atomic and ionic sizes, oxidation states, hard soft acids and bases, molecular geometries.

**UNIT-II**

**USES OF FREE ENERGY AND CHEMICAL EQUILIBRIA:** Thermodynamic functions: Energy Entropy and free energy, Cell potentials, Nernst equations and Its Applications. Acid base Oxidation, reduction and Solubility Equilibria.

Corrosion: Types of Corrosion, Factors Influencing the rate of Corrosion, Prevention of Corrosion (Sacrificial anodic protection, Impressed Cathodic Protection), Anodic and Cathodic Inhibitors, Electro plating (Copper, Nickel, Chromium) and Electroless Plating.

**UNIT-III**

**WATER TECHNOLOGY:** Hardness of water and its units, Estimation of Hardness by EDTA method. Boiler Troubles: Scale & Sludge, Priming and Foaming and Boiler corrosion. Municipal Solid waste water Treatment. Break point chlorination, Water softening methods (Lime-Soda, Zeolite, Ion- Exchange resins). Demineralization of Brackish Water: Reverse Osmosis and Electro Dialysis.

**UNIT-IV**

**ORGANIC REACTIONS AND ORGANIC POLYMERS:** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, Synthesis of a commonly used drug molecules (Paracetamol, Penicillin, Prodrugs - Aspirin, Sulfa drugs)

Organic polymers types (Thermosetting and Thermoplastics), Preparation, Properties and Engineering Applications of PVC, Teflon, Nylon6,6, Bakelite), Moulding Process and its uses, Conducting polymers (polyacetylene, Polyaniline).

**UNIT-V**

**SPECTROSCOPIC TECHNIQUES AND APPLICATIONS:** Principles, selection rules and applications of absorption (UV/Visible, Atomic Absorption, Infrared) and Emission spectroscopy (Flame photometry and Fluorescence and its applications in medicine. Advanced Instrumental Techniques and their Significance: XRD, Scanning Electron microscope (SEM) and Transmission electron microscopy (TEM).

**Text Books:**

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M.S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

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**(18HS0831) MATHEMATICS – II**

**Course Objectives:**

*The objective of this course is to familiarize the prospective engineers with techniques in Multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:*

- *To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.*
- *To introduce effective mathematical tools for the solutions of differential equations that model physical processes.*
- *To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.*

**Course Outcomes:**

*The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariable calculus and complex analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of Mathematics and applications that they would find useful in their disciplines.*

**UNIT-I**

**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS:** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**UNIT-II**

**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS:** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

**UNIT-III**

**MULTIVARIABLE CALCULUS (INTEGRATION):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates.

**UNIT-IV**

**COMPLEX VARIABLE – DIFFERENTIATION:** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

**UNIT-V:**

**COMPLEX VARIABLE – INTEGRATION:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

**Text Books:**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna publishers
2. Engineering Mathematics Volume-I & III by T.K.V. Iyengar, S. Chandpublication

**Reference Books:**

1. Engineering Mathematics, volume-I&III, E. Rukmangadachari & E. Keshava Reddy  
Pearson Publishers
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,  
11th Reprint, 2010.
3. Engineering Mathematics-I & III, T.K.V. Iyengar S. Chand Publications.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi  
Publications, Reprint, 2008.



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**(18EE0240) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

**Course Objectives:**

- *To understand the nature of different circuit elements, fundamental laws and network Theorems.*
- *Understand the operation of dc machines and single phase transformers.*
- *Understand the characteristics of the p-n junction diode.*
- *Understand the characteristics of BJT, FET, MOSFET and characteristics of special purpose electronic devices.*

**Course Outcomes:**

*Upon completion of the course, students will:*

- *Determine the equivalent impedance of given network by using network reduction techniques.*
- *Determine the current through any element and voltage across any element*
- *Apply the network theorems suitably.*
- *Analyze the operating principles of motor and transformer.*
- *Analyze the operating principles of major electronic devices, its characteristics and applications.*
- *Design and analyze the DC bias circuitry of BJT and FET.*

**PART-A**

**UNIT – I****INTRODUCTION TO ELECTRICAL ENGINEERING**

Ohm's Law, Basic Circuit Components, Kirchhoff's Laws, Types of Sources, Resistive Networks, Inductive Networks, Capacitive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities.

**UNIT- II****NETWORK THEOREMS & TWO PORT NETWORKS**

**Network Theorems:** Thevenin's, Norton's, Maximum Power Transfer, Reciprocity and Superposition Theorems for DC Excitations.

**Two Port Networks:** Two Port Network Parameters – Impedance, Admittance, Transmission and Hybrid Parameters and Their Relations.

**UNIT-III****DC MOTORS and TRANSFORMERS**

**DC Motors:** Principle of Operation of DC Motors, Types of DC Motors, Torque Equation, Losses and Efficiency Calculation in DC Motor - Swinburne's Test and Applications.

**Transformers:** Principles of Operation, EMF equation, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.

**PART-B****UNIT I**

**SEMICONDUCTOR DEVICES:** Intrinsic Semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction-Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode-Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

**UNIT II**

**BJT:** Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between  $I_C$ ,  $I_B$  and  $I_E$ . Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch.

**UNIT III**

**JFET & MOSFET:** Junction Field Effect Transistor (JFET)- Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET, MOSFET-The Enhancement and Depletion MOSFET, Static Characteristics of MOSFET, Applications of MOSFET.

**Text Books:**

1. -Basic Electrical Engineering, M.S. Naidu and S. Kamakshiah – TMH.
2. -Basic Electrical Engineering, T.K. Nagasarkar and M.S. Sukhija Oxford University Press.

**References:**

1. 1. -Theory and Problems of Basic Electrical Engineering, D.P. Kothari & I.J. Nagrath PHI.
2. -Principles of Electrical Engineering, V. K Mehta, S. Chand Publications.
3. -Fundamentals of Electrical Electronics Engineering, T. Thyagarajan, SCITECH Publications 5th Edition-2007.
4. -Electrical and Electronic Technology, Hughes – Pearson Education, 2012.

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**(18HS0810) ENGLISH**

**Course Objectives:**

- *To develop interest in reading English Literature for language learning.*
- *To improve knowledge and understanding of Grammar.*
- *To enhance the ability for making use of grammar in writing English.*
- *To enrich communication skills among the students.*
- *To develop their insight and positive attitude towards English language.*
- *To impart LSRW skills and inculcate the habit of learning.*
- *To build vocabulary.*

**Course Outcomes:** Students will be able:

- *To understand the rules of English grammar and their usage in writing English.*
- *To use LSRW skills through the prescribed text and develop their ability to communicate effectively.*
- *To get the mastery of language to express ideas, views, feelings and experience.*
- *To communicate well among themselves.*
- *To inculcate values and ideal characteristic qualities in themselves.*

**UNIT - I****Reading:**

1. *All the World's a Stage* by William Shakespeare. (Act-II, Scene-VII).
2. *After Twenty Years* by O. Henry.

**Writing:** Nature and Style of Sensible Writing: Describing & Defining.**Speaking:** Oral Communication (involves interactive practice sessions) Self -introduction and introducing a friend.**Listening:** Listening activity (Present tense).**Vocabulary:** The concept of word formation & root words from foreign languages.**Grammar:** Subject – Verb Agreement. Sentence Structures & use of phrases and clauses in sentences. Identifying common errors in noun, pronoun and adjectives.**UNIT - II****Reading:**

1. *I Have a Dream* Martin Luther King jr.
2. *Knowledge and Wisdom* by Bertrand Russell.

**Writing:** Importance of proper punctuation and creating coherence- Simple sentences.**Speaking:** Expressing apology.**Listening:** Listening activity. (Past tense)

**Vocabulary:** Prefixes and Suffixes.

**Grammar:** Identifying common errors in Articles, Modifiers and degrees of comparison.

### UNIT - III

**Reading:**

- 1) Nelson Mandela (Biography)
- 2) -The Happy Prince by Oscar Wilde.

**Writing:** Paragraph writing – letter writing.

**Speaking:** Situational dialogues.

**Listening:** Listening activity. (Future tense)

**Vocabulary:** Synonyms and Antonyms.

**Grammar:** Identifying common errors in Prepositions and Link words and complex sentences.

### UNIT - IV

**Reading:**

1. *Where the Mind is without Fear* by Rabindra Nath Tagore.
2. Cause - Effect and Control Measures of Pollution (Air, Water, Noise) and Nuclear Hazards.

**Writing:** Essay writing - Organizing principles of essay writing - Introduction and Conclusion.

**Speaking:** Public speaking dynamics.

**Listening:** Listening activity. (Active voice and passive voice)

**Vocabulary:** Abbreviations and Acronyms.

**Grammar:** Identifying common errors in redundancies and compound sentences.

### UNIT - V

**Reading:**

1. *The Road not Taken* by Robert Frost.
2. *An Astrologer's Day* by R K Narayan.

**Writing:** Techniques for writing precisely.

**Speaking:** Interviews and formal presentations.

**Listening:** speeches of A P J Abdul Kalam, Steve Jobs and so on.

**Vocabulary:** One-word substitutes.

**Grammar:** Identifying common errors in clichés.

### Reference Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007.
3. On Writing Well. William Zinsser. Harper Resource Book, 200.
4. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press, 2006.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press, 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyd. Oxford University Press, 2005.
7. Oscar Wilde, Create Independence Publisher, Kindle Edition, 2017.

8. The Complete Works of William Shakespeare, Kindle Edition, 2017.
9. G. P. Editors, the Complete Works of William Shakespeare, Global Classic, 2018.
10. Robert Frost, Robert Frost Collection, Wider Publication, 2011.

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**(18ME0302) ENGINEERING GRAPHICS & DESIGN**

**Course Objectives:**

- *To familiarize the students in basic concept of conic sections, projections and development of objects.*
- *To develop the imagination and drafting skills of students.*

**Course Outcomes:**

*Students undergoing this course are able to*

- *Frame ideas based on the conceptual modeling and design*
- *Provide good understanding of the methods involved in preparing various views in Engineering drawings*
- *Can prepare 2D and 3D diagrams of various objects*

**UNIT-I**

**Introduction to Engineering Drawing** - Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections, Cycloids and Involutes.

**UNIT-II**

**Projections of Points** - Principles of Orthographic Projections-Conventions - Projections of Points, Traces

**Projections of straight lines** Inclined to both the planes - simple problems only, Traces

**UNIT-III**

**Projections of Planes** – Planes (Inclined to single plane only)

**Projections of Solids-** Introduction– Projections of right regular solids-Prisms, Pyramids in different positions. (Single plane only)

**UNIT-IV**

**Sections of solids** - Sectional Views of Right regular Solids - Prisms, Pyramids.

**Development of surfaces** - Development of surfaces of Right Regular Solids - Prisms, Pyramids.

**UNIT-V**

**Orthographic Projections** - Principles of Orthographic projection, Conversion of objects from 3D to 2D

**Isometric Projections** - Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids, Conversion of 2D to 3D.

**Auto CAD (for Practice only not for External Exam)**

**Introduction to CAD**, Applications, commands, Tool bar, modeling of Simple parts, isometric problems.

**Text Books:**

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. A text Book of Engineering Drawing, K.L. Narayana, Kannaiah, ScitechPublishers, 2010
3. Engineering Graphics with using AutoCAD,2007. Jeyapoovan.T, VikasPublishing House

**References:**

1. Fundamentals of Engineering Drawing, Warren J. Luzadder and Jon. M. Duff Prentice Hall of India Pvt., Ltd., Eleventh Edition, 2001.
2. Engineering Graphics, Bhattacharyya, S.C. Bera, I. K. International Pvt Ltd. 2009.
3. A text Book of Engineering Drawing and Graphic, K. Venugopal NewAge Publishing New Delhi, 2008.

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**(18HS0802) CHEMISTRY LAB****Laboratory Outcomes**

*The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:*

- *Estimate rate constants of reactions from concentration of reactants/products as a function of time.*
- *Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.*
- *Synthesize a small drug molecule and analyse a salt sample.*

**List of Experiments:**

1. Estimation of copper by EDTA method
2. Determination of chloride content of water
3. Determination of acidity of water sample.
4. Determination of alkalinity of water sample
5. Potentiometric determination of  $\text{Fe}^{2+}$  by potassium permanganate.
6. Determination of Viscosity of an oil by Redwood Viscometer
7. Determination of dissolved oxygen in a water sample by Winkler's method
8. Conductometric titrations of strong acid against strong base.
9. Chemical analysis of a salt
10. Synthesis of a polymer/drug



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**(18HS0811) ENGLISH LAB**

**Course Objectives:**

*To get the job students dream of today largely depends on the way they communicate. Due to globalization, civilization and fast-growing technologies, communication has become a very important factor. Good communication skills increase the possibilities of getting good jobs. To meet the requirement of corporate world one has to be capable of expressing oneself.*

- *To provide Computer Assisted Language Learning facility for the students on self-instructional method for improving language.*
- *To improve the correct articulation as English is international language.*
- *To enhance the communication skills with a variety of activities and practice sessions.*

**Course Outcomes:**

*Students will be able:*

- *To recognize sounds of English language with different classifications.*
- *To know phonetic transcription and phonemic symbols of English language.*
- *To understand international accent and utilize the same in their daily conversation.*
- *To create confidence for public speaking, for facing interviews, for making effective oral presentations, for having discussions, and for delivering impromptu speeches.*

**UNIT - I**

- a) Importance of Phonetics – Introduction, organs of speech, classification of sounds, and Phonetic transcriptions.

**UNIT - II**

- a) Syllable, Syllabification, Word stress, Stress Rules and Intonation.
- b) Intonation (Falling, Raising, and fall-raise) - Pitch and Rhythm.
- c) Influence of mother tongue (MTI) - Common Indian Variants in pronunciation.
- d) Difference between British and American Pronunciation

**UNIT - III**

- a) Vocabulary building.
- b) Functional English; Telephone skills; Giving Directions; Situational dialogues; Role play.
- c) JAM, Oral Presentation-Prepared and extempore and PPT presentation.

**UNIT - IV**

- a) Describing people, places, things and situations- Body language— listening some

**UNIT - V**

- a) Preparation of resume (C.V) & Cover Letter.

- b) Interview Skills - mock interviews.
- c) Group Discussion, Debate and Dress code.

**Minimum requirement for ELCS LAB**

1. Computer Assisted Language Learning (CALL) Lab: The Computer Aided Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Camcorder etc.

System Requirement (Hardware component):

Computer network with: LAN with minimum 60 multimedia systems with the following.

Specifications:

- i) P- IV Processor
  - a) Speed 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- ii) Headphones of High quality.

**Suggested Software:**

1. Clarity pronunciation power--- Part 1(skypronunciation)
2. Clarity pronunciation power--- Part 2
3. K-Van Advanced Communication Skills.
4. Walden Info tech Software.

**References Books:**

1. A Textbook of English Phonetics for Indian Students, second edition T. Balasubramanian. (McMillian) 2012.
2. A Course in Phonetics and spoken English, DhamijaSethi, Prentice-hall of India Pvt. Ltd, 2000.
3. Speaking English Effectively, second Edition Krishna Mohan & NP Singh 2011 (McMillian).
4. A Hand Book of English Laboratories, E. Suresh Kumar, P. Sreehari, Foundation books, 2011.
5. Spring Board Success, Sharada Koshik, Bindu Bajwa, Orient Black Swan, Hyderabad, 2010.

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**(18HS0816) INDIAN CONSTITUTION**

**Course Objectives:**

*Students will be able to:*

- *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
- *To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
- *To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.*

**Course Outcomes:**

*Students will be able to:*

- *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*
- *Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*
- *Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*
- *Discuss the passage of the Hindu Code Bill of 1956.*

*The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.*

*The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times.*

*These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".*

**Course content**

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India.
9. Amendment of the Constitutional Powers and Procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

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**(18HS0803) BIOLOGY FOR ENGINEERS**

**Course Objectives**

- *Describe how biological observations of 18th Century that lead to major discoveries.*
- *Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological*
- *Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring*
- *Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine*

**Course Outcomes**

- *Classify enzymes and distinguish between different mechanisms of enzyme action.*
- *Identify DNA as a genetic material in the molecular basis of information transfer.*
- *Analyse biological processes at the reductionistic level*
- *Apply thermodynamic principles to biological systems.*
- *Identify and classify microorganisms.*

**UNIT I**

**INTRODUCTION & CLASSIFICATIONS OF ORGANISMS**

Introduction - classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms - study of different groups - E.coli, S.cerevisiae, D. Melanogaster, C. elegans, A. Thaliana, M. musculus.

**UNIT II**

**GENETICS PURPOSE**

Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis- Concepts of recessiveness and dominance - Concept of mapping of phenotype to genes - single gene disorders in humans - Complementation in human genetics.

**UNIT III**

**BIOMOLECULES PURPOSE & ENZYMES PURPOSE**

Building blocks of Molecules of life & it's types. Introduction & Concepts- Monomer units and polymeric structures, Sugars, starch, cellulose, Amino acids, proteins, Nucleotides, DNA/RNA, Two carbon units and lipids.

Role of catalysis life in existed on earth Enzymology: Enzyme classification. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters related to Biology. RNA catalysis. Classifications and Procedure for Enzyme catalysed reactions with two examples.

**UNIT IV****INFORMATION TRANSFER PURPOSE & MACROMOLECULAR ANALYSIS PURPOSE**

Molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. Genetic material of DNA, Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Introduction and Explanation of genetic code and degeneracy of genetic code. Gene - complementation and recombination.

Biological processes at the reductionist level Proteins - structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

**UNIT V****METABOLISM PURPOSE**

The principles of energy transactions - in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of  $K_{eq}$  and its relation to standard free energy. Spontaneity. ATP as an energy currency- including breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis of glucose from  $CO_2$  and  $H_2O$  (Photosynthesis). Energy yielding and energy consuming reactions.

Microbiology -single celled organisms -species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

**References:**

- 1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
- 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
- 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown

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**(18HS0832) TRANSFORM & DISCRETE MATHEMATICS**

**Course Objectives:**

*The objective of this course is to familiarize the prospective engineers with techniques in Transform Calculus and Discrete Mathematics. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:*

- *To acquaint the student with mathematical tools needed in evaluating Transform Calculus and their usage.*
- *To train the students thoroughly in Mathematical concepts of Algebraic structures, Recurrence Relation, Graph Theory.*
- *To develop the skill pertinent to the practice of the mathematical concepts including the student's abilities to formulate and modelling the problems, to think creatively and to synthesize information.*

**Course Outcomes:**

*The objective of this course is to familiarize the prospective engineers with techniques in Transform Calculus and Discrete Mathematics. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.*

**UNIT- I**

**TRANSFORM CALCULUS-I:** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, Convolution theorem. Evaluation of integrals by Laplace transforms. Solving ODEs by Laplace Transform method.

**UNIT- II**

**TRANSFORM CALCULUS-II:** Fourier sine and cosine transform, properties, inverse Fourier transforms, finite Fourier transforms.

**UNIT- III**

**ALGEBRAIC STRUCTURES:** Algebraic structures with one binary operation – semi group, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup.

**UNIT-IV**

**INTRODUCTION TO COUNTING:** Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, Combination, summations. Introduction to recurrence relation and generating functions.

**UNIT-V**

**INTRODUCTION TO GRAPHS:** Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.

**Text Books:**

1. *Higher Engineering Mathematics*, B.S. Grewal, Khanna publishers.
2. *Engineering Mathematics II* by T.K.V. Iyengar, S. Chand publications.
3. K. H. Rosen, *Discrete Mathematics and its Applications*, 6th Ed., Tata McGraw-Hill, 2007.

**Reference Books:**

1. E. Rukmangadachari & E. Keshava Reddy *Engineering mathematics, volume-II*, Pearson Publishers
2. N. Deo, *Graph Theory*, Prentice Hall of India, 1974.
3. S. Lipschutz and M. L. Lipson, *Schaum's Outline of Theory and Problems of Discrete Mathematics*, 2nd Ed., Tata McGraw-Hill, 1999.
4. J. P. Tremblay and R. P. Manohar, *Discrete Mathematics with Applications to Computer Science*, Tata McGraw-Hill, 1997.



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**(18AG0701) PRINCIPLES OF AGRICULTURAL ENGINEERING**

**Course Objectives:**

- *To present the basic engineering and technology aspects involved in agricultural production technologies and its farm machinery equipment.*

**Course Outcomes:**

*At the end of the course, students would be expected to:*

- *The knowledge gained on soil water conservation, irrigation engineering and farm structures and agricultural processing to provide a strong platform to understand the concepts on these subjects for further learning.*

**UNIT I**

**INTRODUCTION:** Agricultural Engineering – Introduction – Branches - Importance in national and global scenario – Institutes & organizations – Soil & water - Land development, Soil fertility classification - Soil erosion and control, Soil conservation methods, Watershed management - Agro meteorology - Soil Water Plant relationship.

**UNIT II**

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

**UNIT III**

**FARM MACHINERY & EQUIPMENT:** Sources of farm power, Tractor and Power Tiller – Tillage equipment – Sowing, Planting, Fertilizer application, Fertigation equipment - Spraying, Weeding and intercultural equipments – Harvesting and Mowing Equipment, Pumps.

**UNIT IV**

**AGRICULTURAL PROCESS ENGINEERING:** Post-harvest of crops, Unit operations in agricultural processing, Ripening chamber and Cold Storage - Packing of agricultural produces – Material handling equipment\_s – Milk processing and dairy products.

**UNIT V**

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

**Text Books**

- 1 Michael, A.M. & Ojha, T.P. -Principles of Agricultural Engineering Vol. I & III, Seventh Edition, Jain Brothers, New Delhi, 2011.
- 2 Jagdishwar Sahay. -Elements of Agricultural Engineering, Standard Publishers Distributors, 2010.

**References:**

- 1 Sankaran, s. and V.T Subbaiah Mudaliar, 1993. -Principles of Agronomy". The Bangalore printing and pub co. Bangalore.
- 2 Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007.

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**(18CE0151) STRENGTH OF MATERIALS**

**Course Objectives:**

- *To learn about simple stresses and strains and their applications.*
- *To learn how to find shear force and bending moment and construction of SFD & BMD.*
- *To understand about the concept of simple bending and shear stress distribution.*
- *To learn about deflections of Beams by using different methods.*
- *To learn about columns and struts and their applications.*

**Course Outcomes:**

*Students undergoing this course are able to:*

- *The students would be able to understand the behavior of materials under different stress and strain conditions.*
- *The students would be able to draw bending moment, shear force diagram, bending stress and shear stress distribution for beams under the different conditions of loading.*
- *The student would be able to apply knowledge to analyse concept of deflection, bending moment and shear force diagram in beams under various loading conditions.*
- *Determine shear stress in the shaft subjected to torsional moments.*

**UNIT - I**

**SIMPLE STRESSES AND STRAINS:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – Composite bars – Temperature stresses.

**STRAIN ENERGY:** Resilience – Gradual, sudden, impact and shock loadings- Simple applications.

**UNIT - II**

**SHEAR FORCE AND BENDING MOMENTS:** Types of supports – Types of beams – Shear force and bending moment diagrams for simply supported - Cantilever and over hanging beams with point loads, uniformly distributed load, uniformly varying loads and couples – Relationship between shear force and bending moment.

**UNIT - III**

**THEORY OF SIMPLE BENDING:** Assumptions made in the theory of simple bending – Derivation of bending equation:  $M/I = f/y = E/R$  – Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I-Beam and Channel sections – Design of simple beam.

**SHEAR STRESS DISTRIBUTION:** Derivation of formula – Shear stress distribution in rectangular, triangular, circular, I and T sections.

#### UNIT- IV

**DEFLECTIONS OF BEAMS:** Bending into a circular arc – Slope - deflection and radius of Curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads - Uniformly distributed load, uniformly varying load.

**TORSION OF CIRCULAR SHAFTS AND SPRINGS:** Theory of pure torsion – Torsional theory applied to circular shafts – Power transmission - Close and open coiled helical springs under axial loads and axial twist – Carriage springs.

#### UNIT - V

**THIN CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter and volume of thin cylinders – Riveted boiler Shells - Thin spherical shells.

**THICK CYLINDERS:** Thick cylinders – Lamé's equation – Design of thick cylindrical shells – Compound cylinders – Shrink fit allowance – Initial difference of radii at the junction.

#### Text Books:

1. Strength of Materials (Mechanics of Solids), 6th Edition, Dr. R.K. Rajput, S.Chand Publishing, 2015.
2. A Textbook of Strength of Materials, 6th Edition, Dr. R. K. Bansal, Laxmi Publications, 2016.

#### References:

1. 1. Mechanics of Materials, Revised, 2016 Edition, Dr. B. C. Punmia, Dr. Ashok Kr. Jain, Dr. Arun Kumar Jain, Laxmi Publications, 2016.
2. Strength of Materials, 3rd Edition, R. Subramanian, Oxford University Press, 2010.
3. Strength of Materials, 24th Edition, R. S. Khurmi, S. Chand Publishing, 2015.
4. Strength of Materials, 11th Edition, Sadhu Singh, Khanna Publishers, 2013.

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**(18CE0104) INTRODUCTION TO FLUID MECHANICS**

**Course Objectives:**

- *To understand the basic concepts of Fluid properties and fluid statics.*
- *To understand the applications of fluid kinematics and dynamics.*
- *To understand the behavior of pipe flow and losses in pipe flow.*
- *To understand the concepts of flow measurements and boundary layer flows.*

**Course Outcomes:**

- *On completion of the course, the students will be able to:*
- *Determine the properties of fluid like pressure and their measurement.*
- *Apply continuity equation and energy equation in solving problems on flow through conduits.*
- *Compute the frictional loss in laminar and turbulent flows.*

**UNIT-I**

**FLUID PROPERTIES:** Dimensions and Units - Definition of a Fluid – Physical Properties of Fluids- Density, Specific Weight, Specific Volume, Specific Gravity, Compressibility, Vapor Pressure, Surface Tension and Capillarity and Viscosity

**FLUID STATICS:** Pascal's Law - Pressure Variation in a Static Fluid – Atmospheric, Gauge and Absolute Pressures - Measurement of Pressure – Piezometer – U-Tube and Inverted U-Tube Manometers - Hydrostatic Forces on Plane and Curved Surfaces - Center of Pressure - Meta Centric Height - Buoyancy Forces

**UNIT-II**

**FLUID KINEMATICS:** Fluid Kinematics- Classification of Fluid Flow- Steady and Unsteady Flow; Uniform and Non-Uniform Flow; Laminar and Turbulent Flow; Rotational and Irrotational Flow; Compressible and Incompressible Flow; Ideal and Real Fluid Flow; One, Two and Three-Dimensional Flows - Stream Line, Path Line, Streak Line and Stream Tube- Stream Function - Velocity Potential Function - One, Two and Three-Dimensional Continuity Equations in Cartesian Coordinates

**UNIT-III**

**FLUID DYNAMICS:** Fluid Dynamics- Surface and Body Forces - Equations of Motion - Euler's Equation – Bernoulli's Equation - Practical Applications of Bernoulli's Equation: Venturimeter, Orifice Meter and Pitot Tube - Momentum Principle; Forces Exerted by Fluid Flow on Pipe Bend - Vortex Flow – Free and Forced - Analysis of Free Liquid Jets

**UNIT-IV**

**FLOW THROUGH PIPES:** Loss of Head Through Pipes - Darcy-Wiesbach Equation - Minor Losses - Total Energy Equation - Hydraulic Gradient Line - Pipes in Series - Pipes in Parallel - Equivalent Pipes - Siphon - Analysis of Pipe Networks; Hardy Cross Method

**UNIT-V**

**LAMINAR FLOW:** Reynolds Experiment - Laminar Flow Through: Circular Pipes, Parallel Plates

**TURBULENT FLOW:** Definition - Causes of Turbulence - Velocity Distribution in Turbulent Flow in Pipes- Resistance of Smooth and Rough Pipes - Moody\_s Diagram

**Text Books:**

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines (A-4-Size), 20th Edition, Dr. P.N. Modi & Dr. S.M. Seth, Standard Book House
2. A Textbook of Fluid Mechanics and Hydraulic Machines, 9th Edition, Dr. R. K. Bansal, Laxmi Publications

**References:**

1. Fluid Mechanics, 9th Edition, Victor Streeter, E. Benjamin Wylie, K.W. Bedford, McGraw Hill Education
2. Fluid Mechanics and Machinery, 1st Edition, C.S.P. Ojha, P.N. Chandamouli & R. Berndtsson, Oxford University Press
3. Fluid Mechanics and Hydraulic Machines, 1st Edition, S. C. Gupta, Pearson India Education Services Pvt. Ltd.
4. Fluid Mechanics and Machinery, 1st Edition, Rama Durgaiyah D., New Age International

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**(18CE0105) SOLID MECHANICS LAB**

**Course Objectives:**

- *To learn the testing procedures of mild steel by tension, direct shear, torsion, hardness tests*
- *To learn the concept of modulus elasticity, and to know how to measure deflection of beams*
- *To learn the compressive strength of wood, concrete stone and bricks*
- *To learn the testing procedures for clay bricks and comparison with BIS standard of brick*

**Course Outcomes:**

*After completion of the course the student will be able to:*

- *estimate Young's modulus, tensional rigidity of mild steel rods*
- *know the hardness of mild steel and HYSO specimens*
- *analyze the strength of wood, concrete, stone and bricks*
- *assess the quality of wood, concrete, stone and bricks*

**LIST OF EXPERIMENTS:****\*Cycle 1:**

1. Bending test on simple support beam.
2. Compression test on wood or Brick.
3. Impact test on metal specimen (Izod and Charpy)
4. Compression test on helical spring.
5. Tension test on mild steel rod.

**\*Cycle 2:**

6. Torsion test on mild steel rod.
7. Impact test.
8. Shear test.
9. Continuous beam – deflection test.
10. Hardness test on metals (Rockwell and Brinell Hardness Number Tests).
11. Verification of Maxwell's Reciprocal theorem on beams.

**LIST OF EQUIPMENT:**

1. UTM for conducting tension test on rods.
2. Brinnell\_s / Rock well\_s hardness testing machine.
3. Compression testing machine.
4. Izod Impact machine.

5. Steel beam for flexure test.
6. Beam setup for Maxwell's theorem verification.
7. Torsion testing machine.



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**(18CE0106) FLUID MECHANICS LAB**

**Course Objectives:**

- To learn the concepts of Venturimeter & Orifice meter
- To learn the concepts of notch's
- To learn the basic concepts of turbines
- To learn the basics concepts of different types of pumps.

**Course Outcomes:**

Students undergoing this course are able to

- Calibrate Venturimeter & Orifice meter
- Calculate losses in flows
- Estimate the efficiency of different pumps.
- Study the performance of different turbines.

**LIST OF EXPERIMENTS:****\*Cycle 1:**

1. Verification of Bernoulli's equation.
2. Calibration of Coefficient of discharge for Venturimeter.
3. Calibration of Coefficient of discharge for Orifice meter.
4. Calibration of Friction factor. (major losses experiment)
5. Determination of loss of head due to sudden contraction. (minor losses experiment)
6. Calibration of Discharge over Notches (Rectangular/Triangular Notch.)
7. Determination of Coefficient of discharge for a small orifice / mouthpiece by a constant head method / variable head method.

**\*Cycle 2:**

8. Impact of jet on vanes.
9. Performance test on Pelton wheel turbine.
10. Performance test on Francis turbine.
11. Efficiency test on centrifugal pump.
12. Study on Hydraulic jump.
13. Performance test on Kaplan turbine

**\*Minimum Four experiments** must be conducted in the lab from each cycle

**LIST OF EQUIPMENT:**

1. Venturimeter Setup.
2. Orifice meter setup.
3. Friction factor and Minor losses test setup.

4. Impact of jets.
5. Pelton wheel and Francis turbines.
6. Centrifugal pumps.
7. Bernoulli's theorem setup.
8. Hydraulic jump test setup.
9. Kaplan turbine.
10. Rectangular and Triangular notch setups
11. Small orifice and mouth piece setup.

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**(18CE0107) COMPUTER AIDED BUILDING DRAWING**

**Course Objectives:**

- *A Student will able to know how to apply engineering drawing using computers.*
- *A student can understand about the scope of Auto CAD software.*
- *A student will know what is plan and how it should draw in Auto CAD software.*
- *To learn about applications and advantages of Auto CAD.*
- *To learn about the basic commands of Auto CAD.*

**Course Outcomes:**

- *The students will be able to draft the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings using computersoftware's.*
- *Draw the symbols and plan of a residential building using Auto CAD Software.*

**COURSE CONTENT:**

**1.0 Introduction to Computer Aided Drafting (CAD):**

- 1.1 About Auto CAD.
- 1.2 Computer graphics.
- 1.3 Definition of CAD.
- 1.4 Applications of CAD.
- 1.5 Advantages of CAD
- 1.6 Introduction to Auto CAD as drafting package.
- 1.7 Hardware requirements.

**2.0 Practice on Auto CAD:**

- 2.1 Graphical User Interface.
- 2.2 Study of drawing editor screen.
- 2.3 List out methods to access Auto CAD commands.
- 2.4 Practice of setting up of drawing area using utility commands & using setting commands.
- 2.5 Practice of File Management New, Open, Save, Save As, Export, Print, Publish, Drawing utilities, Units.
- 2.6 Practice of Geometrical commands line, Polyline, Circle, Erase, Oops, Snap, Arc, Ellipse, Polygon, Spline, Ellipse, Rectangle, and Donut.
- 2.7 Draw the given geometrical figures using draw commands
- 2.8 Practice of Modify Commands Move, Copy, Array, Break, Mirror, Offset, Scale, Rotate, Trim, Extend, Stretch, Solid, Fillet, Chamfer, Explode.

- 
- 2.9 Draw the given figures using draw & Modifying commands.
  - 2.10 Practice of Object Properties Color, Line type, Line weight.
  - 2.11 Practice of view commands Zoom, Pan.
  - 2.12 Practice of Drafting Settings.
  - 2.13 Practice of Hatch, Gradient commands.
  - 2.14 Practice of Block & insert commands.
- 3.0 Annotations:**
- 3.1 Practice of Text, Text Justifications, Multi Line text, Text style, Scale text, Spell.
  - 3.2 Practice on Leader, Multi Leader and Leader settings.
  - 3.3 Practices on Table.
  - 3.4 Practice on Dimensioning, Dim Linear, Dim radius, Dim Aligned, Dim Diameter, Dim center, Dim Angular, Dim Baseline, Dim continue, Dim ordinate, Dimensional settings.
  - 3.5 Utilities, Distance, Radius, Angle, Area, volume.
  - 3.6 Layer properties, make object Layer current, Match, previous, Isolate and Un Isolate, Freeze, Off, turn all layers on, thaw all layers, Lock, Unlock, change to current Layer, copy objects to new Layer, Layer Walk, isolate to current Viewport, Merge, Delete, Locked Layer fading.
  - 3.7 Practice Plans using Layers.
- 4.0 Geometric constructions:**
- 4.1 Practice on Point, DDP type, Divide, Measure.
  - 4.2 Divide a given line into desired number of equal parts internally.
  - 4.3 Draw tangent lines and arcs.
  - 4.4 Construct a hexagon from the given data.
  - 4.5 Construct ellipse, parabola, hyperbola, cycloid and helix.
  - 4.6 Using CAD software draws & prints the following drawings.
  - 4.7 Draw conventional signs as per I.S. Standards, Symbols used in civil engineering drawing.
  - 4.8 Draw the important joinery components of the building like elevation of fully paneled double leaf door, elevation of partly glazed and partly paneled window.
- 5.0 Residential building:**
- 5.1 Plan, Elevation, Section of single roomed building.
  - 5.2 Single storied bearing type residential building,
    - 5.2.1 One Bed Room House.
    - 5.2.2 Two Bed Room House.
  - 5.3 Single storied framed structure type residential building,
    - 5.3.1 One Bed Room House.
    - 5.3.2 Two Bed Room House.
-

- 5.4** Drawing to be submitted for approval to corporate or municipality showing required details in one sheet such as,
- 5.4.1 Plan-Showing Dimensions of all rooms.
  - 5.4.2 Section-Showing specifications and Typical Foundation Details.
  - 5.4.3 Elevation.
  - 5.4.4 Site Plan- Showing Boundaries of site and plinth Area, carparking, passages and location of septic tank.
  - 5.4.5 Key plan- Showing the location of building.
  - 5.4.6 Title block- Showing Signature of owner & Licensed surveyor\_s.

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**(18HS0804) ENVIRONMENTAL SCIENCE**

**Course Objectives:**

- Students have got an idea about the importance of pollution free air, water, soil and food.
- They know about global environmental problems like Acid Rains, Global Warming, Green House Effects, Ozone layer depletion.
- To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.
- To recognize major concepts in environmental studies and demonstrate in-depth understanding the environment.

**Course Outcomes:**

- Based on this course, the Engineering Student will be able to understand/evaluate/develop technologies on the basis of Ecological principles and environmental regulations along with Legislation, Laws and Policies which in turn help in sustainable development.
- Take preventive measures to reduce air, water, soil pollutions and contaminants in food.
- Effectively carry out waste disposal at individual level.
- Involve in preservation of natural resources.

**UNIT- I**

**INTRODUCTION:** Definition, Scope and Importance-Need for Public Awareness

**NATURAL RESOURCES:** Classification of resources-Forest resources: Use and over-exploitation, deforestation- Mining, dams and their effects on forests and tribal people – Water resources - Use and over utilization of surface and ground water- Floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources –Energy resources: Renewable and Non- Renewable sources of energy- Solar energy, Hydro electrical energy, Wind energy, Nuclear energy, etc.

**UNIT-II**

**ECOSYSTEMS:** Concept of an ecosystem– structural features of ecosystem- Producers, Consumers and Decomposers–Biogeochemical cycles- Ecological Succession-Food chains, food webs and ecological pyramids – Energy flow in the ecosystem-Types of ecosystems (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems.

**UNIT-III**

**BIODIVERSITY AND ITS CONSERVATION:** Introduction, Definition, genetic, species and ecosystem diversity, Bio-geographical classification of India, India as a Mega-diversity Nation, Hot spots of biodiversity, Value of biodiversity, threats to biodiversity, endemic, endangered and extinct species of India, In-Situ and Ex-situ conservation of biodiversity.

**UNIT-IV****ENVIRONMENTAL POLLUTION AND GLOBAL ENVIRONMENTAL ISSUES:**

Natural Disasters: Droughts, Floods, Cyclone, Landslides, Earthquake, Pollution episodes: Air pollution, Water pollution, Land pollution, Noise pollution, Automobile pollution and Nuclear pollution –Effects-Global warming, Acid Rain and Ozone layer depletion and controlling measures. Global Environmental Issues: Population Growth, Urbanizations, Land Management, Water and Waste Water Management. Climate change and impacts on human environment. Solid Waste Management: causes, effects and control measures of Municipal solid wastes – E-waste and management, Role of an individual in prevention of pollution – pollution case studies.

**UNIT-V****ENVIRONMENTAL LEGISLATION, LAWS, POLICIES FOR SUSTAINABLE**

**DEVELOPMENT:** Environmental Legislation, Environmental Protection act – Air Prevention and Control of Pollution act–Water Prevention and control of Pollution act–Wildlife protection act – Forest conservation act – Municipal Solid Waste management, International conventions/Protocols: Earth summit, Kyoto protocol and Montreal Protocol. From Unsustainable to sustainable development, Role of NGOs for Sustainable development, Concepts of Green belt development, Role of IT in Environment-Remote Sensing and GIS methods for Sustainable development.

**Field work-** visit to a local area to document environmental assets-river forest grassland/hill, mountain and polluted sites (urban/rural/industrial/Agriculture)- study simple ecosystems (pond/river/hill slopes)

**Text Books:**

1. A. Kaushik and C.P. Kaushik, Environmental Sciences, 5<sup>th</sup> edition, New age international publishers, 2015.
2. Text Book of Environmental Science and Technology by M. Anji Reddy, BS Publications.

**References:**

1. Anil Kumar and Arnab Kumar De, Environmental Studies, New Age International Publishers, New Delhi, 3<sup>rd</sup> Edition 2015.
2. R.K. Trivedi, —Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
3. Environmental Studies by Dr.K. Mukkanthi, S. Chand Publishers.

4. Rajagopalan.R, -Environmental Studies-From Crisis to Curell, Oxford University Press, 2005.
5. Erach Bharucha, 2010 -Text Book of Environmental Studiesll, University Grants Commission, University Press (India) Pvt.Ltd., Hyderabad

**E-learning resources:**

1. <http://nptel.ac.in/courses.php>
2. <http://jntuk-coerd.in/>



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**(18AG0702) PRINCIPLES OF SOIL SCIENCE**

**Course Objectives:**

- *To impart Knowledge on soils genesis, soil forming processes, structure, soil organic matter, soil chemical properties, etc. which give a comprehensive idea to students how to design farm implements in relation to soils and also how to treat the soils for soil health and structure improvements, soil conservation, irrigation and drainage applications.*

**Course Outcomes:**

*At the end of the course, students would be expected to:*

- *Get Fundamental knowledge of soil physical parameters.*
- *Know the procedures involved in soil survey, soil classification.*
- *Learn soil fertility and nutrients.*
- *Understand Concepts of Ion exchange in soils.*

**UNIT I**

**SOIL GENESIS AND CLASSIFICATION:** Soil as a natural body Pedagogical and edaphological concepts of soil, Soil genesis - Weathering- Physical, chemical and biological weathering - formation and composition of soil - classification of soils. Weathering of rocks – Igneous, Sedimentary and Metamorphic rocks minerals

**UNIT II**

**PROPERTIES OF SOIL:** Texture, structure and basic physical properties, retention and movement of soil water, permeability and ground water flow, gaseous exchange, soil strength and thermal properties of soil.

**SOIL TILLAGE:** Types of tillage – primary tillage, secondary tillage and their influence on soil physical properties and crop performance.

**UNIT - III**

Soil colloids – Properties, types and significance –origin of charge on colloids- Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange - significance. Soil reaction, Buffering capacity and EC

**UNIT - IV**

**ACID SOILS AND SALINE SOILS:** Acid soil formation-characteristics & nutrients availability-reclamation-Lime Requirement-Saline soils – sodic/alkali soils – characteristics-formation-and nutrient availability reclamation – gypsum requirement for reclamation of sodic/alkali soils

**UNIT - V**

**SOIL FERTILITY AND PRODUCTIVITY:** Definition & concepts-factors influencing availability of nutrients-deficiency symptoms of nutrients-Inorganic chemical fertilizers-classification-and their reactions in soils-Liquid fertilizers-and their solubility and compatibility-Beneficial soil microorganisms –Bio fertilizers and their use

**Text Books**

1. Biswas TD. and Mukherjee, S.K. "text Book of Soil Science" 'New Delhi,Tata Mgraw,1987
2. Nyle C. Brady, –*The Nature and Properties of Soil*ll, Macmillan Publishing Company, 10th Edition, New York, 2008.
3. Punmia, B.C., –*Soil Mechanics and Foundation* –Laxmi Publishers, New Delhi. 2007.

**References:**

1. Edward J. Plaster., –*Soil Sciencell*, Cengage Learning India Ltd, New Delhi, 2009.
2. Arora, K.R. –*Soil Mechanics and Foundation Engineering*ll, Standard Publishers and Distributors, New Delhi, 2007.

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**(18AG0703) HYDROLOGY, GROUND WATER & WELL ENGINEERING**

**Course Objectives:**

- *To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,*
- *To understand the techniques of development and management of groundwater.*
- *To know the basic principles and movement of ground water and properties of ground water flow.*

**Course Outcomes:**

*At the end of the course, students must be in a position to*

- *To understand the interaction among various processes in the hydrologic cycle*
- *To understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions*
- *To understand of the physical and mathematical concepts of groundwater hydrology. Some real-world example problems are also being incorporated to give an idea about the complexities and challenges encountered during the modeling and management of groundwater processes.*

**UNIT I**

**INTRODUCTION:** Hydrologic Cycle; Schematic Diagram; Explaining Different Components of Hydrologic Cycles

**METEOROLOGICAL PARAMETERS AND THEIR MEASUREMENTS:** Precipitation; Its Different forms Viz. Snow, Sleet, Rain, Hail Etc. and Their Measurement Technique; Evaporation, Estimation and Measurement Techniques; Evapotranspiration, Estimation and Measurement Techniques; Wind, Measurement Techniques for Velocity and Direction

**UNIT II**

**GROUNDWATER;** Characteristic of Ground Water, Global Distribution of Water, Role of Groundwater in Water Resources System and Their Management, Groundwater Column, Aquifers, Classification of Aquifers, Equilibrium Equations for Confined and Unconfined Aquifers, Aquiclude, Aquifuge, Specific Yield, Specific Retention, Divisions of Subsurface Water, Water Table, Storage Coefficient-Coefficient of Permeability and Transmissibility

**UNIT III**

**GROUNDWATER MANAGEMENT:** Dynamic Equilibrium in Natural Aquifers, Groundwater Budgets, Management Potential of Aquifers, Safe Yield, Seepage from Surface Water, Stream-Aquifer Interaction, Artificial Recharge

**GROUNDWATER QUALITY:** Ground Water Chemistry; Origin, Movement and Quality; Water Quality Standards; Health and Aesthetic Aspects of Water Quality; Saline Intrusion; Environmental Concern and Regulatory Requirements

#### UNIT IV

**GROUNDWATER TRANSPORT PROCESS:** Hydrodynamic Dispersion; Occurrence of Dispersion Phenomena, Coefficient of Dispersion; Aquifer Advection Dispersion Equation and Parameters; Initial and Boundary Conditions; Method of Solutions, Solution of Advection Dispersion Equation

**GROUNDWATER CONSERVATION:** Artificial Recharge Techniques; Remediation of Saline Intrusion; Ground Water Management Studies; Protection Zone Delineation, Contamination Source Inventory, Remediation Schemes; Ground Water Pollution and Legislation

#### UNIT V

**WELL HYDRAULICS;** Objectives of Groundwater Hydraulics; Darcy's Law; Groundwater Equation; Steady State Flow; Dupuit Forchheimer Assumption; Unsteady State Flow; Theis Method; Jacob Method -Slug Tests; Image Well Theory; Partial Penetrations of Wells

#### Text Books:

1. *A Textbook of Hydrology*, Dr. P. Jaya Rami Reddy, University Science Press.
2. *Hydraulics of Groundwater*, Bear J., McGraw-Hill International, 1979.
3. *Ground Water Hydrology*, Todd D.K., John Wiley and Sons, 2000.
4. *Groundwater and Wells*, Driscoll, F., St. Paul, Minnesota, II Ed., 1986.
5. *Ground Water Hydrology*, Raghunath H.M., Wiley Eastern Ltd., Second reprint, 2000.

#### References Books:

1. *Engineering Hydrology*, Subramanya, K., Tata McGraw Hill. Second Edition, 1987
2. *Groundwater Systems Planning and Management*, Willis, R. and W.W.G. Yeh, Prentice-Hall, 1987.
3. *Groundwater Resources Evaluation*, C. Walton, McGraw Hill, 1970.

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**(18CE0109) SURVEYING & GEO MATICS**

**Course Objectives:**

- *To describe the function of surveying in civil engineering construction*
- *To train the students on the basic principles of surveying for the measurement of distances and areas*
- *To measure bearing of a line with prismatic compass and horizontal angles between the lines and vertical angles of elevated or depressed objects by transit theodolite*
- *Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings.*
- *To apply for horizontal and vertical distance computation by tachometry survey*
- *To set out the different types of curves in the field*

**Course Outcomes:**

*The course will enable the students to:*

- *Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities*
- *Translate the knowledge gained for the implementation of civil infrastructure facilities.*
- *To be in a position to apply the basic principle of surveying and usage of surveying instruments in all civil engineering activities, including the construction of buildings, bridges, roads and high ways, pipe lines, dams, ports and harbors*
- *To be an expert of demarcation of ownership and / or delimitation of land, property, etc., through surveying process*
- *Surveying techniques to collect data for planning, designing and execution, able to employ green field*
- *Use total station and able to assess the electromagnetic distances*

**UNIT-I**

**PRINCIPLES OF SURVEYING:** Surveying – Definition; Primary Divisions, Classification- Principles of Surveying - Scales used for Maps and Plans - Duties of a Surveyor - Errors: Accuracy and Precision - Sources and Types of Errors.

**ANGLES, AZIMUTHS AND BEARINGS:** Units of Angle Measurement - Meridians, Azimuths Bearings - Magnetic Declination, Local Attraction and Corrections to Angles and Bearing of Lines.

**TYPES OF SURVEYING:** Introduction to Chain, Compass and Plane Table Survey.

**UNIT-II**

**LEVELLING:** Introduction - Basic definitions - Methods of Leveling - Leveling Instruments: Dumpy Level, Leveling Staff - Temporary Adjustments of Dumpy Level - Theory of Simple and Differential Leveling - Level Field Book - Classification of Direct Leveling Methods – Reciprocal Leveling - Profile Leveling - Cross Sectioning - Curvature and Refraction - Difficulties in Leveling - Errors in Leveling - Degree of Precision.

**CONTOURING:** Introduction - Contour Interval - Characteristics of Contours - Methods of Locating Contours - Direct and Indirect Methods - Interpolation and Sketching of Contours - Contour Gradient- Uses of Contour Maps.

**UNIT-III**

**THEODOLITE:** Vernier Theodolite: Basic Definitions - Fundamental Lines and Desired Relations - Temporary Adjustments - Measurement of a Horizontal Angle - Repetition and Reiteration Methods of Horizontal Angle Measurement - Measurement of Vertical Angle - Sources of Errors in Theodolite Survey – Traversing - Omitted Measurements - Closing Error -Determination of the Level of the Top of an Object, When its base is accessible and inaccessible- Determination of the Height of the Object When the Two Instrument Stations are not in the Same Vertical Plane.

**TACHEOMETRIC SURVEYING:** Definitions - Advantages of Tachometric Surveying - Basic Systems of Tachometric Measurement - Determination of Constants K and C – Inclined Sight with Staff Vertical - Inclined Sight with Staff Normal to the Line of Sight - Movable Hair Method – Tangential Method.

**UNIT-IV**

**CURVES:** Simple Curves – Definitions and Notations - Designation of a Curve - Elements of Simple Curves - Methods of Setting Simple Curves: Rankine\_s method, Two Theodolite Method- Compound curves – Elements of Compound Curve - Reverse Curve – Elements of Reverse Curve - Relationship between Various Elements.

**UNIT-V**

**ELECTRONIC DISTANCE MEASUREMENTS:** Introduction – Basic Concepts- Electromagnetic Waves - Basic Definitions - Phase of the Wave, Units, and Types of waves - Distance from Measurement of Transit Time - Computing the Distance from the Phase Differences - EDM instruments - Electronic Theodolite - Total Station: Models, Fundamental Measurements, Recording, Traversing, and Data Retrieval.

**Text Books:**

1. Surveying Vol-I, 16th Edition, Punmia B. C, Laxmi Publications.
2. Surveying Vol-II & III, 15th Edition, Punmia B.C, Laxmi Publications.
3. Surveying and Leveling, 2nd Edition, Basak N.N, Tata McGraw HillPublishing Company Ltd.

**References:**

1. Surveying and levelling part, I & II, 23rd Edition, Kanetkar.T.P. & S.V. Kulkarni, Puna Vidyarthi Girha, Prakashan
2. Fundamentals of Surveying and Levelling, 1st Edition, R. Subramanian, Oxford University Press, India
3. Surveying Vol-I, 10th Edition, Arora K. R, Rajsons Publications Pvt. Ltd.

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**(18ME0346) MECHANICAL ENGINEERING**

**Course Educational Objectives:**

- *To understand the basic fundamentals of mechanical engineering.*
- *To study the laws of thermodynamics, Energy conversion devices, R&AC.*
- *To understand the principles of welding, manufacturing processes, Power transmission devices.*
- *To Know about Engineering Materials.*

**Course Outcomes:**

*After completion of the course the student will be able to Understand the*

- *fundamentals of mechanical engineering.*
- *Acquire the concept of laws of thermodynamics, Energy conversion devices, R&AC.*
- *Knows the principles of welding, Manufacturing processes, Power transmission devices.*
- *Knows about Engineering Materials.*

**UNIT-I**

**THERMODYNAMICS:** Entropy-Ideal and real gases-Ideal and real gas equations-Analysis of Carnot cycle-Otto cycle-Diesel Cycle-Efficiency. Problems on cycles

**UNIT-II**

**ENERGY CONVERSION DEVICES:** Boilers-Steam Turbines-Gas Turbines-Working principle of 2stroke & 4stroke I.C. Engines (S.I & C.I)-Fuels-CRDI-MPFI-Hybrid Engines-Reciprocating Pumps-Centrifugal Pumps-Hydraulic turbines.

**UNIT-III**

**REFRIGERATION & AIR CONDITIONING:** Vapor compression refrigeration system-Heat pump-COP-Study of household refrigerator-Energy efficiency rating-Psychrometry - Psychrometric Processes-Window Air Conditioner-Split Air Conditioner-Refrigerants and their impact on environment.

**UNIT-IV**

**MATERIALS:** Engineering materials-classification-properties-Alloys & applications

**POWER TRANSMISSION DEVICES:** Belt and belt drives-Chain Drive-Rope Drive-Gears and gear trains-Friction clutch (Cone & Single plate)-Brakes-Types & Applications.



**UNIT-V**

**MANUFACTURING PROCESSES:** Casting-Sheet metal forming-Sheet metal cutting-Forging-Rolling-Extrusion-Metal joining processes-Soldering-Brazing-Welding-Powder metallurgy.

**General Manufacturing Machines (Basic elements, working principle & types of operations):** Lathe-Drilling-Shaper-Planer-Slotter-Milling-Grinding-Introduction to CNC machines.

**Text Books:**

1. *Engineering Thermodynamics*, P.K Nag, TMH Publishers, New Delhi, 5<sup>th</sup> Edition,2013.
2. *Refrigeration and Air conditioning*, C.P. Arora & Domkundwar, 3<sup>rd</sup> edition, McGraw Hill, New Delhi, 2010.
3. *Manufacturing Technology Foundry, Forming and Welding*, P.N. Rao, 4th Edition, Tata Mc Graw Hill, 2003

**Reference Books:**

1. *Principles of Refrigeration*, Roy J. Dossat, 4th edition, Pearson Education Asia, 2009.
2. *Fundamentals of Thermodynamics* – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd, 7<sup>th</sup> Edition, 2009.

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**(18ME0350) THERMODYNAMICS & HEAT ENGINES**

**Course Educational Objectives:**

- *To learn about work and heat interactions, and balance of energy between system and its surroundings*
- *By this subject student will get the awareness on basic thermodynamic principles,*
- *Skills to perform the analysis and design of thermodynamic systems,*
- *First law and second law of thermodynamics and its applications to a wide variety of systems,*
- *Understand the concept of various air standard cycles with the help of P-v and T-s Diagrams.*

**Course Outcomes:**

- *Students are advised to be acquainted with the terms related to steam, steam tables and Mollier chart.*
- *To apply the thermodynamic concepts into various thermal application like IC engines,*

**UNIT-I**

**Basic Concepts:** Definitions of system, boundary, surrounding control volume. Types of thermodynamic systems, Properties of system, definitions for properties like pressure, volume, temperature, enthalpy, internal energy, density, with their units. State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

**Work & Heat Transfer:** Work transfer, Types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

**UNIT-II**

**Zeroth Law of Thermodynamics:** Zeroth Law of Thermodynamics. Heat and temperature - concept of thermal equilibrium

**First Law of Thermodynamics:** First law of thermodynamics- simple problems on heat and work conversions in process and cycle. Non flow energy equation (NFEE), Steady flow energy equation (SFEE). Limitations of First law of thermodynamics.

**Second Law of Thermodynamics:** Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, availability and unavailability – concept of change in entropy – expression for change in entropy.

**UNIT-III**

**Law of Perfect Gas:** Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure, Specific Heats, Internal Energy and Enthalpy of Gas.

**Thermodynamic Processes on Gases:** Flow process, Non Flow Process, P –V and T-S diagrams on Isochoric process, Isobaric, Isothermal process, Isentropic process, Polytropic process. Problems on Non flow Processes.

**UNIT-IV**

**Thermodynamic Cycles:** Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Problems.

**Pure Substances:** P-V, P-T, T-S diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Enthalpy and Entropy of Steam using Steam Tables. Problems.

**UNIT-V**

**Steam Boilers:** Classifications of Boilers, Fire Tube boiler- Cochran boiler, Water Tube boiler- Babcock and Wilcox Boiler, [Modern High Pressure Boilers](#)- Lamont, Benson Boilers.

**Boiler Mountings and Accessories**—pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve— feed pump, economizer, super heater and air pre-heater. Problems on Performance of Boiler and Heat balance sheet.

**Text Books:**

1. *Engineering Thermodynamics*, P.K Nag, TMH Publishers, New Delhi, 5th Edition, 2013.
2. *Thermodynamics: An Engineering Approach* - Cengel and Boles, McGraw Hill Company

**Reference Books:**

1. *Engineering Thermodynamics* by P. Chattopadhyam, Oxford, 1<sup>st</sup> Revised, 2011.
2. *Fundamentals of Thermodynamics* – Sonntag, Borgnakke and van wylen, John Wiley & sons(ASIA) Pte Ltd, 7<sup>th</sup> Edition, 2009.
3. *Thermodynamics – An Engineering Approach* – Yunus Cengel & Boles, TMH, 7<sup>th</sup> Edition 2011.
4. *Thermodynamics* – J.P. Holman, Mc Graw Hill, 2<sup>nd</sup> Edition company New York 1975.
5. *An introduction to Thermodynamics*, YVC Rao, Universities press, 2009 Revised Edition,
6. *Engineering Thermodynamics* – J.B. Jones & R.E. Dugan, PHI, 1<sup>st</sup> Edition, 2009.

**NOTE:** Steam tables, Mollier Diagrams should be supplied

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**(18AG0704) PRINCIPLES OF SOIL SCIENCE LAB**

**Course Objectives:**

- *To know the classification of soils based on presence of different minerals.*
- *To import knowledge on soil genesis, soil colloids and ion exchange in soils.*

**Course Outcomes:**

*After completion of the course the student will be able to:*

- *Determine the different types chemicals and minerals in soils*
- *Know the fertilizers and classifications and their reactions in soils.*
- *Determine the water quality parameters*

**List of Experiments:**

1. Identification of rocks and minerals;
2. Examination of soil profile in the field;
3. Determination of organic carbon of soil;
4. Determination of Nitrogen,
5. Determination of Phosphorus and Potassium;
6. Identification of nutrient deficiency symptoms of crops in the field;
7. Determination of gypsum requirement of sodic soils;
8. Determination of water quality parameters
9. Determination of chlorides in irrigation water
10. Determination of sodium and potassium content in irrigation water and computation of Quality class, RSC and SAR irrigation water

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**(18CE0113) SURVEYING LAB – I**

**Course Objectives:**

- *To train the students in plotting of land by chain and tape plan table surveys*
- *To train the students in determine distance between two inaccessible points by prismatic compass and plane table and theodolite methods*
- *To train the students in plotting of contour maps by conducting leveling survey and total station and tachometric methods*

**Course Outcomes:**

*After completion of the course the student will be able to:*

- *Gain knowledge and expertise in operation of various survey instruments for computation of area of a land.*
- *Successfully carry out survey work in all civil Engineering projects, including the construction of buildings, roads and highways, rail track laying with curves, pipe lines, dams, ports and harbor as well as delimitation of land and property, etc.*

**LIST OF EXPERIMENTS:****\*Cycle 1:**

1. Survey of an area by chain survey (Closed traverse) & Plotting.
2. Chaining across obstacles.
3. Determination of distance between two inaccessible points with compass.
4. Surveying of a given area by prismatic compass (Closed traverse) and plotting after adjustment.
5. Radiation method, intersection methods by plane Table survey.

**\*Cycle 2:**

6. Two point and three-point problems in plane table survey.
7. Traversing by plane table survey.
8. Compound leveling (differential leveling).
9. An exercise of L.S. and C.S. and plotting.
10. Contour survey of reservoir.
11. Contour survey of a highway.

**LIST OF EQUIPMENT:**

1. Chains, tapes, ranging rods, cross staff, arrows.
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses.
4. Leveling instruments and leveling staves.

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**(18HS0817) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**

**Course objective**

*The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.*

**Course Outcome:** Ability to understand, connect up and explain basics of Indian traditional Knowledge in modern scientific perspective.

**Course Contents**

1. Basic structure of Indian Knowledge System: Astadash Vidya- 4 ved
2. Upaved (Ayurved, Dhanurved, Gandharva Ved & Sthapthya Adi.,)
3. Vedanga (Shisha, Kalppa, Nirukha, VYkaran, Jyothish & Chand)
4. Upanga (Dharma Shastra, Meemamsa, Purana & TharkaShastra)
5. Modern Science and Indian Knowledge System
6. Yoga and Holistic Health care
7. Case studies
8. Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain & Boudh
9. Indian Linguistic Tradition – (Phonology, morphology, syntax and semantics)
10. Indian Artistic Tradition - Chitra kala, Moorthi kala, Vasthu kala, Sthapthya, Sangeetha, Nruthya Yevam Sahithya
11. Case studies

**References:**

1. V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya
2. Vidya Bhavan, Mumbai. 5th Edition, 2014
3. Swami Jitatmanand, *modern physics and Vedant*, Bharatiya Vidya Bhavan
4. Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan
5. Fritzo Capra, *Tao of Physics*
6. Fritzo Capra, *The Wave of life*
7. VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay

8. Foundation, Velliarnad, Arnakulam *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
9. GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
10. RN Jha, *Science of Consciousness Psychotherapy and Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
11. P B Sharma (English translation), *Shodashang Hridayam* V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
12. S.C. Chatterjee & D.M. Datta, *An Introduction to Indian Philosophy*, University of Calcutta, 1984
13. K.S. Subrahmanialyer, *Vakyapadiya of Bhartrihari, (Brahma Kanda)*, Decca College Pune 1965
14. *Panini Shiksha*, Motilal Banarasidas V.N. Jha, *Language, Thought and Reality*, Vasudevasharan AGRAWAL Kala yevam Samskruthi, Shithya Bhavan Elahabad, 1952
15. Pramod Chandra, *India Arts*, Howard Univ. Press, 1983
16. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987
17. R. Nagaswamy, *Foundations of Indian Art*, Tamil Arts Academy, 2002

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**(18ME0310) THEORY OF MACHINES**  
(Common to MECH & AGE)

**Course Objectives**

*Students undergoing this course can*

1. Learn the principle of gyroscopic effect, construction and purpose of turning moment diagram.
2. Gain knowledge on working and uses of clutch and Dynamometer.
3. Familiarize with the working principle and application of Governor's.
4. Understand the concept of dynamic balancing in different types of engines.
5. Know the concept of free and forced vibration and their analysis.

**Course Outcomes**

*Students undergoing this course can*

1. Explain the Effect of gyroscopic couple, its reactions and also design flywheel for machinery.
2. Find the uses of clutch and modify its application.
3. Design Brakes according to applications and need.
4. Design a gyroscope in an optimized size with maximum effort.
5. Interpret how to balance an engine to reduce vibration and noise.
6. Identify the cause of vibration and calculate it's magnitude to reduce it.

**UNIT -I**

**Precession-** Gyroscopes, effect of precession motion on the stability of moving vehicles- motor car, motor cycle, aero planes and ships.

**Turning Moment Diagrams and Fly Wheels:** Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - Coefficient of Fluctuation of energy, Coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching Machines.

**UNIT-II**

**Clutches** - Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch

**Brakes and Dynamometers** - Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types-Prony brake, Rope brake,



Epicyclic-train & torsion dynamometers- General description and methods of operation.

**UNIT-III**

**Governors** - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

**UNIT-IV**

**Balancing** - Balancing of rotating masses - single and multiple – single and different planes  
Balancing of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses.  
Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in-line and radial engines for primary and secondary balancing.

**UNIT-V**

**Mechanical Vibrations** - Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method,. Torsional vibrations - two and three rotor systems.

**TEXT BOOKS**

1. R.S. Khurmi, Theory of Machines, Khanna Publishers, 2003.
2. S. S. Ratan, Theory of Machines, Tata McGraw Hill, 2<sup>nd</sup> Edition, 2005
3. Thomas Bevan, Theory of Machines, CBS Publishers, 3<sup>rd</sup> Edition, 1984

**REFERENCES**

1. Ghosh A. and Mallick A.K, Theory of Mechanisms and Machines, Affiliated East-West Press, 2<sup>nd</sup> Edition, 1988.
2. John Uicker, Gordon Pennock, Joseph Shigley, Theory of Machines and Mechanisms, Oxford University Press; 4<sup>th</sup> edition, 2010
3. J.S Rao. & R.V Dukkupati, Mechanism and Machine Theory, Newagepublishers, 2<sup>nd</sup> edition 1992

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III B. TECH - I SEM. (AG)

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**(18CE0154) SOIL MECHANICS**

**Course Objectives**

*The objectives of this course*

1. *To explain how three phase system is used in soil and how are soil properties estimated using three phase system, carry out soil classification*
2. *To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated*
3. *Ability to apply the principle of shear strength and settlement analysis for foundation system*
4. *To explain mechanism of compaction and its parameters*

**Course Outcomes**

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

1. **Describe** volumetric ratios, weight/mass relationships, index properties of soils, **establish** interrelationships and **classify** soils.
2. **State** Darcy's Law, **define** permeability, effective and **determine** the effective stress for different soil profiles
3. **Derive** equation for vertical stress for different load based Boussinesq's equation, calculate the vertical stress using Newmark's charts and Boussinesq's equation
4. **Explain** the phenomenon of compaction, factor affecting compaction, laboratory test to determine the compaction and field methods of compaction
5. **Derive** Terzaghi's equation for one dimensional consolidation and **estimate** consolidation settlements for various soils under various drainage conditions
6. **Learn** Mohr-Coulomb's theory of shear strength of soil and **conduct** various shear strength tests under different drainage conditions

**UNIT – I**

**Introduction of Soil Mechanics:** History of development of Soil Mechanics - Field of Soil Mechanics- Soil formation – Soil structure and clay mineralogy –Relative density – Phase diagram of soils – Mass - Volume relationships-Weight-Volume relationships– Interrelationships – Relative density  
**Index Properties of Soils:** Moisture content- Specific gravity- Insitu density- Grain size analysis – Sieve and hydrometer methods- Consistency limits – Texture of soils - I.S. classification.

**UNIT II**

**Permeability of Soil:** Soil permeability - Capillary rise – Adsorbed water – Flow of water through soils- Darcy's law - Constant head permeability test-Falling head permeability test-Factors affecting permeability -Permeability of layered soils

**Effective Stress:** Principle of effective stress- Total, Neutral and Effective stresses –Quick sand condition – Seepage through soils – Flow Net for Two-dimensional flow: Characteristics and uses

**UNIT – III**

**Stress Distribution in Soils:** Boussinesq's equation for point load - Line load – Strip load – Rectangle load – Circular load and areas of different shapes -Westergaard's equation- Pressure bulbs– Newmark's Influence chart

**Compaction:** Compaction phenomenon - Standard proctor test and Modified proctor test- - Field compaction method and control - Factors affecting compaction - Effects of compaction on soil properties

**UNIT – IV**

**Consolidation:** Types of compressibility – Immediate settlement, Primary consolidation and Secondary consolidation - Stress history of clay;  $e$  Vs  $P$  and  $e$  Vs  $\log(P)$  Curves – Normally consolidated soil, Over consolidated soil and Under consolidated soil – Pre-consolidation pressure and its determination – Terzaghi's one-dimensional consolidation theory – Coefficient of consolidation: Square root time and Logarithm of time fitting methods

**UNIT – V**

**Shear Strength:** Stress at a point- Mohr's circle of stress- Mohr's-Coulomb failure theory- Measurement of shear strength, Direct shear test, Tri-axial compression test- Unconfined compression test, Vane shear test: Problems on shear strength - Shear characteristics of Cohesive soils and Cohesion less soils -Strength envelopes- Shear strength of sands – Dilatancy – Critical void ratio – Liquefaction- Shear strength of clays

**TEXT BOOKS:**

1. C. Venkataramiah, *Geotechnical Engineering*, New age International Pvt. Ltd, 6<sup>th</sup> edition 2018
2. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, Delhi, 7<sup>th</sup> edition, 2019

**REFERENCES:**

1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain , *Soil Mechanics and Foundation*, Laxmi, publications Pvt. Ltd., New Delhi, 2017
2. V.N.S. Murthy, *Soil Mechanics and Foundation Engineering*, CBS Publishers and Distributor's, 2016
3. Manoj Dutta & Gulati S.K, *Geotechnical Engineering by*, Tata McGraw-Hill Publishers New Delhi, 2010
4. Gopal Rajan and A.S.R. Rao, *Basic and Applied Soil Mechanics*, New Age Publications, 2<sup>nd</sup> revised edition, 2014.

III B. TECH - I SEM. (AG)

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**(18ME0335) REFRIGERATION & AIR CONDITIONING****(Common to MECH & AGE)****Course Objectives***The student will be able to*

1. Understand the basic principle of refrigeration and air conditioning
2. Study various refrigeration cycles and evaluate performance using Mollier charts or refrigerant property tables.
3. Learn about the Vapour absorption system and Steam jet refrigeration
4. Know the Psychrometric Properties and Processes
5. Familiarize with Air Conditioning Systems and Distribution of Air

**Course Outcomes:***Upon completion of the course the student will*

1. Summarize the basic concepts of refrigeration and air conditioning systems
2. Explain Various refrigeration cycles, their analysis and applications. Different refrigerants properties, applications and their environmental issues.
3. Describe air conditioning processes on psychrometric charts
4. Evaluate heating and cooling load requirements for various applications.
5. Apply scientific and engineering principles to analyze and design engineering systems that relate to refrigeration and air conditioning

**UNIT- I**

**Introduction** - Introduction to Refrigeration - Unit of Refrigeration and C.O.P.–Ideal cycles, Necessity & Applications of Refrigeration, Types of Air Refrigeration Systems, Problems.

**UNIT-II**

**Vapour Compression Refrigeration System**–Working principle and essential components of VCR system. Vapor compression cycle: P-h and T-S diagrams - deviations from theoretical cycle – sub cooling and super heating, problems

**Refrigerants-** Desired properties- Environmental issues- Refrigerant Mixtures- Zeotropic & Azeotropic mixtures - Cascade systems & Applications.

**UNIT -III**

**Other Refrigeration Systems:** Vapour absorption system–Electrolux, Two fluid and Three fluid System, Steam jet refrigeration- Thermoelectric refrigeration- Vortex tube refrigeration systems.

**UNIT -IV**

**Introduction to Air Conditioning** -Psychrometric Properties and Processes-Psychrometric chart & Construction, Need for ventilation and Infiltration – concepts of RSHF, GSHF, ERSHF and ADP, Air conditioning loads, Problems.

**UNIT -V**

**Air Conditioning Systems and Distribution of Air**–Human comfort, effective temperature & Comfort chart, classifications of Air Conditioning Systems- summer, winter & all year round air conditioning, problems, classification of Ducts, Methods of Duct Design – Grills and Registers.

**TEXT BOOKS**

1. *Refrigeration and Air conditioning*, C.P. Arora & Domkundwar, McGraw Hill, 3<sup>rd</sup> edition, 2010.
2. *Refrigeration and Air conditioning*, R.S. Khurmi., S. Chand Publishers, .5<sup>th</sup> edition, 2006

**REFERENCES**

1. *Principles of Refrigeration*, Roy J. Dossat, Pearson Education Asia, 4th edition, 2009.
2. *Refrigeration and Air Conditioning*, Stoecker, W.F. and Jones J. W., McGraw Hill, 2<sup>nd</sup> edition, 1982.
3. Ashrae Handbook: Refrigeration, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Har/Cdr edition, 2010
4. *Air conditioning engineering*, Jones W.P., Elsevier Butterworth-Heinemann, 5<sup>th</sup> edition, 2001.

III B. TECH - I SEM. (AG)

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**(18AG0705) AGRICULTURAL PROCESS ENGINEERING****Course Objectives:**

1. To train the students on unit operations of agricultural process engineering
2. To acquaint with the engineering properties of agricultural materials
3. Enable the students to understand the concepts of cleaning of cereals, size reduction and rice milling

**Course Outcomes:**

Studies will be familiar with

1. Be proficient in the scope of the process engineering and the use of processing machinery
2. Understand the physical properties, rheological properties and frictional properties of agricultural materials
3. Summarising the thermal properties, electrical properties and the terms related to the machine design aspects
4. Some of the basic concepts related to cleaning and size reduction equipments
5. To acquaint the students with the milling of rice, parboiling technologies and milling of pulses and oil seeds
6. Understand the filtration equipments

**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, Friction – basic

concepts, effect of load sliding velocity, Rheological models - Kelvin and Maxwell models, electrical equivalence of mechanical models, Rheological equations – Generalized Maxwell and Kelvin models

**UNIT-II**

**Frictional Properties:** Friction in agricultural materials – measurement – rolling resistance – angle of internal friction and angle of repose, 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- III**

**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, Cleaning and separation equipment's.

**UNIT- IV**

**Scope and importance of crop processing:** Principles and methods of food processing- cleaning and grading of cereals, 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, 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



**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

**TEXT BOOKS:**

1. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
2. Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.

**REFERENCES:**

1. Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott P 2017 McGraw-Hill Book Co., Boston.
2. Transport Processes and separation Process Principle, Geankopolis C J 2015 Prentice-Hall Inc., New Jersey.
3. Unit operations in Food processing, Earle R L 1983. Pergamon Press, New York

**(18AG0706) FARM MACHINERY AND EQUIPMENT-I****Course Objectives:**

1. Students to recognize the importance of tillage operation in agricultural production.
2. To explain the role of earth moving machinery during land preparation process.
3. To identify the various types of seeding, inter cultivation tools and plant protection equipment used in agricultural production.

**Course Outcomes:**

Studies will be familiar with

1. What is the importance of the Farm Mechanization in agriculture?
2. Classify the types of tillage and tillage tools.
3. Determine the various forces acting on tillage tools
4. Distinguish the various methods involved in sowing, inter cultivation and plant protection operation.
5. Categorize the various types of sowing, inter cultivation and plant protection equipment.
6. Utilize the transplanting concepts in agriculture field.

**UNIT – I**

**Introduction to Farm Mechanization** - Farm mechanization – Objectives, scope, status, advantages and bottlenecks – importance and challenges – constraints. Sources of farm power, merit and demerits 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.

**UNIT –II**

**Tillage**- Classification and types of tillage, concept of tillage i.e. primary and secondary tillage. Primary tillage implements - Mould board plough and its parts, Disc plough, and other ploughs and subsoiler. Secondary tillage equipment's- Disc harrows, spike tooth harrow, blade harrow and rotavator & Cultivators. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipment's, Draft and unit draft related problems. Field capacities of different implements and their economics. Problems on field capacities and cost of cultivation.

**UNIT – III**

**Earth Moving Equipment** - Terminology, Earth moving equipment's, construction and their working principles, Earth moving equipment- shovels, bulldozers, **scraper**, trenchers and elevators.

**UNIT – IV**

**Seeding Method** - Sowing – Methods, Seed drill, Different types of seed metering mechanism, different types of furrow openers. Calibration of Seed Cum Fertilizer Drills. Adjustment of Seed Cum Fertilizer Drills. Planter and their types. Transplanting- different types of Transplanting machinery and their working principle, adjustments in transplanting equipment. Fertilizer application equipment – Fertilizer metering mechanism, calibration of fertilizer equipment. Inter cultivation equipment's- Hoes, dry land weeder and wet land weeder.

**UNIT – V:**

**Plant Protection Equipment** -. Objectives and uses of plant protection equipment. Types of sprayers, types of nozzles and their uses and dusters. Sprayer's calibration and selection. Constructional features of different components of sprayers and dusters and their adjustments.

**TEXT BOOKS:**

1. Kepner R A, Bainer R and Barger E L, Principals of Farm Machinery CBS Publishers and Distributors, Delhi, 2016.
2. Jagadeshwar Sahay, Elements of Agricultural Engineering, Agro Book Agency, Patna, 2015.

**REFERENCES:**

1. Borshahov Mansurov Sergecv, Land Reclamation Machinery, Mir Publishers, Moscow, 1988.
2. Michael A. M and OJha T. P, Principals of Agricultural Engineering Vol.I, Jain Brothers, New Delhi, 2010.
3. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2011.

**(18CE0155) SOIL MECHANICS LAB****COURSE OBJECTIVES**

*The objectives of this course*

- 1. Find index properties such as specific gravity, field density, Atterberg's limits and sieve analysis on soils to classify soils*
- 2. Find the engineering properties such as permeability, maximum dry density and corresponding optimum moisture content, shear strength of soils*

**COURSE OUTCOMES (COs)**

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

- 1. Conduct tests on fine grained soils to determine Atterberg's limits*
- 2. Conduct fields test to find out field density of cohesive and cohesion less soils*
- 3. Perform sieve analysis and sedimentation analysis to classify the soil*
- 4. Conduct field tests on soil to estimate soil permeability*
- 5. Conduct compaction test and draw compaction curve to find out optimum moisture content and maximum dry density*
- 6. Conduct shear tests to predict shear strength of the soil*

**LIST OF EXPERIMENTS**

1. Specific gravity of soil solids (Density bottle)
2. Atterberg's limits (liquid limit and plastic limit)
3. Field density test (Core cutter and Sand replacement methods)
4. Particle size analysis (Dry Sieve analysis and Hydrometer analysis)
5. Permeability of soil (constant and variable head method)
6. Compaction test
7. Vane shear test
8. Consolidation test
9. Unconfined compression test
10. Direct shear test

*Any eight experiments may be conducted*

**TEXT BOOKS**

1. K.V.S. Appa Rao & V.C.S. Rao, *Soil Testing Lab Manual*, University Science Press, Laxmi Publications, 2016
2. S.Mittal and J.P. Shukla, *Soil Testing for Engineers*, Khanna Publishers, Sixth Edition

**(18AG0707) AGRICULTURAL PROCESS ENGINEERING LAB****Course Objectives:**

1. To train the students on unit operations of agricultural process engineering
2. To acquaint with the mixing equipments
3. Enable the students to understand the concepts of cleaning and size reduction

**Course Outcomes:**

1. Be proficient in the scope of the process engineering and the use of processing machinery
2. Understand the types of mixers
3. Summarizing the psychrometric properties
4. Some of the basic concepts related to size reduction equipments
5. To acquaint the students with the problems on distillation
6. Understand the cleaning equipments

**Practical:**

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

**TEXT BOOKS:**

1. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
2. Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.

**(18AG0708) FARM MACHINERY AND EQUIPMENT-I LAB*****Course Objectives:***

1. Illustrate the importance of tillage operation in agricultural production.
2. To explain the role of earth moving machinery during land preparation process.
3. To identify the various types of seeding, inter cultivation tools and plant protection equipment used in agricultural production

***Course Outcomes:***

*Studies will be familiar with*

1. List out the various types of sowing, inter cultivation and plant protection equipment.
2. Classify the types of sprayer and duster.
3. Determine the performance of MB plough, disc plough, disc harrow and cultivator
4. Compare the different types of seed drills.
5. Categorize the various types of sowing, inter cultivation and plant protection equipment.
6. Measure the nozzle discharge and field capacity of sprayer and duster.

**List of Experiments:**

1. Study the constructional details and performance testing of Mould board plough
2. Study the constructional details and performance testing of Disc plough
3. Study the constructional details of Disc harrows and cultivators.
4. Study the constructional details of rotavator
5. Maintenance and adjustments of primary and secondary tillage implements.
6. Numerical problems related to tillage implements – Field capacity, field efficiency and size of Tractor etc.
7. Study the constructional details of different types of seed drills.
8. Calibration and performance testing of seed cum fertilizer drill.
9. Numerical problems on seed cum fertilizer drills – calibration, cost of operation and field capacity etc.
10. Study the constructional details and the performance testing of inter cultivation implements.
11. Study of sprayers and measurement of nozzle discharge and field capacity.
12. Study of dusters and measurement of nozzle discharge and field capacity.

**TEXT BOOKS:**

1. Kepner R A, Bainer R and Barger E L, Principals of Farm Machinery CBS Publishers and Distributors, Delhi, 2016.
2. Jagadeshwar Sahay, Elements of Agricultural Engineering, Agro Book Agency, Patna, 2015.

**REFERENCES:**

1. Borshahov Mansurov Sergecv, Land Reclamation Machinery, Mir Publishers, Moscow, 1988.
2. Michael A. M and OJha T. P, Principals of Agricultural Engineering Vol.I, Jain Brothers, New Delhi, 2010.
3. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2011.

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**III B. TECH - II SEM (AG)**

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**(18HS0842) APTITUDE PRACTICES**

**COURSE OBJECTIVES**

The objectives of this course:

1. *To evaluate various real life situations by resorting to Analysis of key issues and factors.*
2. *To read between the lines and understand various language structures.*
3. *To demonstrate various principles involved in solving Mathematical problems and thereby reducing the time taken for performing job functions.*

**COURSE OUTCOMES**

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

1. *Develop the subtle way of approaching in the candidate.*
2. *Acquired the decision making with in no time.*
3. *Implement logical thinking during professional tenure.*
4. *Improve knowledge on problem solving.*
5. *Understand problems on coding and decoding.*
6. *Apply the knowledge on the concept of reasoning in real life.*

**UNIT – I**

Percentages, Partnership, Ratio and Proportion, Time and Distance, Time and Work.

**UNIT – II**

Clocks, Calendars, Blood relations, Profit and Loss, Simple Interest, Compound Interest.

**UNIT – III**

Permutations and Combinations, Probability.

**Menstruation:** Areas, Volumes of different solids, Problems on Areas, Volumes and Surface Areas, Cubes.

**UNIT – IV**

**Number and letter series:**

Difference series, Product series, Squares series, Cubes series, Alternate series, Combination series, miscellaneous series, Place values of letters.

**Number and Letter Analogies:**

Definition of Analogy, Problems on number analogy.



**Odd man out:**

Problems on number Odd man out, Problems on letter Odd man out, Problems on verbal Odd man out.

**UNIT – V**

Coding and decoding, Directions.

**Critical Reasoning:**

Problems on assumption, Problems on conclusions, Problems on inferences, Problems on strengthening and weakening of arguments, Problems on principle, Problems on paradox.

**TEXTBOOKS :**

1. Barrons GL, *Thorpe's verbal reasoning*, McGraw Hills, LSAT Materials, 2010.
2. Agarwal R S, *A modern approach to Logical reasoning*, S.Chand, 2017.

**REFERENCES:**

1. Agarwal R S, *Quantitative Aptitude*, S Chand, 2017.
2. BARRONS G L, *Quantitative Aptitude*, 2010.
3. Abhijit Guha, *Quantitative Aptitude, PHI Learning PVT. LTD, 2019.*
4. Tyra, *Magical Book on Quicker Maths*, BSC publishing company, 2018.

III B. TECH - II SEM (AG)

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**(18ME0320) HEAT & MASS TRANSFER**  
(Common to MECH & AGE)

**Course Objectives**

*Students undergoing this course are able to understand*

- 1. The mechanisms of basic modes of heat transfer and conduction*
- 2. Mechanisms of heat transfer under steady and transient conditions.*
- 3. The principles of Forced and free convection.*
- 4. The thermal analysis and sizing of heat exchangers.*
- 5. The basic concepts of Radiation and mass transfer.*

**Course Outcomes**

*Students undergoing this course are able to*

- 1. Explain the fundamental principles associated with heat transfer*
- 2. Evaluate multi-dimensional and transient thermal conduction problems*
- 3. Analyze forced convection, internal flows and free convection problems*
- 4. Design heat exchangers for various applications*
- 5. Explain the principles of radiation and mass transfer.*

**UNIT – I**

**Basic Concepts** – Modes of Heat Transfer – **Conduction** - Fourier Law of Conduction Heat transfer by convection and radiation - General Differential equation of Heat Conduction for Cartesian coordinates, cylindrical coordinates and spherical coordinates.

**UNIT – II**

**One Dimensional Steady State Heat Conduction**– Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems –Critical radius of insulation.

**Extended Surfaces**-Types of Fins, Effectiveness and Efficiency of Fins

**Transient Heat conduction** – Heat conduction in solids-Lumped Parameter Analysis Infinite, solids with finite, semi-infinite solids.

**UNIT – III**

**Convection** - Dimensionless numbers and their physical significance. Classifications of convection

**Forced Convection**- Laminar flow over a flat plate, Boundary layer definition and

characteristics - Empirical correlations for forced convection -External Flow – Flow over Plates - Cylinders Spheres and Bank of tubes

**Free Convection** – Empirical correlation of free convection, Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Horizontal cylinders and Spheres.

#### **UNIT – IV**

##### **Phase Change Heat Transfer and Heat Exchangers**

**Boiling** -Types General aspects, Boiling Regimes – Factors affecting nucleate boiling- Boiling correlations.

**Condensation** -Drop wise and film wise condensation -Laminar film condensation on a vertical plate, correlations in condensation.

**Heat Exchanger**-Types of Heat Exchangers- LMTD method - Overall Heat Transfer Coefficient – Fouling Factors – Heat Exchanger Effectiveness-NTU Method

#### **UNIT – V**

**Radiation** -Introduction, Surface emission properties - Absorptivity, Reflectivity and Transmissivity, Concept of a black body. Laws of Radiation – Stefan Boltzmann Law, Kirchoff's Law, Planck's Law, Wiens Displacement Law.

**Mass Transfer**- Introduction, Modes of Mass transfer - Fick's law – Mass Transfer coefficient – Convective Mass Transfer and its correlations.

#### **TEXT BOOKS**

3. R.K.Rajput, *Heat & Mass Transfer*, S.Chand publishers, 5<sup>th</sup> Revised Edition, 2012.
4. P.K. Nag, *Heat Transfer*, Tata Mc Graw Hill, 3<sup>rd</sup> Edition, 2011.
5. Yunus A. Cengel, *Heat Transfer A Practical Approach*, Tata Mc Graw Hill 5<sup>th</sup> Edition –2004.

#### **REFERENCES**

1. Kothandaraman, C. P, *Fundamentals of Heat and Mass Transfer*, New Age International (P) Ltd., 4<sup>th</sup>Edition, 1998.
2. Sachdeva R.C, *Fundamentals of Heat and Mass Transfer*, New Age International (P) Ltd., 4<sup>th</sup>Edition,2012.

**(18AG0709) IRRIGATION & DRAINAGE ENGINEERING****Course Objectives**

1. To understand the concept of micro-irrigation
2. To design the sprinkler and drip irrigation system
3. To understand the concept of planning and design of various methods of land drainage and its impact on environment

**Course Outcomes**

Studies will be familiar with

- 1) Basic terms related to the development of irrigation in India and AP and classification of different irrigation works
- 2) Basic terms related to soil and water conservation
- 3) Various terms related to soil loss estimation models
- 4) Understand the different types of micro irrigation and its design
- 5) Understand the maintenance of micro irrigation system
- 6) Understand the different types of land drainage and its importance

**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 ( $\Delta = (864B) / \text{Duty cm}$ ). 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

**UNIT –II:**

**Sprinkler and Drip Irrigation** – adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power Module for sprinkler irrigation system, performance evaluation of sprinkler irrigation system uniformity coefficient and pattern efficiency.

**UNIT – III**

**Maintenance of Micro Irrigation System** – clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and

their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.

**UNIT – IV**

**Water Logging** – causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state

**Surface Drainage**– Surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table; derivation of Hooghoudt's and Ernst's drain spacing equations.

**Sub-Surface Drainage System**– Design of subsurface drainage system; drainage materials, Drainage pipes, drain envelope; layout, construction and installation of drains. Drainage structures.

**Special Drainage Systems**- vertical drainage; bio-drainage; mole drains. Salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

**UNIT – V**

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

**TEXT BOOKS:**

1. Irrigation Theory and Practice —Michael, A.M. (2008). Vikas Publishing House, New Delhi..
2. Drainage Engineering - Luthin, J. N (2015). John Wiley & Sons, New York.
3. Drainage Principles and Applications Ritzema H. P. (1994). (2 ed.). ILRI Publication

**REFERENCES:**

1. Principles of Farm Irrigation system Design —John Wiley & Sons (1988), New York.
2. Majumdar, D. K. (2014). Irrigation Water Management Principles and Practice. Prentice-Hall of India, New Delhi.
3. Michael, A. M. and Ojha, T.P. (2013). Principles of Agricultural Engineering — (Vol. II).Jain brothers, New Delhi.
4. Murthy, C. S. (2002). Water Resources Engineering Principles and Practice —New Age International (P) Ltd. New Delhi.
5. Murthy, V. (2013). Land and Water Management — Kalyani Publishing, New Delhi.

**(18AG0710) FARM MACHINERY AND EQUIPMENT-II****Course objectives:**

1. Illustrate the basic principles of cutting mechanisms involved in harvesting machines
2. Classify the various types of harvesting machines.
3. Develop an ability to identify, formulate and solve problems related to various harvesting machines and threshers

**Course outcomes:**

Studies will be familiar with

1. Classify the crop harvesting machineries.
2. Explain about different types of mower.
3. Distinguish between reaper and combine harvester.
4. Demonstrate the performance of harvesting machineries and thresher.
5. Create an idea towards development of fruit harvesting machineries based on the problem faced during harvesting of fruits.
6. Carry out the testing of farm machines by using farm machines testing procedure

**UNIT – I**

**Harvesting** – Crop harvesting machinery, history of development, manual harvesting and its classification. Principles and types of cutting mechanisms – principle of cutting mechanism, , types - impact cutting & shear cutting.

**Mowers** – History and development, components of mower, conventional type of 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 assembly, alignment and registration of cutter bar.

**Windrowing** – Methods of windrowing, Self-propelled windrows. Reapers- Animal drawn reaper, Tractor mounted Vertical conveyer reaper, Reaper binders – Care and maintenance.

**UNIT –II**

**Forage Harvesting Equipment** - Field forage harvesters, types of field forage harvesters. Field chopper harvesters, forage wagons and self-propelled forage harvester

**Harvesters** – 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. Corn harvesting equipment- Types of corn pickers - Snappers, picker husker & picker sheller.

**UNIT – III**

**Root Crop Harvesting Equipment** – Groundnut harvester & potato harvesters and adjustments.

**Fruit Harvesters** - Principles of fruit harvesting tools and machines – Harvesting methods – manual harvesters – hold on and twist type – Horticultural tools and gadgets.

**UNIT – IV**

**Cotton Harvesting Equipment** – Cotton stripper, types of cotton strippers. Cotton pickers – types of pickers, drum type and chain belt spindle arrangements in cotton pickers. Sugar cane harvesters – self-propelled sugar cane harvester.

**UNIT – V**

**Threshing** – Principles of threshing, threshing methods, threshing by manual, threshing by animals, threshing by machines, Olpad threshers, Power thresher – types of power threshers. Components of power thresher. Cleaning unit- Aspirator, blower, winnower, winnowing fan, cylinder adjustment. Wheat thresher and groundnut thresher.

**Testing of farm machine**- Introduction, Standardization efforts, testing programme and Procedure, Type of testing systems, national testing, prototype testing, testing for quality marketing

**TEXT BOOKS:**

1. Kepner R.A., Bainer R and Barger E.L, Principals of Farm Machinery. CBS Publishers and Distributors, Delhi, 1987.
2. Ajith k Srivatsava, Carrol E. Goering, Roger P. Rohrbach, Engineering principles of Agricultural machines, ASAE Publishers, 1993.

**REFERENCES:**

1. Smith H.P, Farm Machinery and Equipment, Tata McGraw-Hills Publishing Co., Ltd., New Delhi, 1971.
2. Mehta M.L., Verma S.R. Misra S.K and Sharma V.K, Testing and Evaluation of Agricultural Machinery, Daya Publishing House, New Delhi.
3. Michael A. M and OJha T. P, Principals of Agricultural Engineering-Vol.I, Jain Brothers, New Delhi. —2010.

III B. TECH - II SEM (AG)

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## (18AG0718) AGRICULTURAL ENGINEERING STRUCTURES

## (PEC-I)

**Course Objectives:**

1. To enable the student to understand the principles and acquire the knowledge on various aspects in farmstead design and construction
2. Design and construction of farm structures like dairy barns, barn for poultry, compost pit, fodder silos, farm fencing, implement sheds
3. Grain storage structures and the design and construction of silos and farm roads, sewage system, rural living and development

**Course Outcomes:**

Studies will be familiar with

1. To acquaint the students with various aspects of agricultural structures such as farm stead and dairy barn
2. To acquaint the students with various aspects of farm roads and storage structures
3. Design and construction of farm fences and farm roads
4. Summarizing the grain storage structures, types of silos and the loads acting on it
5. Classifying the poultry houses, planning and requirements
6. Rural living and development, sewage system and design

**UNIT – I**

**Planning and layout of farmstead** - location – definition and arrangement, location of various buildings – Scope, importance and need for environmental control, Farm service buildings - site selection, planning farm service buildings, factors effecting planning of farmstead, Physiological reactions of livestock to solar radiation (dairy cattle, poultry, beef cattle and sheep), Influence of climate and thermoregulation - temperature, relative humidity, direct effect of temperature, direct effect of solar radiation, Environmental factors effecting design of farm residence or animal shelter - temperature, relative humidity, air purity, air movement, light, heat and moisture production



**UNIT – II**

**Livestock production facilities** - water and electricity, sanitary requirements, etc. BIS standards for dairy, piggery, poultry and other farm structures, Design, construction and cost estimation of farm structures - animal shelters, dairy barn, compost pit, fodder silo, Cost estimation of different farm buildings - method of building estimates - actual cost - detailed estimates of main items of work.

**Fencing** - design and construction of farm fences, planning of farm fences, Type of farm fences - wooden fencing, woven wire fencing, barbed wire fencing, plain wire fencing and electrical fencing, Cost estimation of farm fences - wooden fencing, woven wire fencing, barbed wire fencing, plain wire fencing and electrical fencing - cost estimation

**UNIT – III**

**Implement shed** - requirements of farm machinery and implement shed - requirements of farm work shop, Planning and construction of shed and pump houses - problems and layout, Threshing and drying yards - design and construction of drying and threshing floors.

**Barn for cows, buffalo** - planning and design of different barns, Types of dairy barns based on construction - housing systems - stable barns, free stalls and milking parlor barn layout.

**Poultry houses** – Classification - planning and requirements, environmental requirements, Modern poultry houses - deep litter housing, building of poultry houses

**UNIT – IV**

**Storage of grains** - causes of spoilage - water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins - requirements of good storage structures, Types of grain storage structures - Traditional storage structures and their improvements - construction of Bhukari, Morai, Kothari type storage structures, Improved grain storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Design consideration for grain storage godowns, Bag storage structures, Shallow and Deep bin. Calculation of pressure in bins, Silo - design and construction of silos in respect of farm uses - types of silos - pit silo, tower silo, trench silo, bunkers. Storage of seeds

**UNIT - V**

**Engineering for rural living and development.** Rural roads - design and construction of farm road - Construction cost of different roads, repair and maintenance, Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community, Site and orientation of building in regard to sanitation,

community sanitation system - Sewage system and its design, cost and maintenance, design of septic tank for small family, Estimation of domestic power requirement, source of power supply and electrification of rural housing

**TEXT BOOKS:**

1. Principles and Practices of Agricultural Structures and Environmental Control Pandey P H 2004. Kalyani publishers, Ludhiana.
2. Principal of Agricultural Engineering Vol. I Michael A M and Ojha T P 2004. Jain Brothers, New Delhi.

**REFERENCES:**

1. Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas publishing pvt. Ltd, Noida.
2. Jagdishwar Sahay. -Elements of Agricultural Engineering, Standard Publishers Distributors, 2010.
3. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA,2007.

**(18AG0719) DAIRY & FOOD ENGINEERING  
(PEC-I)**

**Course Objectives:**

1. Knowledge on milk and food processing unit operations offer strength to students
2. To handle pasteurization, sterilization, packaging, etc. of dairy products
3. Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

**Course Outcomes:**

1. Enable the students to understand the methods of food preservation and the dairy development
2. Developed the understanding of physic – chemical properties of milk
3. Summarizing the methods of pasteurization and its importance
4. To acquaint the students with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing and drying of milk
5. Understanding the design and layout of a dairy plant
6. Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

**UNIT-I**

**Deterioration in food product and their controls-** causes of food spoilage and classification of food with respect to spoilage and consumption. Principles of food preservation, effect pH and water content on growth of microorganisms. Physical, chemical and biological methods of food preservation. Effect of climate change on livestock.

**Dairy development in India and dairy technology-** Indian dairy industry products Concentrated whole milk products, – Composition of milk, physico-chemical properties of milk, water content, acidity, pH, developed acidity, natural acidity, total acidity, density, specific gravity, freezing point of milk colour of milk, flavor.

**Unit operations of various dairy and food processing systems-** introduction, sampling, pasteurization, sterilization, packaging, cleaning grading, evaporation, drying, filtration, clarification, distillation, crystallization, freezing.

**UNIT-II**

Principle and equipment related to receiving of milk, quality determination, cleaning and disinfection of milk cans and tankers. Process flow charts for product manufacture – Pasteurized milk, Pearson square method and mass balance method for making balances method for milk standardization.

**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 (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).

**Thermal processing** - Thermal death time curve, reaction kinetics of the heat treatment of milk and its use for the assessment of UHT treatment methods

**UNIT- III**

**Homogenization** – Emulsifying, types of emulsions, emulsifiers, application, mode of operation, effect on the product. Centrifugation and cream separation- working of disc centrifuge, working of cyclone separator.

**Preparation methods and equipment**- Manufacture of cheese, paneer, butter and ice cream.

**Filling and packaging** – Packaging of milk, cultured milk, cheese, butter, concentrated milk, products, dried milk products.

**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, plant utilities requirement – electricity, water and power requirement.

**UNIT-IV**

Principles of operation and equipment for thermal processing, canning, aseptic processing.

**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 calandria, 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).

#### **UNIT-V**

**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,

**Filtration** - ultra-filtration, processing variables, applications or ultra-filtration in milk processing, reverse osmosis, Membrane separation – Membrane separation methods.

Composition and proximate analysis of food products- Carbohydrates, protein, lipids, minerals, Vitamins, 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 Change undergone by food components during processing –Changes during heating, evaporation, drying, freezing, filtration and separation.

#### **TEXT BOOKS:**

1. Fundamentals of Food Engineering —Rao, D.G. 2010. PHI learning Pvt. Ltd. New Delhi.
2. Introduction to Food Engineering — Singh, R.P. & Heldman, D.R. 2001. Academic Press.

#### **REFERENCES:**

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

III B. TECH - II SEM (AG)

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**(18AG0720) SOLID WASTE & BY-PRODUCT UTILIZATION  
(PEC-I)**

**Course Objectives:**

1. To impart the knowledge on solid waste conversion technologies
2. To create awareness on solid waste utilization and management
3. To recommend the bio-energy development process by using biomass wastes.

**Course Outcomes:**

*Studies will be familiar with*

1. Decide more efficient waste management methodologies / technologies
2. Be proficient in execute the effective utilization and conversion of solid waste material into useful fuels
3. Distinguish the different biomass conversion technologies used for converting biomass into biofuel
4. Design of gasifier technology more effectively
5. Illustrate about working principle and constructional details of different types of biogas plant.
6. Develop an ability to recognize the different types of briquetting making machines

**UNIT I:**

**Introduction** - Solid waste management (SWM) – common sources of waste – Different types of waste – Waste management and minimization – Recovery of energy from SWM. Recycling – Recycling process – Waste Recycling management – Advantages and Disadvantages of Recycling of a product. Land fill – Composting – Incineration.

**UNIT II:**

**Bio – Energy-** Bioenergy – Biomass – Importance of biomass – Classification of biomass - Properties of biomass sources and characteristics of biomass. Biomass conversion technologies – principles of combustion, pyrolysis and gasification. Bio fuels-raw materials.

**UNIT III:**

**Gasifiers** – Operating parameters for the gasifiers – processing of biomass for gasification – chemistry of gasification. Gasifiers – types of gasifiers – producer gas and its utilization. Construction and working of principle of fixed bed down draft, updraft, cross draft and open core gasifiers and fluidized bed gasifiers.

**UNIT IV:**

**Biogas** – principle of biogas production – phases of anaerobic digestion – Advantages, disadvantages, utilization of biogas for cooking, lighting and running IC engines. Biogas production – materials used for biogas production – Factors affecting the biogas production – site selection for biogas plant – Filling a biogas plant digester for starting. Biogas plants – classification of biogas plants – Constructional details of biogas plant – KVIC and Janatha type biogas plants – Comparison between fixed dome and floating drum biogas plants. Constructional details of Deenabhandu biogas plant – Maintenance of biogas plants

**UNIT V:**

**Briquetting of biomass** – Briquetting machines – Types of briquetting machines – construction and working of briquetting machines – Screw type and piston crank type – uses – shredding machines. Biodiesel production – Principles – Processes for production of biodiesel from Jatropha and pongamia. Ethanol production from sugarcane and corn.

**TEXT BOOKS:**

1. Non-Conventional Sources of Energy Rai GD 2004. Khanna Publishers, New Delhi
2. Solid and Hazardous Waste Management. Rao M.N, and Razia Sultana. B.S. Publication, Hyderabad

**REFERENCES:**

1. Alternate sources of energy Rathore NS 2005. ICAR Publications, New Delhi
2. Energy Technology Non-conventional, Renewable and conventional. Rao S and Parulekar, B.B. Khanna publishers, New Delhi.
3. Sustainable Development through Renewable Energy Sources, Pratap Singh et. al. 2004, Yash Publications, Bikaner.

III B. TECH - II SEM (AG)

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**(18CE0127) ELEMENTS OF ROAD TRAFFIC SAFETY****(OE-I)****Course Objectives**

1. To understand the accident statistics globally and in India specifically, its causes and measures to overcome the situation.
2. The traffic regulation, parking problems, understanding of road signs, signals and marking are also taught; so that the student is well informed about all safety measures that a traffic engineer need to understand.
3. To understand the various aspects of street lighting.

**Course Outcomes**

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

1. Identify the causes for road accidents and can implement measures to prevent road accidents
2. Describe traffic regulations and implement parking methods
3. Classify different traffic signal and can design traffic signal system
4. List and illustrate various traffic signs
5. List and discuss various road markings
6. Discuss importance of street lighting and classify various street lighting system

**UNIT – I**

**Road Accidents – Causes & Prevention:** Road Accidents & Traffic Engineering – Accident Situation in India – International Comparison of Road Accidents – Road & its Effects on Accidents – The Vehicle – The Driven – Skidding – Speed in Relation of Safety – Weather & its Effects on Accidents – Pedestrian Safety -Cyclists – Motor Cycle & Scooter Rider – Parking & Its Influence on Accident – Legislation, Enforcement, Education & Propaganda – Cost of Road Accidents.

**UNIT – II**

**Regulations of Traffic:** Basic Principals of Regulation – Regulation of Speed – Regulation of Vehicles – Regulations Concerning the Driver – Regulations Concerning Traffic – Parking Regulations – Enforcement of Regulations.

**Parking:** Traffic & Parking Problems – Ill-Effects of Parking – Zoning & Parking Space Requirement Standards – Design Standards for On-Street Parking Facilities – Traffic Regulatory Measures for On-Street Parking – Off-Street Parking Facilities – Peripheral Parking Schemes – Loading & Unloading Facilities – Truck Terminals – Long Distance Bus Terminals.



**UNIT – III**

**Traffic Signs:** Importance of Traffic Signs – Need for International Standardization – The Situation in India – General Principles of Traffic Signing – Types of Traffic Signs – Danger Signs (Warning Signs or Cautionary Signs) – Prohibitory Signs – Mandatory Signs – Informative Signs – Indication Signs – Direction Signs, Advance Direction Signs & Place Identification Signs – Overhead Signs – Route Marker Signs – Location, Height & Maintenance of Traffic Signs.

**UNIT – IV**

**Traffic Signals:** Advantages & Disadvantages of Traffic Signals – Signal Indications – Signal Face – Illustration of the Signals – Number & Location of Signal Faces – Amber Period, Red/Amber Period & Inter Green Period – Fixed Time Signals & Vehicle Actuated Signals – Determination of Optimum Cycle Length & Signal Settings for an Intersection with Fixed Time Signals – Warrants for Signals – Co-ordinated Control of Signals – Signal Approach Dimensions – Area Traffic Control – Delay at Signalized Intersection.

**UNIT – V**

**Road Markings:** Function – Types of Road Marking – General Principles of Longitudinal Pavement Markings – Material & Color – Centre Lines – Traffic Lane Lines – No Overtaking Zone Markings – Pavement Edge Lines – Carriageway Width Reduction Transition Marking – Obstruction Approach Markings – Stop Lines – Pedestrian Crossings – Cyclist Crossings – Route Direction Arrows – Word Messages – Markings at Approaches to Intersections – Parking Space Limits – Object Markings.

**Street Lighting:** Need for Street Lighting – Definition of Common Terms – Some Laws of Illumination – Mounting Height – Spacing – Lantern Arrangements – Type of Lamps – Lamp Installation at T-junctions & Cross Roads – Illumination of Traffic Rotaries – Lighting of Bends – Lighting of Dual Carriageways – Lighting of Roads Carrying Only Local Traffic – Lighting Bridges – Tunnel Lighting – Maintenance of Lighting Installation.

**TEXT BOOKS**

1. L.R.Kadiyali and Lal, *Traffic Engineering and Transportation Planning*, Khanna Publications, 9<sup>th</sup> edition, 1999.
2. S.K.Khanna & C.E.G.Justo, *Highway Engineering*, Published by Nemchand & Bros, 10<sup>th</sup> edition, 2012.

**REFERENCES**

1. L.R.Kadiyali and Lal, *Principles and Practice of Highway Engineering Design*, Khanna Publications, 7<sup>th</sup> edition, 2013.
2. R.Srinivasa Kumar, *Text book of Highway Engineering*, Universities Press. James H Banks, *Introduction to Transportation Engineering*, Tata McGraw hill Publications, 2<sup>nd</sup> edition.

**(18EE0234) INDUSTRIAL INSTRUMENTATION****(OE-I)****Course Objectives:**

The objectives of this course are:

1. To Analyse the Common errors that occur in measurement systems, and their classification.
2. To understand the characteristics of signals, their representation, and signal modulation techniques.
3. To learn the Methods of Data Transmission, Telemetry, and Data acquisition.
4. To study working principles of different Signal Analyzers and Digital meters.
5. To learn about several types of transducers and their use for measurement of non-electrical quantities.

**Course Outcomes:**

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

1. Identify and explain the types of errors occurring in measurement systems.
2. Differentiate among the types of data transmission and modulation techniques.
3. Apply digital techniques to measure voltage, frequency and speed.
4. Analyse the working principles of different Signal Analyzers and Digitalmeters.
5. Understand the operation of several types of transducers.
6. Choose suitable Transducers for the measurement of non-electrical quantities.

**UNIT-I:****CHARACTERISTICS OF SIGNALS AND THEIR REPRESENTATION:** Measuring

Systems, Performance Characteristics, Static Characteristics, Dynamic Characteristics; Errors in Measurement Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signals and their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

**UNIT-II:****DATA TRANSMISSION, TELEMETRY AND DAS:** MethodsofDataTransmission–

General Telemetry System .Frequency Modulation (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM)Telemetry. Comparison of FM,

PM, PAM and PCM. Analog and Digital Data Acquisition Systems –Components of Analog DAS–Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS–Block Diagram—Modern Digital DAS (BlockDiagram)

**UNIT-III:**

**SIGNAL ANALYZERS, DIGITAL METERS:** Wave Analysers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers-Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, QMeter. Peak Reading and RMS Voltmeters, Digital Voltmeters- Successive Approximation, Ramp and Integrating Type- Digital Frequency Meter- Digital Multimeter-Digital Tachometer

**UNIT-IV:**

**TRANSDUCERS:** Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezo electric Transducers, Photovoltaic, Photo Conductive Cells, PhotoDiodes.

**UNIT-V:**

**MEASUREMENT OF NON-ELECTRICAL QUANTITIES:** Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

**TEXTBOOKS:**

1. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, DhanpatRai&Co., 2012.
2. Transducers and Instrumentation, D.V.S.Murty,PrenticeHallofIndia,2<sup>nd</sup>Edition,2004.

**REFERENCE BOOKS:**

1. Modern Electronic Instrumentation and Measurement technique, A.Dhelfrick and W.D.Cooper, Pearson/Prentice Hall of India., 1990.
2. Electronic Instrumentation, H.S. Kalsi Tata MCGraw-Hill Edition, 2010.
3. Industrial Instrumentation–Principles and Design, T.R.Padmanabhan, Springer,

**(18ME0307) NON-CONVENTIONAL ENERGY RESOURCES****(OE-I)****Course Objectives**

To make the students understand

1. The importance of energy, resources of renewable energy, their usage and impact on environment.
2. Solar energy, its harnessing technologies, types of solar collectors, measuring devices. & its applications
3. Method of exploiting energy from wind and parameters to be considered for the selection of site for wind turbine installation
4. The concept of bio energy and its conversion devices
5. Different renewable energies such as tidal energy, geothermal energy, fuel cells etc.

**Course Outcomes**

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

1. State various sources of Energies, its availability and explain the importance of them by observing the global energy scenario.
2. Distinguish the types of solar energy tapping devices and describe the method of harnessing the solar energy.
3. Summarize the Wind energy systems and elucidate the impact of it in environmental aspects.
4. Describe the Biomass conversion process and list out various bioenergy applications.
5. Interpret the knowledge of renewable energies such as tidal energy, OTEC, Fuel cell, etc. for effective construction of Hybrid systems.
6. Identify numerous applications renewable energy resources and illustrate its harnessing technologies

**UNIT-I**

Introduction -world energy use – classification of energy's-reserves of energy resources– environmental aspects of energy utilization – need of renewable energy– renewable Energy scenario in Andhra Pradesh, India and around the world.

**UNIT-II**

Solar thermal conversion - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications– Solar thermal Power Generation

Photo voltaic Conversion: Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications, Solar Radiation Measurements

**UNIT-III**

Wind Energy - Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine–Wind Energy Measurements–Safety and Environmental Aspects

**UNIT-IV**

Bio – Energy- Biomass direct combustion – Biomass gasifiers – Biogas plants–Ethanol production – Biodiesel – Cogeneration - Biomass Applications

**UNIT-V**

Other Sources of Energy - Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

**TEXT BOOKS**

1. *"Non-conventional Energy Sources and Utilization"*, R.K. Rajput, S. Chand Publishers, 2<sup>nd</sup> Edition, 2014.
2. *"Non-Conventional Energy Sources"*, G. D Rai, Khanna Publishers, 1<sup>st</sup> Edition, 2010.
3. *–Renewable Energy Engineering*ll, Nicholas Jenkins & Janaka Ekanayake, Cambridge University Press; 1<sup>st</sup> Edition, 2017.

**REFERENCES**

1. *"Non-Conventional Energy Resources"* Dr. R K Singal, S.K Kataria & Sons, 4<sup>th</sup> Edition, 2014.
2. *"Renewable Energy Sources"*, John Twidell & Tony Weir, Routledge publisher, 3<sup>rd</sup> Edition, 2015.
3. *"Solar Energy, Principles of Thermal Collection and Storage"*, Sukhatme. S.P, Tata McGraw Hill Publishing Company Limited, 6<sup>th</sup> Edition, 1990.

**(18EC0449) INTRODUCTION TO IoT  
(OE-I)**

**Course Objectives**

1. To provide an overview on the ICT ecosystem and enabling environment to foster Internet of Things (including technology, standards, system management and applications) deployments.
2. Define the infrastructure for supporting IoT deployments.
3. To provide an understanding of the technologies and the standards relating to the Internet of Things.
4. Understand various case studies related to IoT domain.

**Course Outcomes**

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

1. Understand the technology and standards relating to IoTs.
2. Understand where the IoT concept fits within the broader ICT industry and possible future trends.
3. Understand the key components that make up an IoT system.
4. Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
5. Configure Raspberry Pi, Understand Sensors, Actuators & get started with python on Raspberry Pi.
6. Apply the knowledge and skills acquired during the course to design, build and test a complete, working IoT system involving prototyping, programming and data analysis.

**UNIT – I**

**IoT Introduction & Concepts:** Introduction to Internet of Things - Physical Design of IoT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels & Deployment Templates.

**UNIT – II**

**Domain Specific IoTs:** Home Automation – Cities – Environment – Energy – Retail – Logistics - Agriculture – Industry - Health & Lifestyle.

**UNIT – III**

**IoT and M2M:** Introduction – M2M – Difference between IoT and M2M - Software Defined Networking - Network Function Virtualization for IoT.

**Developing Internet of Things:** IoT Design Methodology – Motivation for using Python

**UNIT – IV**

**IoT Physical Devices & Endpoints:** IoT Device – Raspberry Pi Board - Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming raspberry Pi with Python – Other IoT devices.

**UNIT – V**

**Case Studies Illustrating IoT Design:** Home Automation – Cities – Environment – Agriculture – Productivity applications.

**TEXT BOOKS**

1. Vijay Madiseti – Arshdeep Bahga, *Internet of Things a Hands-on Approach*, Arshdeep Bahga & Vijay Madiseti ,1<sup>st</sup> Edition, 2014.
2. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press,1<sup>st</sup>Edition, 2014.

**REFERENCES**

1. Raj Kamal, *Embedded Systems*, Tata McGraw-Hill Education, 2<sup>nd</sup>Edition, 2011.
2. Adrian McEwen & Hakim Cassimally, *Designing of Internet of Things*, John Wiley and sons Ltd, 1<sup>st</sup> Edition, 2014,
3. Daniel Kellmerit - Daniel Obodovski, *The Silent Intelligence: The Internet of Things*,DnD Ventures, 1<sup>st</sup> Edition,2013.

III B. TECH - II SEM (AG)

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**(18CS0517) PYTHON PROGRAMMING  
(OE-I)**

**Course Objectives**

1. Introduce Scripting Language
2. Exposure to various problem solving approaches of computer science
3. Introduce function-oriented programming paradigm
4. Exposure to solve the problems using object oriented concepts, exceptional handling
- 5 Exposure to solve the problems using Files, Regular Expressions and, Standard Libraries

**Course Outcomes**

On Successful Completion of this course, the student will be able to

1. Solve the problems using control structures, input and output statements.
2. Summarize the features of lists, tuples, dictionaries, strings and files
3. Experience the usage of standard libraries, objects, and modules
4. Solve the problems using Object Oriented Programming Concepts
5. Build the software for real time applications using python
6. Install various Python packages

**UNIT – I**

**Introduction:** History of Python- Python features- Applications-Programming Using the REPL - Running Python Scripts-Variables – Assignment- Keywords- Input-Output- Indentation.

**Data Types: Single-Value data types** - int, float, complex and boolean.

**Multi-Valued Data types** - Lists, Tuples, Sets, Dictionaries ,Strings- indexing and slicing.

**UNIT – II**

**Operators and Expressions:** Operators-Arithmetic Operators, Comparison Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators- Expressions and order of evaluations

**Control Flow:** Branching- simple if, if-else, if-elif-else, nested if, looping-while and for- jumping – break- continue and pass.

**UNIT – III**

**Functions:** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions- Nested functions, Recursive functions- Scope of the Variables in a Function.

**Object Oriented Programming in Python:** Classes and Objects- self-variable- Methods – Constructor- Inheritance-polymorphism- Method Overloading- Method Overriding.



**UNIT – IV**

**Modules:** Creating modules, import statement, from...import statement and name spacing.

**Python packages:** Introduction to PIP- Installing Packages via PIP (Numpy, Pandas, Matplotlib etc.,) - Using Python Packages.

**Exception Handling:** Introduction to Errors and Exceptions, Handling Exceptions, Raising Exceptions, User Defined Exceptions, Regular Expressions-Searching and Matching.

**UNIT – V**

**Functional Programming:** Iterators and Generators - Maps and Filters.

**Files:** Text files- Reading and Writing files- Command line arguments.

**Brief Tour of the Standard Library:** Dates and Times- Data Compression- Python Runtime Services- Data Management and Object Persistence.

**GUI Programming** - Turtle Graphics

**TEXT BOOKS**

1. Python Programming: Using Problem Solving Approach, Reema Thareja, First Edition, Oxford University Press.
2. Python Programming: A Modern Approach, Vamsi Kurama Pearson.

**REFERENCES**

1. Learning Python, Mark Lutz, Orielly
2. Think Python ,Allen Downey, Green Tea Press
3. Core Python Programming ,W.Chun, Pearson.
4. Introduction to Python ,Kenneth A. Lambert, Cengage
5. Data Structures and Algorithms in Python, Michael T. Goodrich , Roberto Tamassia, Michael H. Goldwasser, 1st Edition , kindle

III B. TECH - II SEM (AG)

L	T	P	C
3	-	-	3

**(18HS0814) INTELLECTUAL PROPERTY RIGHTS  
(OE-I)**

**Course Objectives:**

1. To provide an understanding of the concept and significance of intellectual property rights
2. To understand the concept of trademarks, copy rights, patents and the need for their protection
3. To comprehend the concept of competition, unfair competition and the latest developments in the laws pertaining to intellectual property rights

**Course Outcomes:**

1. Become aware of intellectual property rights, concepts, treaties, agencies and international organizations involved in sanctioning IP rights
2. Identify different types of intellectual properties, ownership rights and the scope of the protection
3. Get an adequate knowledge on patents, trademarks, copy rights and to get property rights for their intellectual work
4. Able to identify, apply, and assess ownership rights, registration processes for IP rights
5. To discern the approaches for intellectual property management and intellectual property audits
6. Demonstrate knowledge and understanding on unfair competition and latest developments in IP rights at international level

**UNIT-I**

**INTRODUCTION TO INTELLECTUAL PROPERTY:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT-II**

**TRADE MARKS:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**UNIT-III**

**LAW OF COPY RIGHTS:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**LAW OF PATENTS:** Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT-IV**

**TRADE SECRETS:** Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secretelitigation.

**UNFAIR COMPETITION:** Misappropriation right of publicity, Falseadvertising.

**UNIT-V**

**NEW DEVELOPMENT OF INTELLECTUAL PROPERTY:** new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

**TEXT BOOKS:**

1. *Intellectual property right*, Deborah, E. Bouchoux, cengage learning
2. *Intellectual property rights: Protection and Management*. India, Nityananda KV, Cengage Learning India Private Limited.

**REFERENCES:**

1. *Intellectual property right - Unleashing the knowledge economy*, Prabuddha ganguli, Tata McGraw Hill Publishing CompanyLtd.
2. *Law relating to Intellectual Property rights*. India. Ahuja VK IN: Lexis Nexis
3. *Intellectual Property Rights*, India. Neeraj P &Khusdeep D, PHI learning pvt limited.

**III B. TECH - II SEM (AG)**

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**(18AG0711) IRRIGATION & DRAINAGE ENGINEERING LAB****COURSE OBJECTIVES**

- 1. To understand the concept of micro-irrigation*
- 2. To design the sprinkler and drip irrigation system*
- 3. To understand the concept of planning and design of various methods of land drainage and its impact on environment*

**COURSE OUTCOMES**

*Studies will be familiar with*

- 1. Basic terms related to the development of irrigation in India and AP and classification of different irrigation works*
- 2. Basic terms related to soil and water conservation*
- 3. Various terms related to soil loss estimation models*
- 4. Understand the different types of micro irrigation and its design*
- 5. Understand the maintenance of micro irrigation system*  
*Understand the different types of land drainage and its importance*

**LIST OF EXPERIMENTS**

1. Measurement of soil moisture by different soil moisture measuring instruments.
2. Determination of soil moisture constants by pressure plate and pressure membrane apparatus.
3. Measurement of irrigation water and infiltration rate.
4. Computation of evapotranspiration.
5. Determination of crop water requirement.
6. Irrigation scheduling.
7. Land grading exercises.
8. Design of underground pipe line system.
9. Design of drip and sprinkler irrigation.
10. Measurement of uniformity coefficient of sprinkler irrigation method.
11. Measurement of uniformity coefficient of drip irrigation method.
12. Field problems and remedial measures for sprinkler and drip irrigation method.
13. In situ measurement of hydraulic conductivity-Auger hole method.

14. Determination of drainage coefficients.
15. Preparation of water contour maps.
16. Measurement of hydraulic conductivity through drain testing.
17. Measurement of drainable porosity through drain testing.
18. Design of surface drainage systems.
19. Design of subsurface drainage systems.
20. Installation techniques of sub-surface drainage system.
21. Cost analysis of surface and sub-surface drainage system.

**TEXT BOOKS:**

1. Irrigation Theory and Practice —Michael, A.M. (2008). Vikas Publishing House, New Delhi.
2. Drainage Engineering - Luthin, J. N (2015). John Wiley & Sons, New York.
3. Drainage Principles and Applications Ritzema H. P. (1994). (2 ed.). ILRI Publication

**REFERENCES:**

1. Principles of Farm Irrigation system Design —John Wiley & Sons (1988), New York.
2. Majumdar, D. K. (2014). Irrigation Water Management Principles and Practice. Prentice-Hall of India, New Delhi.
3. Michael, A. M. and Ojha, T.P. (2013). Principles of Agricultural Engineering — (Vol. II). Jain brothers, New Delhi.
4. Murthy, C. S. (2002). Water Resources Engineering Principles and Practice —New Age International (P) Ltd. New Delhi.
5. Murthy, V. (2013). Land and Water Management — Kalyani Publishing, New Delhi.

## (18AG0712) FARM MACHINERY AND EQUIPMENT-II LAB

**Course objectives:**

1. Illustrate the basic principles of cutting mechanisms involved in harvesting machines
2. Classify the various types of harvesting machines.
3. Develop an ability to identify, formulate and solve problems related to various harvesting machines and threshers

**Course outcomes:**

Studies will be familiar with

1. Classify the crop harvesting machineries.
2. Explain about different types of mower.
3. Distinguish between reaper and combine harvester.
4. Demonstrate the performance of harvesting machineries and thresher.
5. Create an idea towards development of fruit harvesting machineries based on the problem faced during harvesting of fruits.
6. Carry out the operation, repair, maintenance and safety precautions of chaff cutters, post hole digger and self-propelled sugar cane harvester

**List of Experiments:**

1. Study the constructional details of mowers
2. Study the performance of combine harvester (Paddy)
3. Study the performance of paddy reaper and reaper binder
4. Repair and maintenance of mowers
5. Repair and maintenance of reapers
6. Study the performance of paddy transplanter
7. Operation, repair, maintenance and safety precautions of chaff cutters
8. Study the performance of Groundnut digger shaker and windrower
9. Study the performance, repair and maintenance of post hole digger
10. Operation, repair and maintenance of self-propelled sugar cane harvester
11. Study the performance of groundnut pod stripper
12. Study the performance of thresher

**TEXT BOOKS:**

1. Kepner R.A., Bainer R and Barger E.L, Principals of Farm Machinery. CBS Publishers and Distributors, Delhi, 1987.
2. Ajith k Srivatsava, Carrol E. Goering, Roger P. Rohrbach, Engineering principles of Agricultural machines, ASAE Publishers, 1993.

**REFERENCES:**

1. Smith H.P, Farm Machinery and Equipment, Tata McGraw-Hills Publishing Co., Ltd., New Delhi, 1971.
2. Mehta M.L., Verma S.R. Misra S.K and Sharma V.K, Testing and Evaluation of Agricultural Machinery, Daya Publishing House, New Delhi.
3. Michael A. M and OJha T. P, Principals of Agricultural Engineering-Vol.I, Jain Brothers, New Delhi, 2010.

## III B. TECH - II SEM (AG)

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**(18HS0859) ENGLISH FOR CORPORATE COMMUNICATION SKILLS LAB**  
**(Common to CE, EEE, ME, CSE, CSIT & AGE)**

**Course Objectives:**

- 1. To improve the students' fluency in English, through a well-developed vocabulary*
- 2. To enable them listening spoken English at normal conversational speed by educated English speakers*
- 3. To respond appropriately in different social-cultural and professional contexts*
- 4. To develop drafting skills among the students.*
- 5. To improve students' inter and intra-personal skills*

**Course Outcomes**

- 1. Flair in Writing and felicity in written expression*
- 2. To enhance job prospects*
- 3. Improving Effective Speaking Abilities*
- 4. To prepare effective Interview techniques*
- 5. To apply various communicative techniques in their inter and intra-personal communications.*

**UNIT I****COMMUNICATIVE COMPETENCY:**

1. Reading Comprehension
2. Listening Comprehension
3. Vocabulary for competitive purpose
4. Spotting Errors

**UNIT II****TECHNICAL WRITING**

5. Report writing
6. Curriculum vitae
7. Cover Letter
8. E-mail writing



**UNIT III****PRESENTATIONAL SKILLS**

9. Oral presentation
10. Power point presentation
11. Poster presentation
12. Stage Dynamics

**UNIT IV****CORPORATE SKILLS**

13. Dress code
14. Telephonic skills
15. Net-etiquettes

**UNIT V****GETTING READY FOR JOB**

16. Group Discussion
17. Interview skills
18. Psychometric test.

**Minimum Requirements for Advanced Professional Communication Skills Lab:**

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer Aided Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
2. The Communication Skills Lab with movable chairs and audio visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Camcorder etc.

System Requirement (Hardware component):

Computer network with: LAN with minimum 60 multimedia systems with the following.

Specifications:

- i) P- IV Processor
  - a) Speed 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- ii) Headphones of High quality

**Suggested Software:**

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – Part II
3. K – Van Advanced Communication Skills
4. Walden Info Tech Software.

**References:**

1. Effective Tech Communication, Rizvi, Tata McGraw – Hill Education, 2007.
2. Communication skills, Sanjay Kumar & Pushpalatha, Oxford University Press, 2012.
3. Writing Tutor. Advanced English Learners‘ Dictionary, 9<sup>th</sup> Edition, Oxford University Press, 2015.
4. Powerful Vocabulary Builder, Anjana Agarwal, New Age International Publishers, 2011.
5. Listening Extra, Miles Craven, Cambridge University Press, 2008.
6. Reading Extra, Liz Driscoll, Cambridge University Press, 2004.
7. Writing Extra, Graham Palmer, Cambridge University Press, 2004.
8. Speak Well, Jayashree Mohanraj et al, Orient Blackswan, 2013

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**IV B.Tech I Sem**

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**(18HS0860) SUPPLY CHAIN MANAGEMENT**

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**Course objectives:**

1. *To understand the role of distribution logistics and supply chain management in an economy*
2. *Understand the concepts of SCM such as outsourcing, distribution strategies, planning for uncertainty, decision making*
3. *To provide an insight in to the role of IT in supply chain management*

**Course Outcomes:**

After the completion of course the student would be able to:

1. *Appreciate the evolution and identify the role of supply chain management in the economy*
2. *Identify and evaluate the drivers of supply chain management*
3. *Analyze the importance of make or buy decisions and identify appropriate suppliers*
4. *Appraise the importance of supply chain networks*
5. *Assess the risk associated with supply chain practices and take better decisions*
6. *Familiarize with and apply various computer based supply chain optimization tools*

**UNIT I**

**Role of Distribution in Value discovery:** Designing a distribution logistics system –Outsourcing of distribution logistics – Distinction between distribution logistics and supply chain management. Introduction - Supply Chain – Fundamentals –Evolution-Role in Economy -Importance - Decision Phases - Supplier- Manufacturer-Customer chain. - Enablers/Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

**UNIT II**

**Strategic Sourcing** - Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Supplier Development - World Wide Sourcing

**UNIT III**

**Supply Chain Network** - Distribution Network Design – Role – Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation - Distribution Center Location Models - Supply Chain Network optimization models. Network Design decisions using Decision trees.

**UNIT IV**

**Planning Demand, Inventory And Supply** - Managing supply chain cycle inventory. Uncertainty in the supply chain -- Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life – cycle products - multiple item -multiple location inventory management. Pricing and Revenue Management

**UNIT V**

**Current Trends** - Supply Chain Integration - Building partnership and trust in SC Value of

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Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping -SC process restructuring,-IT in Supply Chain- Agile Supply Chains- Reverse Supply chain.-Agro Supply Chains.

**TEXT BOOKS:**

1. Textbook of Logistics and supply chain management, DK Agarwal, Macmillan 2003
2. *Supply Chain Management*, Janat Shah, Pearson

**REFERENCES:**

1. *Supply chain Logistics Management*, Bowersox, Closs, Cooper,2/e,TMH.
2. *Supply chain management concepts and cases*, Rahul V. Altekar, PHI.
3. *Exploring Supply Chain – theory and practice*, Upendra Kachru, excel.

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<b>B. Tech IV Year I Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**(18AG0721) GREENHOUSE TECHNOLOGY**

*The objectives of this course*

1. *To understand the various types of greenhouses and its effect on environment*
2. *To study the various climatic factors required for growing different varieties of crops*
3. *To study the structural design and planning of greenhouse and also to use the greenhouses for off season usage and also to manage them commercially.*

**COURSE OUTCOMES (COs)**

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

1. *Be proficient about identify the types and structures of existing greenhouse.*
2. *Students will learn the different systems for climate control in greenhouse and their management.*
3. *Familiar with the techniques of light management and CO<sub>2</sub> enrichment used for increasing and control crop production.*
4. *Learn the site selection and structural design of greenhouse*
5. *Understand the different types of material used in greenhouse*
6. *Learn about the economy of greenhouse construction*

**UNIT – I:**

**INTRODUCTION** – 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. Natural and forced ventilation summer and winter cooling systems, carbon dioxide enrichment method.

**UNIT – III:**

**PLANNING OF GREENHOUSE FACILITY** – Site selection and orientation, structural design, covering materials. Materials used for construction of greenhouses – Wood, Galvanised iron pipe and glass.

**GREENHOUSE COVERING MATERIALS** – Polyethylene film, PVC, Polyester, Tefzel T<sup>2</sup> film, Polyvinyl chloride rigid panel, fiber glass reinforced plastic rigid panel, Acrylic and

**UNIT – IV:**

Design criteria and construction details of glass and pipe framed greenhouses – Material requirement and procedure for erection.

**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.

**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. S. Kothari, S.C. Kaushik and A.N. Mathur. (2006). Greenhouse, Science &Technology, Himanshu Publications, Udaipur.
2. N.S. Rathore, A.K. Kurchania, N.L. Panwar. (2007). Non-Conventional Energy Sources, Himanshu Publications.
3. Pratap Singh et. al. (2004). Sustainable Development through Renewable Energy Sources Yash Publications, Bikaner.

**REFERENCES:**

1. Green house Technology and Management. RadhaManohar K and IgathinathaneC (2007), B.S. Publication, Hyderabad.
2. Green house Technology for controlled environment. TiwariG.NandGoyal (2009), NarosaPublishingR.K.House, New Delhi.
3. The complete Book of Greenhouse Gardening. Cavendish M (1991), Marshal cavandish Books Ltd , London

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B. Tech IV Year I Semester

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**(18AG0722) FOOD PROCESSING PLANT DESIGN AND LAYOUT  
(PEC – II)**

**Course objectives:**

1. Students will be trained in organization of food and agricultural processing plant machinery as per process flow. Also, site selection, layout procedures, project design concepts, etc. Will be explained for bringing the talent to establish an engineering industry.

**Course outcomes:**

*Studies will be familiar with*

1. Be proficient about Unit areas concept, two – dimensional layouts, scale models.
2. Be proficient about Principles of plant layout – Storage layout, equipment layout, safety, plant expansion, floor space, utilities servicing, building, materials handling equipment, rail road's and roads.
3. Be proficient about Salient features of processing of different plants.
4. Be proficient about Location selection criteria – Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout
5. Food plant sanitation
6. pollution control
7. Cost analysis - Cost indexes, cost factors in capital investment, estimation of total product cost.

**UNIT – I:**

Plant layout – Definition, meaning, objectives, principles. Plant layout – Factors in planning layouts. Methods of layout planning – Principles of plant layout – Storage layout, equipment layout, safety, plant expansion, floor space, utilities servicing, building, materials handling equipment, rail roads and roads. Types of plant layout – fruit processing plant. Salient features of rice processing plant. Salient features of maize processing plant. Salient features of pulses – processing plants. Salient features of oilseeds processing plants. Salient features of horticulture processing plants. Salient features of processing plants of vegetable crops.

**UNIT – II:**

Salient features of processing of poultry plants. Salient features of processing of fish processing plant. Salient features of processing of meat processing plant. Salient features of milk and milk products processing plants. Salient features of milk and milk products processing plants. 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, and materials of construction.

**UNIT –III:**

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 designs, feasibility

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survey, process development, design, construction and operation, design information from the literature.

**UNIT – IV:**

Flow diagrams-Qualitative and quantitative flow diagrams. Selection of equipment - 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 equipment - 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 - 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 reports, organization of reports, organization of a design report, preparing the report, rhetoric, checklist for the final report.

**TEXT BOOKS:**

1. Plant Layout and Design, James M Moor, Macmillan, New York.
2. Dairy and Food Engineering, Farall F W 2018. John Wiley & Sons, New York.

**REFERENCES:**

1. Milk Plant Layout, Hall H S and Y. Rosen, FAO publications, Rome.
2. Principles of Food Sanitation, Marriott N G 1985. Van Nostrand Reinhold Company, New York.
3. Food Technology Processing and Laboratory control. Aylward F 2012. Allied Scientific Publishers, Bikaner. Laboratory Control.



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<b>B. Tech IV Year I Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**(18AG0723) FOOD PACKAGING TECHNOLOGY  
(PEC – II)**

**Course Objectives:**

1. To enable the student to understand the principles and acquire the knowledge on various aspects of food packaging materials and environmental control for different foods for handling, transportation and also to extend the shelf life.
2. Provides knowledge on spoilage of food materials, various packaging systems,
3. Provide knowledge on different packaging materials and their properties, testing of packaging materials and packaging equipments

**Course Outcome:**

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

1. Acquaint with various food packaging materials,
2. Various aspects of packaging methods and technology.
3. Spoilage of food materials, various packaging systems
4. Packaging materials and their properties
5. Testing of packaging materials
6. Packaging equipments

**Unit-I**

**Shelf life of Foods-** Factors affecting shelf of food material during storage, spoilage mechanism during storage.

**Packaging of foods-** Definition, requirement, importance and scope of packaging of foods, types and classification of packaging system, advantage of modern packaging system.

**Unit-II**

**Packaging materials-** Types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in food packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

**Unit-III**

Nutritional labeling on packages, CAP and MAP, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

**Unit-IV**

Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

**Unit-V**

**Advanced Packaging Techniques-** Active packaging - smart packaging - intelligent packaging, Packaging requirement for raw and processed foods and their selection of packaging materials. Factors affecting the

**TEXT BOOK**

1. John, P.J. 2008. A Handbook on Food Packaging, Narendra Publishing House,
2. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata McGraw Hill
3. Robertson, G. L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and Francis Pub.

**REFERENCES**

1. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide, Narendra Publishing House.
2. Gosby, N.T. 2001. Food Packaging Materials, Applied Science Publication
3. Coles R., McDowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Blackwell Publishing Co.

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**(18AG0724) FOOD QUALITY AND CONTROL  
(PEC – II)**

**Course Objectives:**

1. To provide a basic understanding of quality concepts and practice in food companies.
2. To provide approaches to the planning and organization of a quality control system.
3. To provide a basic acquaintance with standards and specifications

**Course outcomes:**

1. To understand the application of food quality assessment of Food materials
2. To Identify the Statistical Quality Control of Foods, Sensory Evaluation of Food Quality
3. To understand the Different methods of quantitative descriptive analysis and
4. To understand the consumer studies
5. To understand the fundamentals of food regulations
6. To understand the Food grade and standards and concept of HACCP

**UNIT I**

Food Quality – its need and its role in Food Industry, Food Quality and Quality Attributes- Classification of Quality Attributes and their role in food Quality, Objectives, Importance and Functions of Quality Control, Methods of quality concepts of Dough Rheology, Quality Assessment of Food materials – Fruits and Vegetables, Quality Assessment of Food materials –Cereals and legumes, Quality Assessment of Food materials –dairy Products, Quality Assessment of Food materials –Meat, Poultry, Egg and Processed food Products

**UNIT II**

Statistical Quality Control of Foods, Sensory Evaluation of Food Quality – Introduction -Panel Screening Selection of Panel members, Requirements for conducting Sensory Evaluation and serving procedures, Methods of Sensory Evaluation and Evaluation cards – Difference/discrimination procedures, Methods of Sensory Evaluation and Evaluation cards- Ranking and Rating procedures.

**UNIT III**

Different methods of Quantitative descriptive analysis, Determination of Sensory thresholds and taste Interactions, Objective/Instrumental analysis of Quality Control, Food laws and Standards (BIS), Consumer Studies – Types of Consumer studies- Preference Studies and Acceptance Studies, Consumer Studies – Types of Consumer studies- Preference Studies Objectives of Consumer Preference Studies-factors affecting consumer acceptance.

**UNIT IV**

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Information obtained from Consumer Study -Factors Influencing results from Consumer surveys, Methods of Approach-Development of the questionnaire- Types of Questionnaire and other methods of data collection, Comparison of Laboratory Panels with Consumer panels. Limitations of Consumer Survey, Fundamentals of Food regulations-pertaining to Additives and Contaminants, Food regulations pertaining to aspects of Hygiene - Novel Foods & aspects of Labelling.

### **UNIT V**

Different existing Food legislations-norms in implementation, Food grade and standards, International food regulations and certifications, Indian food regulations and Certifications, Concept of Codex Alimentarius, The concept and process of implementation of HACCP in an industry, USFDA - the cause of its existence - its role in safe guarding food quality – Significance, Food Adulteration and Food Safety.

### **TEXT BOOKS**

1. Chandrashekar, U. 2002. Food Science and Applications in Indian Cookery. Phoenix Publishing House Pvt. Ltd.
2. Food Safety and Standards Authority of India. Ministry of Health and Family Welfare, Government of India.
3. Satarkar, A. 2008. Food Science and Nutrition. ABD Publishers. Jaipur
4. Sethi, M. 2008. Institutional Food Management. New Age Publishers. New Delhi.

### **REFERENCES :**

1. Philip,A.C. Reconceptualizing quality. New Age International Publishers, Bangalore. 2001.
2. Bhatia,R. and Ichhpujan,R.L. Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi. 2004.
3. Kher, C.P. Quality control for the food industry. ITC Publishers, Geneva. 2000.

**(18AG0725) TRACTOR SYSTEM AND CONTROLS  
(PEC – III)**

**Course objectives:**

1. To enables the students for acquiring the knowledge pertaining to transmission system
2. Be proficient about different types of clutch and gears
3. Enrich knowledge on tractor power outlets like P.T.O., tractor stability testing and ergonomics.

**Course outcomes:**

1. To impart knowledge about different transmission system in tractor.
2. Identify different parts of transmission systems.
3. Be proficient about identify the different types of clutch and gears of existing tractor.
4. To get knowledge on brake, steering and hydraulic system
5. Students will learn about the tractor power outlets like P.T.O., and tractor stability testing.
6. Familiar with the ergonomics aspect in point of tractors design.

**UNIT – I:**

**INTRODUCTION TO TRANSMISSION SYSTEM**-drive train of tractor, necessity of drive trains, components of drive train, function of drive train. **Clutch**-need, types, function requirement, construction and principle of operation familiarization with mechanical and hydraulic clutches-single, multi, centrifugal and dual clutch systems, construction and working of fluid coupling and torque converter. **Gear box**- gearing theory, principle of operation, gear box types, functional requirement and calculation of speed ratio. working of sliding mesh and constant mesh gear box. Differential system and final drive system.

**UNIT –II:**

**BRAKE SYSTEM**- types, principle of operation, construction, working of mechanical brake, internal expanding, and external contracting, working of disc brake and hydraulic brake.

**STEERING SYSTEM**- types, requirement, steering geometry characteristics, functional components, working of mechanical steering, working of power steering. Condition of good steering, advantages of power steering, qualities of good steering, familiarization with ackerman steering, steering system in track type tractors.

**UNIT – III:**

**HYDRAULIC SYSTEM IN TRACTOR**- principle of operation, types of main functional components, types of hydraulic controls, necessity of hydraulic control, important and working of draft control and position control system, hitching implement, familiarization with the hydraulic system adjustment and ADDC (Auto Draft and Depth Control). Hitching system in tractor-construction and working of three-point linkage mechanisms, force analysis, terminologies related to hitching, types of three-point hitch operation, free link and restrained link operation.

**UNIT – IV:**

Tractor power outlet- PTO, drawbar, hydraulic system, PTO construction, PTO standards, types and

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functional requirements. Introduction to traction, traction terminology and its characteristics. Traction theory and traction aids. Wheel and tyres- types like solid tyres and pneumatic tyres. Study of tractor mechanics, forces acting on the tractor, free body diagram of tractor implement combination, methods of CG measurement of tractor. Tractor stability- longitudinal stability, lateral stability, mechanics of tractor under static condition, mechanics of tractor under dynamic condition, mechanics of tractor implement combination, weight transfer and its importance, determination of maximum drawbar pull, study of tractor stability-types of tractor accident, precaution to overcome tractor accident, condition to avoid sideways overturning during turning, safety devices in tractor.

**UNIT – V:**

Introduction to tractor testing and performance, preparation of test, types of tractor tests- test procedure, power test, agronomical tests and miscellaneous tests. Tractor chassis- function, types of chassis, precaution to be taken prolonged life. Ergonomic consideration and operation safety of tractor, safety measurement in tractor ROPS, construction.

**TEXT BOOKS:**

1. Jagdishwar sahay. 2015. Elements of agricultural engineering. Standard publication, New Delhi.
2. Nakra C.P., 2009, Farm Machines and Equipment's. Dhanpat Rai Publication, New Delhi.

**REFERENCES:**

1. Sanjay kumar. 2007. A Textbook of tractor at Glance. International Book Distribution Company, New Delhi.
2. Farm Machinery and Equipment — Smith H.P. 1971. Tata McGraw-Hills Publishing Co., Ltd., New Delhi.
3. Principles of Farm Machinery —Kepner R.A., Bainer R and Barger E.L, 2010. CBS Publishers and Distributors, Delhi.

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**(18AG0726) DESIGN OF AGRICULTURAL MACHINERY**  
**(PEC – III)**

**Course objectives:**

1. To enable the students to understand the general procedure for designing any machine parts.
2. To know the design of cotter and knuckle joints, levers, springs various types of shafts, couplings bearings and various IC engine parts.
3. To develop an ability to identify, formulate and solve engineering problems.

**Course outcomes:**

*Studies will be familiar with*

1. Be proficient in the use of software for analysis and design.
2. Be proficient in an ability to identify, formulate and solve engineering problems.
3. Various basic terms related to machine design aspects.
4. Some of the basic concepts related to Fundamental units, Mass and Weight, inertia, Laws of motion, force, moment of force, couple mass density, torque, work, power and energy.

**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, and 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.

**DESIGN OF MACHINERY** – Design of Tillage equipment – cultivator, Rotovator, sowing machinery – Tractor Operated seed com Fertilize drill - Design of harvesting & threshing equipment – reaper, power thresher, Design of spraying equipment – Tractor mounted Boom sprayer.

**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:**

Fly wheel – Introduction, Coefficient of fluctuation of speed, fluctuation of energy, maximum fluctuation of energy, energy stored in a flywheel. Bearing – Introduction, classification of bearing, types of sliding contact bearings, rolling contact bearings – Introduction, advantages and disadvantages of rolling contact bearing over sliding contact bearings. Types of rolling contact bearings, types of radial ball bearings, Standard dimensions and designations of ball bearings, types of roller bearings, basic static load rating of rolling contact bearings, life of a bearing. Basic dynamic load rating of rolling contact bearings, dynamic load rating for rolling contact bearings under variable loads, reliability of bearing, lubrication of ball and roller bearings.

**TEXT BOOKS:**

1. Machine Design – Khurmi R.S. and Gupta J.K. 2005, Eurasia Publishing House Pvt.Ltd.,New Delhi.
2. Machine Design-Robert.I.Norton.2018, Person Education.

**REFERENCES:**

1. Machine Design – Jain R.K. 1991. Khanna Publishers, New Delhi.
2. Machine Design-P.C.Gope. 2012, Prentice hall India learning private limited.



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**(18AG0727) PRECISION AGRICULTURE AND SYSTEM MANAGEMENT  
(PEC – III)**

**Course Objective:**

1. To enable the students to know the development of high precision agricultural machinery viz. sowing, planting spraying equipment.

**Course Outcomes:**

1. Upon completion of this course, the students can get knowledge on different functional requirements of precision agricultural machinery
2. Be proficient about identify the types and structures of existing greenhouse.
3. Students will learn the different systems for climate control in greenhouse and their management.
4. Familiar with the techniques of light management and CO<sub>2</sub> enrichment used for increasing and control crop production.

**UNIT I:**

**Introduction to precision agriculture** – need and functional requirements, Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines. Familiarization with precision agriculture problems and issues.

**UNIT II:**

Familiarization with equipment for precision agriculture including power sprayers, land clearing machines, laser guided land levelers.

**UNIT III:**

Familiarization with equipment for precision agriculture including straw chopper, straw-balers, grain combines etc. Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation.

**UNIT IV:**

Database management - system concept - system approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations.

**UNIT V:**

Application of PERT and CPM for machinery system management

**Text books**

- 1.Sharma DN and S Mukesh. Farm Power and Machinery Management Vol I.
- 2.Hunt Donnell. Farm Power and Machinery Management.

**References**

1. Kuhar J E. The Precision Farming Guide for Agriculturist.
2. Dutta SK. Soil Conservation and land management.
3. Sigma and Jagmohan. Earth Moving Machinery.

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**(18AG0728) INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT  
(PEC – IV)**

**Course Objectives:**

1. In the present scenario, modern land and water management systems needs to know precise database of weather parameters, water availability & water demand, gross command area, crop water requirements, crop production for different amount of water supply, to prepare water supplying scheduled, water billing etc.
2. Scientific researches in irrigation in different countries can be easily accessible by internet than any other publication source.
3. This course is mainly aimed the students to get knowledge about information technology, database, multimedia technologies, networking system and communication technology etc.

**Course outcomes:**

1. To understand the basic concept of information technology
2. To understand internet application and communication technology in land and water management
3. To understand the concept of database systems in land and water management.
4. To understand application of remote sensing, GIS and GPS in watershed characteristics.
5. Application of mathematical models in irrigation and water resource management

**UNIT-I**

Information technology (IT) introduction - users needs in terms of land and water information systems and decision-support systems. Information technology concepts and its application potential. Role of IT in natural resources management in modern irrigation sector. Existing system of information generation in land water management and organizations involved in the field of land and water management. Multimedia technologies – introduction – applications. Role of multi-media in the development of natural resources.

**UNIT-II**

Internet application tools in water management planning. Web technology - introduction – study of websites available for information on land and water resources. Networking system of information – introduction - types – study of water supply networks - global network on water and development information for arid lands (G-WADI). Communication technology - the role of communication

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technology in land and water information systems - problems and prospects of new information and communication technology.

**UNIT-III**

Database – introduction - types of database management systems. Different data base systems in land and water management. Development of database concept for effective natural resources management. Application of remote sensing, geographic information system (GIS) and GPS in thematic mapping like soil, water, ground water, resource, drainage etc. Application of remote sensing, geographic information system (GIS) and GPS in natural resource inventory. Application of remote sensing, geographic information system (GIS) and GPS in watershed characterization, watershed prioritization, inventory & assessment of natural resources, wasteland mapping,

**UNIT-IV**

Application of remote sensing, geographic information system (GIS) and GPS in ground water potential zones, run off estimation, water resources action plan, land resources action plan, site selection for implementation, land resource and evaluation. Use of satellite data for monitoring the changes in land and water. Relational data base management system (RDBMS) - definition- special application in land and water management (FAO). Information system – overview - types of information systems - development – integrated land and water information systems. Decision support systems – elements - support elements, water availability elements, water demand elements, integrated water management elements.

**UNIT-V**

Expert systems in relation to water management. Agricultural information management systems – models – types of models. Mathematical models in irrigation, optimization and water resource management. Mathematical models in soil and water conservation 264. Application of decision support systems - multi sensor data loggers. Overview of software packages in natural resource management.

**TEXT BOOKS**

1. Climate-Smart Agriculture – Source Book. 2013. Food and Agriculture Organization.
2. Daniel P. Loucks and Eelco van Beek. 2005. Water Resources Systems Planning and Management - An Introduction to Methods
3. Dipak De and Basavaprabhu Jirli (Eds.). 2010. Communication Support for Sustainable Development. Ganga Kaveri Publishing House
1. FAO. 1998. Land and Water Resources Information Systems. FAO Land and Water Bulletin

2. Fuling Bian and Yichun Xie (Eds.). 2015. Geo-Informatics in Resource Management and Sustainable Ecosystem. Springer.

**REFERENCES**

1. ICFAI Business School (IBS). 2012. Information Technology and Systems. IBS Centre for Management Research
2. Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Environmental Science. Springer
3. Sarvanan. R. 2011. Information and Communication Technology for Agriculture and Rural Development. New India Publishing Agency
4. Soam, S.K., P.D. Sreekanth and N.H. Rao (Eds.). 2013. Geospatial Technologies for Natural Resources Management. New India Publishing Agency.

**(18AG0729) WATERSHED DEVELOPMENT****(PEC – IV)****Course Objective**

1. 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 project proposals.

**Course outcomes:**

Studies will be familiar with

1. Recognize importance of watershed.
2. To understand the Geomorphology of watershed and watershed management
3. Be proficient about the Integrated watershed management practices
4. Various basic terms related to watershed .
5. Formulation of project proposal for watershed management programme.

**UNIT I**

Watershed - Introduction – concept and characteristics - watershed development – watershed area, command area and identification of watershed problems and prospects. Major investigations on 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. Geomorphology of watersheds - size and shape of watershed, slope, order, number of streams in a basin, stream pattern and other. Evolution of effects of watershed management treatments - statistically, hydrological sediment yield and scatter diagrams. Hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds

**UNIT III**

Sediment yield – factors affecting the sediment yield – measurement and sediment yield index-controlling sedimentation, water budgeting in a watershed . Management measures - rainwater conservation technologies - in-situ and exsitu storage - water harvesting and recycling- advantages and benefits. Dry farming techniques - inter-terrace and inter-bund land management. Forest plantation – terracing, surface cover brushwood and planting

**UNIT IV**

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Integrated watershed management – concept, objectives, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology.

**UNIT V**

Watershed programme - execution - project implementation and evaluation, follow-up practices - characteristics of forest watersheds, forest plantation, streams and soils .Watershed programme – maintenance and control measurements, monitoring, evaluation and reporting. Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning of project proposal for watershed management programme including cost-benefit analysis. Formulation of project proposal for watershed management programme including cost-benefit analysis

**TEXT BOOKS:**

1. Soil and water Conservation Engineering. Suresh, R. (2014). Standard Publishers and Distributors.
2. Hydrology and Soil Conservation Engineering: Including Watershed Management. Ghansyam Das (2009). Prentice Hall India Learning Private Limited publisher

**REFERENCES:**

1. R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
2. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi. 4 Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006.

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**(18AG0730) SOIL AND WATER CONSERVATION ENGINEERING  
(PEC – IV)**

**Course objectives:**

1. To enable the students to acquire knowledge on different soil loss estimation models, run off estimation by rational, curve number, cook's etc.
2. Land use, capability classification, Land treatment works like contour bunding, terracing, bench terraces, contour trenches and their types and complete design calculations.
3. 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.

**Course outcomes:**

*Studies will be familiar with*

1. Various basic terms related to Soil Erosions, Rainfall-Runoff relationships.
2. Some of the basic concepts related to soil conservation.
3. Simple terms related to soil loss estimation models.
4. Recognize importance of various soil conservation structures and their designs.
5. Understand and design vegetated water ways
6. Understand the concepts of water harvesting techniques.

**UNIT – I:**

**INTRODUCTION** – Soil and Water conservation research Centre–Its sub-centers in India–Soil Erosion– Geologic, Accelerated types. Causes and agents of erosion – Factors affecting erosion – Different stages of erosion – Rill – Sheet – Gully and Ravines-Water Erosion–Forms of water erosion– Mechanics of Erosion – Gullies and their classification, stages of gully development. Soil Loss estimation–Universal Soil Loss equation and modified soil loss equation, expansion of various terms – Estimation of their various parameters.

**UNIT – II:**

**WIND EROSION**– Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, and wind erosion control measures – Vegetative, mechanical measures, wind blades and shelter belts, sand dunes stabilization – Wind erosion and its control.

**RUNOFF**– Factors affecting runoff – Runoff – Peak Runoff and design peak runoff –its estimation – Rational method – Time of concentration estimation – Curve number method – Cook's method. Land use capability classification based on different criteria with a special reference to slope – Erosion control measures – Agronomic and mechanical or engineering measures.

**UNIT – III:**



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**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. Contour trenching – Staggered and continuous trench – Adaptability and types.

**GRADED BUNDS**– Design of graded bunds. Introduction to Conservation Ditching. **TERRACES** – Classification of Terraces-Design of narrow based and broad based terraces. Bench Terraces – Types of Bench Terraces Derivation for an equation for finding of vertical interval –Design of bench terraces.

**UNIT – IV:**

**VEGETATED WATER WAYS** – Types of water ways based on shapes – Expression for wetted perimeters –Areas – Hydraulic radii – 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 – Analysis of toposheets.

**UNIT – V:**

**WATER HARVESTING TECHNIQUES** – Estimation of Earth work Design of farm ponds – 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

**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. 2017.Oxford and IBH Publishing Co. Ltd., New Delhi.
3. Chow, V. T. (2009). Open Channel Hydraulics. McGraw Hill.
4. Soil and Water Conservation Research in India. Dhruvanarayana, V. V. (2012). ICAR, New Delhi.
5. Erosion and Sediment Control. Goldman, S. J, Jackson K. and Bursztynsky, T. A.(1986). Handbook. McGraw-Hill Book Company.
6. Principles of Agricultural Engineering. Michael, A. M. and Ojha, T.P. (2013). (Vol. II). Jain brothers, New Delhi.

**REFERENCES:**

1. Land and Water Management Engineering. Murthy V V N (2013). Kalyani Publishers, New

2. Introduction to Soil and Water Conservation Engineering. Mal B.C. (2011) Kalyani Publishers, Rajinder Nagar, Ludhiana.
3. Soil and water Conservation Engineering. Suresh, R. (2014). Standard Publishers and Distributors.
4. Soil and water conservation engineering. Schwab, G.O, Frevert, R.K., Edminister T.W., and Barnes, K.K. (1993). John Wiley and sons.
5. Design of Small Canal Structures. USBR. (2017). U S Bureau of Reclamation

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**(18CE0146) PROJECT PLANNING AND CONTROL****COURSE OBJECTIVES**

1. To describe various elements of an engineering project and to draw the network
2. To perform PERT & CPM calculations and to identify the critical path
3. To perform various operations on the network

**COURSE OUTCOMES (COs)**

After the successful completion of the course the student able to

1. Differentiate various tools for planning and controlling the project
2. Construct the network for a project
3. Perform PERT computations and evaluate the critical path
4. Perform CPM computations and identify the critical path
5. Optimize time and cost for a project
6. Work with network during the progress of a project by updating the network and allocating the resource

**UNIT – I**

**Project Management:** Project planning – Project scheduling – Project controlling – Project monitoring and control – Project monitoring and information cell – Decision making in project management – Project life cycle

**Basic Techniques of Project Management:** Bar charts – Steps for the construction of a bar chart – Limitations of bar charts – Milestone charts – Velocity diagrams – Development of Network – CPM/PERT Networks – Advantages of network over milestone chart

**UNIT – II**

**Elements of Network:** Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles

**Development of Network:** Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies

**UNIT – III**

**PERT: Time Estimates:** Uncertainties: Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time

**PERT: Time Computations & Network Analysis:** Earliest expected time – Formulation for  $T_E$  – Latest allowable occurrence time – Formulation for  $T_L$  – Combined tabular computations for  $T_E$  and  $T_L$  – Slack – Critical path – Probability of meeting scheduled date

**UNIT – IV**

**CPM: Network Analysis:** CPM Process – CPM Network – Activity time estimate – Earliest event

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time – Latest allowable occurrence time – Combined tabular computations for  $T_E$  and  $T_L$  – Start and finish times of activity – Float – Critical activities and critical path

### UNIT – V

**CPM: Cost Model:** Project cost – Indirect project cost – Direct project cost – Slope of direct cost curve – Total project cost and optimum duration – Contracting the network for cost optimization – Steps in time cost optimization

**CPM: Updating:** Updating process – Data required for updating – Steps in the process updating – When to update

**Resources Allocation:** Resources usage profiles: histograms – Resources smoothing – Resources levelling

### TEXT BOOKS

1. Dr.B.C. Punmia, K.K. Khandelwal, *Project Planning and Control with PERT AND CPM*, Laxmi Publications (P) Ltd., 4<sup>th</sup> Edition, Reprint 2006
2. Dr.P.N. Modi, Sanjeev Modi and Rajeev Modi, *Program Evolution and Review Technique and Critical Path Method*, Standard Book House, 5<sup>th</sup> Edition, 2012

### REFERENCES

1. L.S. Srinath, *PERT and CPM Principles and Applications*, Affiliated East-West Press (Pvt.) Ltd.
2. S.K. Bhattacharjee, *Fundamentals of PERT/CPM and Project Management*, Khanna Publishers
3. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, Pearson, 2<sup>nd</sup> edition, 2015

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**(18EE0236) SOLAR PHOTOVOLTAIC SYSTEMS  
(Open Elective-II)**

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**COURSE OBJECTIVES**

The objectives of the course are

1. *To develop a comprehensive technological understanding in solar PV system components*
2. *To provide in-depth understanding of design parameters to help design and simulate the performance of a solar PV power plant*
3. *To pertain knowledge about planning, project implementation and operation of solar PV power generation*

**COURSE OUTCOMES**

After the end of the course, a student should be able to

1. *Understand of renewable and non-renewable sources of energy*
2. *Gain knowledge about working principle of various solar energy systems*
3. *Analyse the solar power PV power generation*
4. *Applying the knowledge on to installation and integration of PV modules for different applications*
5. *Understand the operation of different solar collectors in the market*
6. *Understand the solar thermal energy storage systems*

**UNIT-1****Introduction**

Sources of renewable energy; global potential for solar electrical energy systems. Solar radiation. Extra terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data

**UNIT-2****PV cells and modules**

Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters

**UNIT-3****Solar Photovoltaic Module Array**

Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.

**UNIT-4****Solar PV System Design and Integration**

Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System,

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Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant.

### **UNIT-5**

#### **Solar collectors and Solar energy storage**

Different types of solar collectors, Flat plate and concentrated type collectors, Fundamental Terminologies of thermal storage, Sensible heat storage materials, Latent heat storage materials, Solar thermo-chemical energy storage systems, Advantages and disadvantages of solar thermal storage, application of thermal storage

#### **TEXT BOOKS**

1. Chetansingh solanki *Solar Photovoltaic* PHI, Learning private ltd., New dehli- 2018
2. G.D Rai *Non-conventional Sources of Energy* Khanna Publishers, Delhi, 2012

#### **REFERENCE BOOKS**

1. Chetan Singh Solanki *Renewable Energy Technologies; A Practical Guide for Beginners* PHI School Books (2008)
2. Kothari D.P. and Signal K.C *Renewable Energy Sources and Emerging Technologies*, New Arrivals –PHI; 2 Edition (2011)

IV B.Tech - I Sem

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3 - - 3**(18ME0353) COMPUTER AIDED PROCESS PLANNING**  
**[Open Elective– II]****COURSE OBJECTIVES***The objectives of this course is to*

1. Provide the student with an understanding of the importance of process planning role in manufacturing.
2. Classify the various methods of CAPP
3. Understand the importance of product development through CIMS, shop floor control, Computer Integrated Manufacturing and Automation
4. Understands about NC, CNC and DNC systems.
5. Know about capacity Planning, Adaptive control machining systems, FMS and MRP's

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

1. Know the importance of process planning role in manufacturing
2. Describe the various methods of CAPP
3. Recognize the importance of product development through CIMS, shop floor control, Computer Integrated Manufacturing and Automation
4. Gain the knowledge about NC, CNC and DNC systems.
5. Identify about capacity Planning, Adaptive control machining systems
6. Familiar in FMS and MRP I and MRP II

**UNIT- I**

**Introduction to Process Planning:** Role of process planning in the manufacturing cycle- Information requirement for process planning system - Merits of conventional process planning over CAPP - Structure of automated process planning system, features recognition, methods.

**UNIT- II**

**Generative CAPP System:** Importance - Generative CAPP system - Automation of logical decisions - Knowledge based systems - Inference Engine, implementation, benefits.

**Retrieval CAPP System:** Significance - Retrieval CAPP system, structure, relative advantages and disadvantages- implementation and applications.

**UNIT- III**

**Implementation Techniques for CAPP:** MIPLAN system - The Bottom-up approach - The Top-Down approach - Computer programming languages for CAPP- Criteria for selecting a CAPP system - Benefits of CAPP - MRP - I, MRP - II and benefits.

**UNIT- IV**

**Computer Integrated Production Planning:** Capacity planning- shop floor control- MRP-I, MRP-II- CIMS benefits.

**Computer Integrated Manufacturing System (CIMS):** Introduction to CIMS, Automation strategies, Automation and CAD/CAM, Scope of CIM- Computer controls in NC- NC, CNC and

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DNC systems, components, block diagram, applications- Part programming- Group technology, benefits.

### **UNIT- V**

**Flexible Manufacturing systems (FMS):** Components of FMS, workstation, Material handling system and computer control system, FMS Layout configurations and benefits of FMS.

**Adaptive control machining systems:** Introduction to adaptive control machining systems, application- approaches, adaptive control optimization system, adaptive control constraint system, applications to machining processes, computer process monitoring and computer process control.

### **TEXT BOOKS**

1. Mikel P.Groover *Automation, Production systems and Computer Integrated Manufacturing Systems*, Pearson Higher Education, Inc., 4<sup>th</sup> Edition, 2015.
2. Dr. Sadhu Singh, *Computer Aided Design and Manufacturing*, Khanna Publishers, 2009.

### **REFERENCES**

1. Gideon Halevi and Roland D. Weill, "Principles of Process Planning", A logical approach, Chapman & Hall, 1995.
2. Chang T C and Richard A Wysk, "An Introduction to automated process planning systems", Prentice Hall, 1985.
3. H.P. Wang and J.K. Li, "Computer Aided Process Planning", Elsevier Science and Technology Publishers, 1st edition, 1991.



**(18EC0450) MATLAB PROGRAMMING**  
**(Open Elective-II)**

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**COURSE OBJECTIVES**

The objectives of this course:

1. Understand the MATLAB Desktop, Command window and the Graph Window.
2. Be able to do simple and complex calculation using MATLAB.
3. Understand the mathematical concepts upon which numerical methods.
4. Understand the tools that are essential in solving engineering problems.

**COURSE OUTCOMES (COs)**

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

1. Analyze and visualize data effectively by using MATLAB.
2. Apply numeric techniques and computer simulations to solve engineering-related problems.
3. Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
4. Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.
5. Demonstrate understanding and use of fundamental data structures (classes).
6. Create and control simple plot and user-interface graphics objects in MATLAB.

**UNIT-I**

**Introduction to MATLAB:** MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB.

**UNIT-II**

**Arrays:** Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

**UNIT-III**

**Functions & Files:** Elementary Mathematical Functions, User Defined Functions, Advanced Function Programming, Working with Data Files.

**UNIT-IV**

**Programming Techniques:** Program Design and Development, Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging MATLAB Programs.

**Plotting:** XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

**UNIT-V**

**Linear Algebraic Equations:** Elementary Solution Methods, Matrix Methods for Linear Equations,

**TEXT BOOKS**

1. G. H. Golub and C. F. Van Loan, *Matrix Computations*, 3rd Ed., Johns Hopkins University Press, 1996.
2. B. N. Datta, *Numerical Linear Algebra and Applications*, Brooks/Cole, 1994 (out of print)

**REFERENCES**

1. William J Palm, *Introduction to MATLAB for Engineers*, 3rd edition, Mc GRAW HIL.
2. L. Elden, *Matrix Methods in Data Mining and Pattern Recognition*, SIAM Press, 2007.
3. Amos Gilat, *MATLAB: An Introduction with Applications*, 4<sup>th</sup> edition, WILEY.

**(18CS0544) SOFTWARE DEVELOPMENT & TESTING  
(OPEN ELECTIVE-II)**

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**COURSE OBJECTIVES**

The objectives of this course is to

1. *Illustrate the Software Development Models*
2. *Explain Software Requirements Engineering Process and SRS document*
3. *Illustrate the importance of modeling and modeling languages*
4. *Explain various testing methodologies*
5. *Explain Quality assurance and test cases*

**COURSE OUTCOMES (COs)**

On successful completion of the course, the students will be able to

1. *Define and develop as software project from requirement gathering to implementation*
2. *Ability to code and test the software*
3. *Ability to plan, estimate and maintain software systems*
4. *Understand the basic testing procedures*
5. *Able to generate test cases and test suites.*
6. *Test the applications manually by applying different testing methods and automation tools.*

**UNIT-I**

**Introduction:** Introduction to Software Engineering , Software Process, Software Myths, A generic view of process, A layered Technology, A Process Framework, Software Process Models, Unified process

**Introduction to Agility:** Agility, Agile Process, Agile Process Models

**UNIT-II**

**Requirements Analysis and Specification:** Requirements Engineering, Eliciting Requirements, Requirements Analysis, Types of Requirements, Requirement Modeling and Data Modeling, Concepts.

**Architectural Design Concepts:** The Design Process, Design Concepts, Design Model, Software Architecture, Architecture Styles.

**UNIT-III**

**User Interface Design:** The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps.

**Web App Design:** Introduction, Web App Interface Design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Component-Level Design.

**UNIT-IV**

**Software Testing:** Introduction, Levels of Software Testing – Unit Testing, Module Testing,

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Integration Testing, System Testing, Acceptance Testing, Alpha Testing, Beta Testing,  
**Approach to Software Testing:** Types of Software Testing - Black Box Testing, White Box Testing,  
Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Art of  
Debugging.

### **UNIT-V**

**Software Quality:** Software Testing Life Cycle, Software Quality, Testing Principles, Test Process  
– Testing Activities, Quality Assurance.

**Software Test Cases:** Introduction to Test cases, Test Case Selection – Test Planning and Design –  
Test Execution – Case Study on Test tools and automation.

### **TEXT BOOKS**

1. Roger S.Pressman, Software Engineering- A practitioner's Approach, McGraw-Hill International Edition, seventh edition, 2001.
2. Software Testing techniques, Boris Beizer, Dreamtech, Second Edition

### **REFERENCES**

1. Ian Sommerville, Software Engineering, 8th Edition, Pearson Education, 2008.
2. Richard Fairley, Software Engineering Concepts, McGraw Hill, 2004.
3. Dr.K.V.K.K.Prasad, *Software Testing Tools*, Dreamtech

## IV B.Tech I Sem

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(18HS0815) ENTREPRENEURSHIP DEVELOPMENT  
(Open Elective-II)**Course objectives:**

1. To acquire necessary skills and knowledge required for organizing and carrying out entrepreneurial activities,
2. To develop the ability of analyzing and understanding business situations in which entrepreneurs act
3. To develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development

**Course outcomes:**

1. The ability to discern distinct entrepreneurial traits and identify the successful elements of successful entrepreneurial ventures
2. Consider the legal and financial conditions for starting a venture and to assess the opportunities and constraints for new ventures
3. Design strategies for the successful implementation of ideas
4. To comprehend the evaluation of business opportunity from the prospective of an investor
5. Identify the most suitable sources of finance for start-ups
6. To write and execute their own business plan

**UNIT-I**

**Introduction to Entrepreneurship** - Concept of Entrepreneur's, Enterprise and Entrepreneurship; Characteristics, Qualities, Functions of entrepreneur and Advantages of Entrepreneurship; Role of entrepreneurship in Economic development, Challenges faced by entrepreneurs, Entrepreneurial scenario in India and Abroad; Elements of Social Entrepreneurship, Types of Entrepreneurs, Entrepreneurship vs. Intrapreneurship.

**UNIT-II**

**Small Business and its Importance** - Introduction, Need, Classification of Micro, Small and Medium Enterprises (MSMEs), Role of MSMEs, Problems of MSMEs, Steps for Starting MSMEs, The role of government in supporting MSMEs in India.

**Forms of Business Organization:** Evaluation of Form of Business organization: Sole Proprietorship, Partnership, Joint Hindu Family, Joint Stock Company and Co-operative Society. Special forms of business ownership: Licensing, Franchising and Leasing.

**UNIT-III**

**Innovation and Idea Generation in Entrepreneurship** - Concept of Invention and Innovation, types of innovation, Sources of Innovation, Importance of Innovation in Entrepreneurship. Sources of new ideas, Methods of generating ideas and Opportunity recognition and idea generation in entrepreneurship. Intellectual Property Rights (IPRs): Patents, trademarks, copyrights, and trade secrets. E-commerce and Business Start-ups, Sources of information for Start-up Entrepreneurs in India. Problems of Start-ups without IPRs.

**UNIT-IV**

**Entrepreneurial Motivation** - Concept of Motivation and Factors influencing the entrepreneurs; Motivational Theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory.

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Entrepreneurship Development Programs (EDPs) - Need and Role of EDPs. Opportunities for entrepreneurship in present scenario. Successful entrepreneurs

**Financing of Enterprises** - Source of financing - Debt capital, seed capital, venture capital, Loans available for starting ventures in India, Role of government agencies in small business financing. Role of consultancy organizations.

### **UNIT-V**

**Project Planning and Feasibility Study** - Meaning of Project, Project Life Cycle, and Stages of Planning Process. Project Planning and Feasibility, Project proposal and report preparation.

### **TEXT BOOKS:**

1. *Entrepreneurship*, 8/e, Robert D Hisrich, Mathew J.Manimala, Michael PPeters, Dean A.Shepherd, McGraw HillEducation.
2. *The Dynamics of Entrepreneurial Development and Management*, VasanthDesai, Himalaya Publishing House,Mumbai.

### **REFERENCES:**

1. *Entrepreneurial Development*, S.S. Khanka, S. Chand and CompanyLimited.,
2. *Fundamentals of Entrepreneurship*, H. Nandan,PHI.
3. *Entrepreneurship Management – text and cases*, Bholanath Dutta, ExcelBooks.
4. *Entrepreneurship – New venture Creation*, Holt, andPHI.
5. *Entrepreneurial Development*, Ramachandran, Tata McGraw Hill, NewDelhi.

B. Tech IV Year I Semester

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- - 3 1.5

**(18AG0713) REMOTE SENSING & GIS APPLICATIONS IN AGRICULTURAL ENGINEERING LAB****Course objectives:***The Objective of this course are*

1. To introduce the students to the basic concepts and principles of various components of remote sensing.
2. To provide an exposure to GIS and its practical applications in Agricultural Engineering Analyze the energy interactions in the atmosphere and earth surface features

**Course outcomes:***On completion of the course the students will have knowledge on*

1. To familerize with remote sensing and GIS hardware
2. Various features of GIS softwer
3. Digitization of maps and data editing
4. Prepare drainage network maps and Landuse and land cover maps
5. Prepare slope and contour maps
6. Use of software for image interpretation

**List of Experiments:**

1. Familiarization with remote sensing and GIS hardware.
2. Basic GIS operations such as image display
3. Study of various features of GIS software package
4. Digitization of maps and data editing.
5. Data base query and map algebra.
6. Preparation of Drainage network maps
7. Preparation of Landuse and land cover maps
8. Preparation slope maps
9. Preparation of contour map
10. Use of software for image interpretation .

**References**

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.

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**B. Tech IV Year I Semester**

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**(18AG0714) AGRICULTURAL ENGINEERING LAB (VIRTUAL LAB)**

**Course Objectives**

*The Objective of this course is to make students familiar with*

1. *The design of heat exchanges, understand the Membrane separation process.*
2. *Determine the drying characteristic for rotary dryer*
3. *Heat transfer by conduction, natural convection and radiation*
4. *Determine the water content of the soil by the oven drying method, Calculate the friction in pipes and Measurement of flow using venturi meter*

**Course Outcomes**

*On successful completion of this course, the Student will be able to*

1. *Design of heat exchangers*
2. *Membrane separation process*
3. *Determine the drying characteristic for rotary dryer*
4. *Heat transfer by conduction, natural convection and radiation*
5. *Determine the water content of the soil by the oven drying method*
6. *Calculate the friction in pipes and Measurement of flow using venturi meter*

**List of experiments**

1. To study heat exchanger
2. To study heat transfer in a double pipe heat exchanger
3. To study membrane separation process
4. To determine the drying characteristic for rotary dryer
5. Heat transfer by conduction
6. Heat transfer by natural convection
7. Heat transfer by radiation
8. To determine the water content of the soil by the oven drying method.
9. To calculate the friction in pipes
10. To measure the flow using venturi meter

**References**

1. <http://vlabs.iitkgp.ac.in/cpd/exp2/index.html>
2. <http://ce-iitb.vlabs.ac.in/exp8/Aim.html?domain=Chemical%20Engineering&lab=Chemical%20Engineering%20Lab>
3. <http://vlabs.iitkgp.ac.in/cpd/exp7/index.html>
4. [http://vmt-iitg.vlabs.ac.in/Rotary\\_dryer\(theory\).html](http://vmt-iitg.vlabs.ac.in/Rotary_dryer(theory).html)
5. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=1>
6. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=791&cnt=1>
7. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1>
8. <https://smfe-iiith.vlabs.ac.in/exp/water-content/>
9. <http://fm-nitk.vlabs.ac.in/exp4/index.html#>
10. <http://fm-nitk.vlabs.ac.in/exp5/index.html>



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<b>B. Tech IV Year I Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	-	-	4	2
<b>(18AG0716) PROJECT PHASE-I</b>				

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<b>B. Tech IV Year II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>MOOCs-I</b>				

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<b>B. Tech IV Year II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>MOOCs-II</b>				

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<b>B. Tech IV Year II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	-	-	22	11
<b>(18AG0717) PROJECT PHASE-II</b>				

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<b>B. Tech IV Year II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	-	-	-	2
<b>(18AG0731) COMPREHENSIVE VIVA VOCE</b>				