Curriculum
for
Bachelor of Technology
in
Agricultural Engineering

Department of Agricultural Engineering
Triguna Sen School of Technology
Assam University Silchar
2023-24

Department of Agricultural Engineering
Triguna Sen School of Technology
Curriculum for B.Tech.

The Programme Educational Objectives (PEOs)

B.Tech in Agricultural Engineering typically outline the expected accomplishments or career achievements of graduates of the programme within a few years after graduation. The major PEOs are as follows:

1. Graduates of the program will have successfully applied their knowledge of agricultural engineering principles and techniques to solve real-world problems in agricultural production, processing, and management.
2. Graduates will have advanced in their careers in agricultural engineering or related fields, such as agribusiness, agricultural machinery manufacturing, farm management, or research and development.
3. Graduates will have developed innovative solutions to challenges in agriculture and related industries, and some may have started their own entrepreneurial ventures or contributed to technology transfer and commercialization efforts.
4. Graduates will have pursued continuous learning and professional development opportunities to stay updated with advancements in agricultural engineering and related fields, possibly through advanced degrees, professional certifications, or participation in workshops and seminars.
5. Graduates will have effectively communicated technical information and ideas to diverse audiences, including agricultural stakeholders, policymakers, and the general public, through written reports, oral presentations, and other forms of communication.

By achieving these Programme Educational Objectives, graduates of a B.Tech programme in Agricultural Engineering can make significant contributions to the agricultural sector, promote sustainable practices, and improve the quality of life for individuals and communities around the world.

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A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Course Code and Definition for Courses /offered/ Supported by ASH Department:

Course code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
C	Credits
B	Basic Science Courses
E	Engineering Science Courses
M	Humanities and Social Sciences including Management courses
OEC-ASH	Open Elective courses of ASH
LC	Laboratory course
MC	Mandatory courses
A	Audit Course

C. Course Level Coding Scheme for courses offered by ASH:

Three-digit number is used as suffix with three letters to represent department (ASH), followedby representation of the category of course in one letter (B For Basic Science Courses; E for Engineering Science Courses; H for Humanities, Social Science, including ManagementCourses; and so on). Digit at hundred's place signifies the year in which it is offered, followedby the serial number of the course.

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D. Course Code and Definition for Courses offered Agricultural Engineering Department (AG)

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
PC	Professional Core Course
EC	Engineering Science Courses
MC	Mandatory courses
PE	Professional Elective Courses
OE (#)	Open Elective Courses
PR	Project Work, Grand Viva, Seminar, Summer Training, Internship
AG	Agricultural Engineering

E. Course Level Coding Scheme for courses offered by AG:

Three-digit number is used as suffix with two letters to represent department (AG), followed byrepresentation of the category of course in two letters (PC for Professional Core Course; EC for Engineering Science Courses; PE for Professional Elective Courses, PR for Project Work, Grand Viva, Seminar, Summer Training, Internship; and so on). Digit at hundred's place signifies the year in which it is offered, followed by the serial number of the course.

F. Credits - The total credit for the B.Tech. programme is kept as **162.**

G. Course Categories wise credit break up

Sl. No.	Categories	Credit Break UP
1.	Humanities and Social Sciences including Management courses (H)	**16**
2.	Basic Science courses (B)	**20**
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer/civil etc. (EC)	**23**
4.	Professional core courses (PC)	**64**
5.	Professional Elective courses relevant to AG (PE)	**15**
6.	Open subjects – Electives from other technical and /or emerging specialization/branch/MOOCs (OE)	**09**
7.	Project work, Seminar, Summer Training and internship in industry (PR)	**15**
8.	Mandatory Courses Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition (MC)	**No Credit**
9.	Audit Course (A)	**No Credit**

H. Humanities and Social Sciences including Management courses (H)

Sl. No.	Course Code	Course Title	L	T	P	Credit	Semester
1	ASHH107	Design Thinking	0	0	2	1	I
2	ASHH154	English	2	0	2	3	II
3	ASHH155	Universal Human Values	2	1	0	3	II
4	ASHH202	Effective Technical Communication	2	0	2	3	III
5	ASHH251	Management-I (Organizational Behavior)	3	0	0	3	IV
6	ASHH301	Management-II	3	0	0	3	V

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I. Basic Science courses (B):

Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	ASHB102	Mathematics-I	3	1	0	4	I
2	ASHC101	Chemistry-I	3	1	0	4	I
3	ASHC105	Chemistry-I Lab	0	0	2	1	I
4	ASHB152	Mathematics-II	3	1	0	4	II
5	ASHP151	Physics-I	3	1	0	4	II
6	ASHP156	Physics-I Lab	0	0	2	1	II
7	ASHB201	Mathematics-III (Ordinary Differential Equation and Complex Variable)	2	0	0	2	III

J. Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer/civil etc. (EC) :

Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	ASHE103	Basic Electrical Engineering	3	1	0	4	I
2	ASHE104	Engineering Graphics and Design	1	0	4	3	I
3	ASHE106	Basic Electrical Engineering Lab	0	0	2	1	I
4	ASHE153	Programming for Problem Solving	3	0	0	3	II
5	ASHE157	Programming for Problem Solving Lab	0	0	4	2	II
6	ASHE158	Workshop/ Manufacturing Practices	1	0	4	3	II
7	AGEC203	Basic Electronics Engineering	3	1	0	4	III
8	AGEC204	Engineering Mechanics	2	1	0	3	III

K. Professional core courses (PC):

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Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	AGPC205	Fluid Mechanics	2	0	0	2	III
2	AGPC206	Thermodynamics	2	1	0	3	III
3	AGPC207	Surveying and leveling	2	0	0	2	III
4	AGPC208	Fluid Mechanics Lab.	0	0	2	1	III
5	AGPC209	Surveying and Leveling Lab.	0	0	2	1	III
6	AGPC210	Advanced Workshop Technology	0	0	4	2	III
7	AGPC252	Strength of Materials	2	1	0	3	IV
8	AGPC253	Watershed Hydrology	2	0	0	2	IV
9	AGPC254	Soil Science and Soil Mechanics	3	0	0	3	IV
10	AGPC255	Farm Power	2	0	0	2	IV
11	AGPC256	Post Harvest Operations	2	0	0	2	IV
12	AGPC257	Watershed Hydrology Lab.	0	0	2	1	IV
13	AGPC258	Soil Science and Soil Mechanics Lab.	0	0	2	1	IV
14	AGPC259	Farm Power Lab.	0	0	2	1	IV
15	AGPC260	Post Harvest Operations Lab.	0	0	2	1	IV
16	AGPC302	Kinematics and Theory of Machines	2	1	0	3	V
17	AGPC303	Soil and Water Conservation Engineering	3	0	0	3	V
18	AGPC304	Farm Machinery	2	0	0	2	V
19	AGPC305	Mechanical Operation in Food Processing	2	0	0	2	V
20	AGPC306	Soil and Water Conservation Engineering. Lab.	0	0	2	1	V
21	AGPC307	Farm Machinery Lab.	0	0	2	1	V
22	AGPC308	Mechanical Operation in Food Processing Lab.	0	0	2	1	V
23	AGPC351	Thermal Operation in Food Processing	3	0	0	3	VI
24	AGPC352	Machine Design and drawing	2	0	0	2	VI
25	AGPC353	Renewable Energy Technologies	2	0	0	2	VI
26	AGPC354	Irrigation & Drainage Engineering	2	0	0	2	VI
27	AGPC355	Aquacultural Engineering	3	0	0	3	VI
28	AGPC356	Thermal Operation in Food Processing Lab.	0	0	2	1	VI
29	AGPC357	Machine Design and drawing Lab.	0	0	2	1	VI

30	AGPC358	Renewable Energy Technologies Lab	0	0	2	1	VI
31	AGPC359	Irrigation & Drainage Engineering Lab.	0	0	2	1	VI
32	AGPC401	Land and Water Resource Management	3	0	0	3	VII
33	AGPC402	Fruits and Vegetable Processing	2	1	0	3	VII
34	AGPC451	Engineering Properties of Food Materials	**2**	**0**	**0**	**2**	VIII

L. Professional Elective courses (PE):

Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credit**	**Semester**
1	AGPE31*	Professional Elective – I	3	0	0	3	V
2	AGPE35*	Professional Elective II	3	0	0	3	VI
3	AGPE40*	Professional Elective - III	3	0	0	3	VII
4	AGPE40*	Professional Elective -IV	3	0	0	3	VII
5	AGPE45*	Professional Elective - V	3	0	0	3	VIII

* Serial Number mentioned in the Basket of Professional Electives of course structure.

M. Open subjects – Electives from other technical and /or emerging specialization/branch/MOOCs (OE):

Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credit**	**Semester**
1	#	Open Elective –I	3	0	0	3	VI
2	#	Open Elective – II	3	0	0	3	VII
3	#	Open Elective – III	3	0	0	3	VIII

Course will be offered by other Department or Selected from MOOCs

N. Project work, Seminar, Summer Training and internship in industry (PR):

Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	AGPR309	Summer Training - I	0	0	0	2	V
2	AGPR403	Summer Training - II	0	0	0	2	VII
3	AGPR404	Project- I	0	0	10	5	VII
4	AGPR453	Project- II	0	0	12	6	VIII

O. Mandatory Courses; Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition (MC):

Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	AGMC261	Environmental Science	2	0	0	0	IV

P. Audit Course (A):

Sl No	Course Code	Course Title	L	T	P	Credit	Semester
1	ASHA108	IDEA Lab Workshop	2	0	4	0	I
2	ASHA159	Sports and Yoga or NCC/ NSS	2	0	0	0	II
3	ASHA302	Constitution of India	2	0	0	0	V

Q. Basket of Professional Electives:

Semester V	
Professional Elective -I	
Sl. No.	**Name of Electives**
1.	Watershed Planning and Management
2.	Dairy Food Technology
3.	Testing & Evaluation of Tractors & Machines
4.	Water Quality Management Practices
5.	Photovoltaic Technology and Systems

Semester VI	
Professional Elective -II	
Sl. No.	**Name of Electives**
1.	Refrigeration & Air Conditioning
2.	Advanced Farm Power
3.	Food Packaging Technology
4.	Planning and Design of Aquaculture Project

Semester VII	
Professional Elective -III	
Sl. No.	**Name of Electives**
1.	Environmental Engineering Fundamentals
2.	Food Fermentation Technology
3.	Open Channel Hydraulics & Coastal Engineering

4.	Bio-Energy Systems: Design and Applications
Professional Elective -IV	
5.	Planning and Design of Aquaculture Facilities
6.	Tea Technology
7.	Earth Moving Machinery
8.	Food Chemistry and Microbiology

Semester VIII	
Professional Elective -V	
Sl. No.	**Name of Electives**
1.	Agricultural Business Management
2.	Food Safety and Quality Assurance
3.	Instrumentation and Control
4.	Building Materials & Structural Design
5.	Renewable Power Sources

R. Bridge Courses:

For Lateral Entry from B.Voc. to B.Tech. Students only

Sl. No	Course Code	Course Title	L	T	P	Credits	Semester
1.	ASHC101	Chemistry-I	3	1	0	4	III
2.	ASHE103	Basic Electrical Engineering	3	1	0	4	III
3.	ASHP151	Physics-I	3	1	0	4	IV
4.	ASHE153	Programming for Problem Solving	3	0	0	3	IV

Course Structure B.Tech. (Agricultural Engineering)

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Semester I [First year]

Sl N	Category of Course	Course Code	Course Title	L	T	P	Credit	Type
1.	Basic Science Course	ASHC101	Chemistry-I	3	1	0	4	Theory Paper
2.	Basic Science Course	ASHB102	Mathematics-I	3	1	0	4	Theory Paper
3.	Engineering ScienceCourse	ASHE103	Basic Electrical Engineering	3	1	0	4	Theory Paper
4.	Engineering ScienceCourse	ASHE104	Engineering Graphicsand Design	1	0	4	3	Practical Paper
5.	Basic Science Course	ASHC105	Chemistry-I Lab	0	0	2	1	Practical Paper
6.	Engineering ScienceCourse	ASHE106	Basic Electrical Engineering Lab	0	0	2	1	Practical Paper
7.	Humanities Social Science including Management Courses	ASHH107	Design Thinking	0	0	2	1	Practical Paper
8.	Audit Course	ASHA108	IDEA Lab Workshop	2	0	4	0	Practical Paper
			Total				**18**	

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Semester II [First year]

Sl No	Category of Course	Course Code	Course Title	L	T	P	Credit	Type
1.	Basic Science Course	ASHP151	Physics-I	3	1	0	4	Theory Paper
2.	Basic Science Course	ASHB152	Mathematics-II	3	1	0	4	Theory Paper
3.	Engineering ScienceCourse	ASHE153	Programming for ProblemSolving	3	0	0	3	Theory Paper
4.	Humanities Social Scienceincluding Management Courses	ASHH154	English	2	0	2	3	Theory Paper
5.	Humanities Social Scienceincluding Management Courses	ASHH155	Universal Human Values	2	1	0	3	Theory Paper
6.	Basic Science Course	ASHP156	Physics-I Lab	0	0	2	1	Practical Paper
7.	Engineering ScienceCourse	ASHE157	Programming for ProblemSolving Lab	0	0	4	2	Practical Paper
8.	Engineering ScienceCourse	ASHE158	Workshop/ ManufacturingPractices	1	0	4	3	Practical Paper
9.	Audit Course	ASHA159	Sports and Yoga or NCC/NSS	2	0	0	0	Practical Paper
			Total				**23**	

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Semester III [Second year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	ASHB201	Mathematics-III (Ordinary Differential Equation and Complex Variable)	2	0	0	2	2
2	ASHH202	Effective Technical Communication	2	0	2	4	3
3	***AGEC203***	***Basic Electronics Engineering***	3	1	0	4	4
4	AGEC204	Engineering Mechanics	2	1	0	3	3
5	AGPC205	Fluid Mechanics	2	0	0	2	2
6	AGPC206	Thermodynamics	2	1	0	3	3
7	AGPC207	Surveying and leveling	2	0	0	2	2
8	AGPC208	Fluid Mechanics Lab.	0	0	2	2	1
9	AGPC209	Surveying and Leveling Lab.	0	0	2	2	1
10	AGPC210	Advanced Workshop Technology	0	0	4	4	2
						28	**23**
		Total Credits: 23					

Bridge Courses:

For Lateral Entry from B.Voc. to B.Tech. Students only

Sl. No	Course Code	Course Title	L	T	P	Total Contact hours	Credits
1.	ASHC101	Chemistry-I	3	1	0	4	4
2.	ASHE103	Basic Electrical Engineering	3	1	0	4	4

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Semester IV [Second year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	ASHH251	Management-I (Organizational Behaviour)	3	0	0	3	3
2	AGPC252	Strength of Materials	2	1	0	3	3
3	AGPC253	Watershed Hydrology	2	0	0	2	2
4	AGPC254	Soil Science and Soil Mechanics	3	0	0	3	3
5	AGPC255	Farm Power	2	0	0	2	2
6	AGPC256	Post Harvest Operations	2	0	0	2	2
7	AGPC257	Watershed Hydrology Lab.	0	0	2	2	1
8	AGPC258	Soil Science and Soil Mechanics Lab.	0	0	2	2	1
9	AGPC259	Farm Power Lab.	0	0	2	2	1
10	AGPC260	Post Harvest Operations Lab.	0	0	2	2	1
11	AGMC261	Environmental Science	2	0	0	2	0
						25	**19**
	Total Credits: 19						

Bridge Courses:

For Lateral Entry from B.Voc. to B.Tech. Students only

Sl. No	Course Code	Course Title	L	T	P	Total Contact hours	Credits
1.	ASHP151	Physics-I	3	1	0	4	4
2.	ASHE153	Programming for Problem Solving	3	0	0	3	3

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Semester V [Third year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	ASHH301	Management-II	3	0	0	3	3
2	AGPC302	Kinematics and Theory of Machines	2	1	0	3	3
3	AGPC303	Soil and Water Conservation Engineering	3	0	0	3	3
4	AGPC304	Farm Machinery	2	0	0	2	2
5	AGPC305	Mechanical Operation in Food Processing	2	0	0	2	2
6	AGPC306	Soil and Water Conservation Engineering. Lab.	0	0	2	2	1
7	AGPC307	Farm Machinery Lab.	0	0	2	2	1
8	AGPC308	Mechanical Operation in Food Processing Lab.	0	0	2	2	1
9	AGPR309	Summer Training - I	-	-	-	-	2
10	ASHA302	Constitution of India	2	0	0	2	0
11	AGPE31*	Professional Elective – I	3	0	0	3	3
						26	**21**
		Total Credits: 21					

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Semester VI [Third year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	AGPC351	Thermal Operation in Food Processing	3	0	0	3	3
2	AGPC352	Machine Design and drawing	2	0	0	2	2
3	AGPC353	Renewable Energy Technologies	2	0	0	2	2
4	AGPC354	Irrigation & Drainage Engineering	2	0	0	2	2
5	AGPC355	Aquacultural Engineering	3	0	0	3	3
6	AGPC356	Thermal Operation in Food Processing Lab.	0	0	2	2	1
7	AGPC357	Machine Design and drawing Lab.	0	0	2	2	1
8	AGPC358	Renewable Energy Technologies Lab	0	0	2	2	1
9	AGPC359	Irrigation & Drainage Engineering Lab.	0	0	2	2	1
10	AGPE35*	Professional Elective II	3	0	0	3	3
11	#	Open Elective –I	3	0	0	3	3
						26	**22**
		Total Credits: 22					

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Semester VII [Fourth year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	AGPC401	Land and Water Resource Management	3	0	0	3	3
2	AGPC402	Fruits and Vegetable Processing	2	1	0	3	3
3	AGPR403	Summer Training - II	-	-	-	-	2
4	AGPR404	Project- I	0	0	10	10	5
5	AGPE40*	Professional Elective - III	3	0	0	3	3
6	AGPE40*	Professional Elective - IV	3	0	0	3	3
7	#	Open Elective – II	3	0	0	3	3
						25	**22**
Total Credits: 22							

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Semester VIII [Fourth year]

Sl. No.	Course Code	Course Title	Hours per week			Total Contact hours	Credits
			Lecture	Tutorial	Practical		
1	AGPC451	Engineering Properties of Food Materials	**2**	**0**	**0**	**2**	**2**
2	AGPR452	Project- II	0	0	12	12	6
3	AGPE45*	Professional Elective - V	3	0	0	3	3
4	#	Open Elective – III	3	0	0	3	3
						20	**14**
Total Credits: 14							

Proposed total credits of four-year B.Tech. (Agricultural Engineering): 162

* Serial Number mentioned in the Basket of Professional Electives of course structure.

Course will be offered by other Department or Selected from MOOCs.

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Syllabus
B.Tech.
(Agricultural Engineering)

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FIRST YEAR

Department of Agricultural Engineering
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Semester I

COURSE CODE:	**COURSE NAME:**	L	T	P	C
i) ASHC101 ii) ASHC105	i) Chemistry-I	3	1	0	4
	ii) Chemistry-I Lab	0	0	2	1

Category of Course: Basic Science Course

Course Objectives:

1. To understand the basic concepts of bonding and shapes of atoms, molecules and solids.
2. To understand the concepts of crystal field theory of transition metal ions.
3. To understand the basic concepts of different spectroscopic techniques and its applications in emerging fields.
4. To study the interaction forces of gases and potential energy surfaces of molecules.
5. To study the different thermodynamic functions.
6. To study the basic concepts of oxidation and reduction
7. To study the different properties of periodic table.
8. To understand the phenomenon of isomerism and optical activity.
9. To study different types of organic reactions.
10. Chemistry lab will provide students with the first-hand experience of verifying various theoretical concepts learnt in theory courses.

Course Outcomes:

This course will enable the students to

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and will help in identifying different organic molecules.
4. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. Learnt the different types of organic reactions.
6. Apply basic knowledge of chemistry to solve real-world problems.
8. Estimate rate constants of reactions from concentration of reactants/products as a function of time.
9. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
10. Synthesize a small drug molecule and analyse a salt sample

Engineering Chemistry [L:3; T:1; P:0 (4 credits)]

Course Contents:

UNIT I:

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. 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. Band structure of solids and the role of doping on band structures.

UNIT II:

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

UNIT III:

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces. Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams

UNIT-IV:

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT-V:

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text/Reference 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

Engineering Chemistry Lab [L:0; T:0; P:2 (1 credit)]

Engineering Chemistry Lab

Experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscometers to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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COURSE CODE: ASHB102	**COURSE NAME:**	L	T	P	C
	Mathematics-I (Calculus and Linear Algebra)	3	1	0	4

Category of Course: Basic Science Courses

Course Objectives:

1. To introduce the idea of applying differential and integral calculus to the notions of Curvature and to improper integrals. Apart from some applications, it gives a basic introduction on Beta and Gamma functions.
2. To discuss Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. To develop the tool of matrices to solve systems of linear equations arising in many engineering problems by different methods.
4. To familiarize the students with the concepts of vector spaces that is essential in most branches of engineering.

Course Outcomes:

At the end of the course the students should be able to

1. understand the basic knowledge of Calculus and its applications
2. be familiar with the concept of Matrices and solution of system of linear equations
3. be thorough with the concept of Linear Algebra and its applications in engineering

Course Contents:

Unit I: **Calculus**

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit II: Calculus

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Unit III: **Matrices**

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Unit IV: **Vector Spaces**

Vector Space, linear dependence and independence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

Unit V: **Vector Spaces**

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Text Books/ References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

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COURSE CODE:	**COURSE NAME:**	L	T	P	C
iii) ASHE103 iv) ASHE106	iii) Basic Electrical Engineering	3	1	0	4
	iv) Basic Electrical Engineering Lab	0	0	2	1

Category of Course: Basic Science Course

Course Objectives:

11. To understand and analyze basic electric and magnetic circuits.
12. To study the working principles of electrical machines and power converters.
13. To introduce the components of high and low-voltage electrical installations.

Course Outcomes:

The students will learn:

1. To explain the strong basics of Electrical Engineering and practical implementation of Electrical fundamentals.
2. To identify different applications of commonly used electrical machinery.

Course Contents:

UNIT I:

D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields.

UNIT II:

Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three-phase systems, Generation of three-phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three-phase circuits, measurement of power by two wattmeter method.

UNIT III:

Transformers covering, Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation; Synchronous

Generators covering, Principle of operation; Types and constructional features; EMF equation.

UNIT-IV:

DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor.

UNIT V:

Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation.

Suggested Books

1. AICTE's Prescribed Textbook: Basic Electrical Engineering, Khanna Book Publishing
2. Ritu Sahdev (2022), Basic Electrical Engineering, Khanna Book Publishing.
3. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
4. Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India Hughes, E.
2005)
7. Mittel & Mittal, Basic Electrical Engineering, Tata McGraw Hill.

ASHE106-- Basic Electrical Engineering Lab

Physics Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.

3. Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary sides. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

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COURSE CODE: ASHE104	**COURSE NAME:**	L	T	P	C
	Engineering Graphics & Design	1	0	4	3

Category of Course: Engineering Science Courses

Course Objectives:

The objective of this Course is to provide the basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning, and specifications, so useful for a student in preparing for an engineering career.

Course Outcomes:

After the completion of the course, the learner will be able to

1. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. use the techniques, skills, and modern engineering tools necessary for engineering practice.
3. describe engineering design and its place in society.
4. discuss the visual aspects of engineering design.
5. use engineering graphics standards.
6. illustrate solid modelling.
7. use computer-aided geometric design.
8. design creating working drawings.
10. inspect engineering communication.

Course Contents:

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

Unit I: **Introduction to Engineering Drawing**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier

Scales; Orthographic Projections Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Unit II: Projections of Regular Solids

Covering those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids,objects from industry and dwellings (foundation to slab only)..

Unit III: **Isometric Projections**

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Viewsand Vice-versa, Conventions;

Unit IV: **Overview of Computer Graphics**

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Customisation & CAD Drawing Consisting of set up of the drawing page and the printer, including scale settings, setting up of Modules and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Unit V: **Annotations, layering & other functions**

Covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computeraided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part

editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Demonstration of a simple team design project that illustrates

Geometry and topology of engineered components: creation of engineering models and their

presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed

topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Text Books/ References:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing
House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. (Corresponding set of) CAD Software Theory and User Manuals

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COURSE CODE: ASHH107	**COURSE NAME:**	L	T	P	C
	Design Thinking	0	0	2	1

Category of Course: Humanities and Social Sciences including Management courses

Course Objectives:

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes:

Student will able to

1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education
2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development
5. Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

Course Contents:

Unit I: **An Insight to Learning**

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting, Understanding the Memory process, Problems in retention, Memory enhancement techniques, Understanding Emotions, Experience & Expression, Assessing Empathy, Application with Peers

Unit II: Basics of Design Thinking

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Unit III: **Being Ingenious & Fixing Problem**

Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving, Understanding Individual differences & Uniqueness, Group

Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Unit IV: **Process of Product Design**

Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design

Unit V: **Prototyping & Testing**

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing

Text Books/ References:

As provided by the course instructor.

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COURSE CODE: ASHA108	**COURSE NAME:**	L	T	P	C
	IDEA Lab Workshop	2	0	4	0

Category of Course: Audit Course

Course Objectives:

The objective of Idea Lab is to make engineering graduates more imaginative and creative in critical thinking, problem solving, design thinking, collaboration, communication, lifelong learning etc. In addition, it will help them

1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. To learn useful mechanical and electronic fabrication processes.
3. To learn necessary skills to build useful and standalone system/ project with enclosures.
4. To learn necessary skills to create print and electronic documentation for the system/project

Course Outcomes:

Upon completion of this laboratory course, students will be able to

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiselling.

Course Contents:

Unit I:

Introduction to basic hand tools - Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading.

Adhesives

Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,

Unit II:

Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc.

Basic welding and brazing and other joining techniques for assembly.

Concept of Lab aboard a Box.

Unit III:

3D printing and prototyping technology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering.

Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers.
Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab

Unit IV:
Discussion and implementation of a mini project.

Unit V:
Documentation of the mini project (Report and video).

List of Lab activities and experiments:

1. Machining of 3D geometry on soft material such as soft wood or modelling wax.
2. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
3. Familiarity and use of welding equipment.
4. Familiarity and use of normal and wood lathe.
5. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

Text Books/ References:

1. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
2. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
3 Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
4. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
5. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
6. Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 978-9352133703
7. Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
8. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633
9. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13 : 978-1260019193.
10. Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13 : 978-1484200773
11. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.
12. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010

13. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.

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Semester II

COURSE CODE: i) ASHP151 ii) ASHP156	**COURSE NAME:**	L	T	P	C
	v) Physics-I	3	1	0	4
	ii) Physics-I Lab	0	0	2	1

Category of Course: Basic Science Course

Course Objectives:

14. To use scalar and vector analytical techniques for analysing forces
15. To understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
16. To study Bragg's Law and introduce the basic concept of crystallography
17. To study the basic concepts of quantum physics.
18. To understand the principles of semiconductor Physics
19. Physics lab provides students with the first-hand experience of verifying various theoretical concepts learnt in theory courses.

Course Outcomes:

At the end of the course, the students will be able to learn the basics of physics and apply them to solve engineering problems.

1. Understand and be able to apply Newton's laws of motion.
2. Understand and be able to apply other basic dynamics concepts - the Work-Energy principle and Impulse-Momentum.
3. Knowledge to solve simple quantum mechanics calculations
4. Understand and utilize the mathematical models of semiconductor junctions
5. Understand various laws which they have studied through experiments
6. Apply basic knowledge of physics to solve real-world problems

Course Contents:

UNIT I:

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Solving Newton's equations of motion in polar coordinates; Potential energy function; F = - Grad V; Conservative and non-conservative forces; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Application: Satellite manoeuvres; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance.

UNIT II:

Crystal structure: Seven systems of crystals, Bravais space lattice, crystal structure (bce, fee and sc) lattice dimensions, lattice planes, and miller indices and their significance, X-rays-absorption of X-rays diffraction, Bragg's law. Bragg's X-ray spectrometer.

UNIT III:

Wave particle duality, Uncertainty principle, Free-particle wave function and wave-packets, probability current, Expectation values, Schrodinger equation and its application to particle in a box and harmonic oscillator.

UNIT-IV:

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

UNIT V:

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

Suggested Books

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. An Introduction to Mechanics — D Kleppner & R Kolenkow
4. Principles of Mechanics — JL Synge & BA Griffiths
5. Mechanics — JP Den Hartog
6. Introduction to Quantum Physics D. J. Griffiths,
7. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
8. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
9. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
10. Charks Kittle, Introduction to Solid State Physics, John Wiley & Sons
11. Chottopadhyay and Rakshit, Quantum Mechanics, Statistical Mechanics and Solid State Physics

Physics-I Lab

Physics Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

Experiments from the following:

Introduction to Electromagnetic Theory
1. Magnetic field from Helmholtz coil
2. Measurement of Lorentz force in a vacuum tube.

Introduction to Mechanics
1. Coupled oscillators
2. Experiments on an air-track
3. Experiment on the moment of inertia measurement
4. Experiments with gyroscope
5. Resonance phenomena in mechanical oscillators.

Quantum Mechanics for Engineers
1. Frank-Hertz experiment
2. Photoelectric effect experiment
3. Recording hydrogen atom Spectrum

Oscillations, waves and optics
1. Diffraction and interference experiments (from ordinary light or laser pointers)
2. Measurement of the speed of light on a tabletop using modulation
3. Minimum deviation from a prism.

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COURSE CODE: ASHB152	**COURSE NAME:**	L	T	P	C
	Mathematics-II (Probability and Statistics)	3	1	0	4

Category of Course: Basic Science Courses

Course Objectives:

1. To make the students familiar with the basics of probability theory.
2. To explain the use of continuous and bivariate probability distributions in all branches of engineering.
3. To develop the tools of basic statistics, applied statistics and small samples in connection with engineering purpose.

Course Outcomes:

At the end of the course the students will be able to learn the basics of Probability and Statistics and apply them to solve engineering problems.

Course Contents:

Unit I: **Basic Probability**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables.

Unit II: Continuous Probability Distributions

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

Unit III: **Other Distributions**

Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials; Expectation of Discrete Random Variables, Correlation coefficient.

Unit IV: **Basic Statistics**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions. Test of significance.

Unit V: **Applied Statistics**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas

and more general curves. Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Text Books/ References:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. T. Veerarajan, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

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COURSE CODE:	**COURSE NAME:**	L	T	P	C
i) ASHE153 ii) ASHE157	i) Programming for Problem Solving	3	0	0	3
	ii) Programming for Problem Solving Lab	0	0	4	2
Category of Course: Engineering Science Courses					

Course Objectives:

20. To learn the fundamentals of computers.
21. To understand the various steps in program development.
22. To learn the syntax and semantics of C programming language.
23. To learn the usage of structured programming approach in solving problems.
24. To understated and formulate algorithm for programming script
25. To analyze the output based on the given input variables

Course Outcomes:

The student will learn

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course Contents:

Unit I:

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:
Flowchart/Pseudo code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Unit II:

Arithmetic expressions and precedence.

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Arrays (1-D, 2-D), Character arrays and Strings.

Unit III:
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

Unit IV:
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Structures, Defining structures and Array of Structures

Unit V:
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

File handling (only if time is available, otherwise should be done as part of the lab)

ASHE157 Programming for problem Solving Lab
Laboratory - Programming for Problem Solving [L : 0; T:0 ; P : 4 (2credits)]

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Suggested Text/ Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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COURSE CODE: ASHH154	**COURSE NAME:**	L	T	P	C
	English	2	0	2	3

Category of Course: Humanities and Social Sciences including Management courses

Course Objectives:

1. To provide learning environment to practice listening, speaking, reading and writing skills.
2. To assist the students to carry on the tasks and activities through guided instructions and materials.
3. To effectively integrate English language learning with employability skills and training.
4. To provide hands-on experience through group and individual presentations.

Course Outcomes:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Contents:

Unit I: Vocabulary Building

1.1. The concept of Word Formation
1.2. Root words from foreign languages and their use in English
1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4. Synonyms, antonyms, and standard abbreviations.

Unit II: Basic Writing Skills

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

Unit III: Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

Unit IV: Nature and Style of Sensible Writing
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion
4.6 Comprehension
4.7 Précis Writing
4.8 Essay Writing

Unit V: Oral Communication
5.1 Listening Comprehension
5.2 Pronunciation, Intonation, Stress and Rhythm
5.3 Common Everyday Situations: Conversations and Dialogues
5.4 Communication at Workplace
5.5 Interviews
5.6 Formal Presentations

Text Books/ References:

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. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. 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, Hyderabad. Oxford University Press.

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COURSE CODE: ASHH155	**COURSE NAME:**	L	T	P	C
	Universal Human Values	2	1	0	3

Category of Course: Humanities and Social Sciences including Management courses

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and
2. 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
3. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
4. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
5. To provide a much-needed orientational input in value education to the young enquiring minds.

Course Outcomes:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-today settings in real life, at least a beginning would be made in this direction.

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behaviour
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

This is only an introductory foundational input. It would be desirable to follow it up by

a) Faculty-student or mentor-mentee programs throughout their time with the institution

b) Higher level courses on human values in every aspect of living.

Course Contents:

Unit I: **Introduction to Value Education**

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: Self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

Unit II: Harmony in the Human Being

Lecture 7: Understanding Human being as the Co-existence of the Self and the Body
Lecture 8: Distinguishing between the Needs of the Self and the Body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body
Lecture 9: The Body as an Instrument of the Self
Lecture 10: Understanding Harmony in the Self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self
Lecture 11: Harmony of the Self with the Body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of Self with the Body

Unit III: **Harmony in the Family and Society**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

Unit IV: **Harmony in the Nature/Existence**
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

Unit V: **Implications of the Holistic Understanding – a Look at Professional Ethics**
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Text Books/ References:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana,
2. G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-
3. 47-1
4. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
5. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
6. The Story of Stuff (Book).

7. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
8. Small is Beautiful - E. F Schumacher.
9. Slow is Beautiful - Cecile Andrews
10. Economy of Permanence - J C Kumarappa
11. Bharat Mein Angreji Raj – Pandit Sunderlal
12. Rediscovering India - by Dharampal
13. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
14. India Wins Freedom - Maulana Abdul Kalam Azad
15. Vivekananda - Romain Rolland (English)
16. Gandhi - Romain Rolland (English)

COURSE CODE: ASHE158	**COURSE NAME:**	L	T	P	C
	Workshop/Manufacturing Practices	1	0	4	3

Category of Course: Engineering Science Courses

Course Objectives:

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, foundry operations and fitting
4. To have a study on measurement of electrical quantities, energy and resistance to earth.
5. To have a practice on soldering

Course Outcomes:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Upon completion of this laboratory course, students will be able:

1. To fabricate components with their own hands.
2. To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible
3. with different manufacturing processes.
4. To design small devices of their interest by assembling different components

Course Contents:

Module I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Module II: CNC machining, Additive manufacturing.

Module III: Fitting operations & power tools.

Module IV: Electrical & Electronics.

Module V: Carpentry.
Module VI: Plastic moulding, glass cutting.
Module VII: Metal casting.
Module VIII: Welding (arc welding & gas welding), brazing.

Practicals:
1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

Text Books/ References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai**.**
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

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COURSE CODE: ASHA159	**COURSE NAME:**	L	T	P	C
	Sports and Yoga	2	0	0	0

Category of Course: Audit Course

Course Objectives:

1. To make the students understand the importance of sound health and fitness principles as they relate to better health.
2. To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
3. To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
4. To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Course Outcomes:

On successful completion of the course the students will be able:

1. To practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
2. To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
3. To learn breathing exercises and healthy fitness activities
4. To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
5. To perform yoga movements in various combination and forms.
6. To assess current personal fitness levels.
7. To identify opportModuleies for participation in yoga and sports activities.
8. To develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
9. To improve personal fitness through participation in sports and yogic activities.
10. To develop understanding of psychological problems associated with the age and lifestyle.
11. To demonstrate an understanding of sound nutritional practices as related to health and physical performance.
12. To assess yoga activities in terms of fitness value.
13. To identify and apply injury prevention principles related to yoga and physical fitness activities.
14. To understand and correctly apply biomechanical and physiological principles elated to exercise and training.

Course Contents:

Unit I:

Module I: Introduction to Physical Education

Meaning & definition of Physical Education
Aims & Objectives of Physical Education
Changing trends in Physical Education
Module II: Olympic Movement
Ancient & Modern Olympics (Summer & Winter)
Olympic Symbols, Ideals, Objectives & Values
Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Unit II:
Module III: Physical Fitness, Wellness & Lifestyle
Meaning & Importance of Physical Fitness & Wellness
Components of Physical fitness
Components of Health related fitness
Components of wellness
Preventing Health Threats through Lifestyle Change
Concept of Positive Lifestyle
Module IV: Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga
Define Anatomy, Physiology & Its Importance
Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
Module V: Kinesiology, Biomechanics & Sports
Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
Newton's Law of Motion & its application in sports.
Friction and its effects in Sports.

Unit III:
Module VI: Postures
Meaning and Concept of Postures.
Causes of Bad Posture.
Advantages & disadvantages of weight training.
Concept & advantages of Correct Posture.
Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
Corrective Measures for Postural Deformities

Module VII: Yoga
Meaning & Importance of Yoga
Elements of Yoga
Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
Relaxation Techniques for improving concentration - Yog-nidra
Module VIII: Yoga & Lifestyle

Asanas as preventive measures.
Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

Unit IV:
Module IX: Training and Planning in Sports
Meaning of Training
Warming up and limbering down
Skill, Technique & Style
Meaning and Objectives of Planning.
Tournament – Knock-Out, League/Round Robin & Combination.
Module X: Psychology & Sports
Definition & Importance of Psychology in Physical Edu. & Sports
Define & Differentiate Between Growth & Development
Adolescent Problems & Their Management
Emotion: Concept, Type & Controlling of emotions
Meaning, Concept & Types of Aggressions in Sports.
Psychological benefits of exercise.
Anxiety & Fear and its effects on Sports Performance.
Motivation, its type & techniques.
Understanding Stress & Coping Strategies.
Module XI: Doping
Meaning and Concept of Doping
Prohibited Substances & Methods
Side Effects of Prohibited Substances

Unit V:
Module XII: Sports Medicine
First Aid – Definition, Aims & Objectives.
Sports injuries: Classification, Causes & Prevention.
Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries
Module XIII: Sports / Games
Following subtopics related to any one Game/Sport of choice of student out of:
Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.
History of the Game/Sport.
Latest General Rules of the Game/Sport.
Specifications of Play Fields and Related Sports Equipment.

Important Tournaments and Venues.
Sports Personalities.
Proper Sports Gear and its Importance.

Text Books/ References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

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SECOND YEAR

Semester III

COURSE CODE: ASHB201	**COURSE NAME:**	L	T	P	C
	Mathematics-III (Calculus, Differential Equations and Algebraic Structures)	2	0	0	2
Category of Course: Basic Science Courses					
Course Objectives: 1. To present the effective mathematical tools for the solutions of differential equations that model physical processes. 2. To introduce the tools of different multivariable calculus and algebraic structures that are used in the modeling of various engineering problems.					
Course Outcomes: At the end of the course the students should be able to 1. understand the basics of ordinary differential equations and their applications in engineering 2. get familiar with the concept of sequences, series, multivariable calculus and algebraic structures and their applications					

Course Contents:

Unit – 1: Sequences and Series

Convergence of sequence and series, tests for convergence; Power series, Taylor's series.

Unit – 2: Multivariable Calculus

Limit, continuity and partial derivatives, directional derivatives, total derivative. Maxima, minima and saddle points; Gradient, Curl, Divergence.

Unit– 3: First order ordinary differential equations

Exact, linear and Bernoulli's equations, Euler's equations

Unit – 4: Ordinary differential equations of higher degree and higher orders

Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients, method of variation of parameters.

Unit – 5: Algebraic Structures

Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Text books/References:

1. G. B. Thomas and R .L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint,
   2002.
2. E. Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9thEdn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rdEd., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

COURSE CODE: ASHH202	**COURSE NAME:**	L	T	P	C
	Effective Technical Communication	2	0	2	3

Category of Course: Humanities and Social Sciences including Management courses

Course Objectives:

Considering the significance of English language as a tool for academic and professional communication, the course aims to develop and enhance the linguistic and communicative competence of the learners. This course aims to train the B.Tech students in basic principles of communication and language by developing their LSRW skills, namely listening, speaking, reading and writing skills, and thereby, improving their proficiency in oral and written communication in English. During the course, the learners will be exposed to various forms of professional communication.

Course Outcomes:

1. At the successful completion of the course, students will be able to understand
2. How communication works and why it is important
3. The barriers, challenges, and frameworks of business communication
4. Methods for speaking and presenting with confidence
5. How to share views in a professional setting
6. Different types of reading based on purpose
7. Techniques for writing crisp and professional business documents

8. How to interact in one-on-one or group meetings

Course Contents:

Unit I:
Differences between technical and literary style; Different kinds of technical documents; Organization structures; Strategies for organization; writing for print and for online media; Recognizing coherence and sequencing of sentences.

Unit II:
Technical Writing; Grammar and Editing; Creating indexes; Technical writing style and language; Editing strategies to achieve appropriate technical style. Basics of grammar; Study of advanced grammar; Use of appropriate diction.

Unit III:
Public speaking; Group discussion; Oral presentation; Interviews; Graphic presentation; Presentation aids; Rapid reading; Impromptu Speech.

Unit IV:
Newsletters; Technical articles; Manuals; Official notes; Business letters; Memos; Progress reports; Minutes of meetings; Event report; Writing project report; Official letter writing; Paragraph Writing; Brochures; Manuals; Notice; Agendas; Minutes of the Meeting; Event Report.

Unit V:
Writing Etiquettes in social and office settings; Email etiquettes; Requests, Offers, Refusal, Acceptance; Initiating and closing conversations; Tempo of speech & Phrasal pause.

Text Books/ References:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

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AGEC203	Basic Electronics Engineering	3L:1T:0P	4 Credits

Objectives of the course

To provide an overview of electronic device components to Agricultural engineering students

Outcomes of Course

Students should be able to identify and describe the function of basic electronic components such as resistors, capacitors, inductors, diodes, and transistors.

Syllabus Contents

Unit 1: Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and

79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Unit 2: Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Unit 3:Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and

mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Unit 4: Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, de-

multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Unit 5: Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Course Outcomes

At the end of this course students will demonstrate the ability to

- Understand the principles of semiconductor devices and their applications.
- Design an application using Operational amplifier.
- Understand the working of timing circuits and oscillators.
- Understand logic gates, flip flop as a building block of digital systems.
- Learn the basics of Electronic communication system.

References

1.Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2.R.P. Jain, "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3.Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001.

AGEC 204	Engineering Mechanics	2L:1T:0P	3 Credits

Course Objective:

1. Understand fundamental principles governing static and dynamic systems.
2. Analyze and solve engineering problems in agricultural machinery and structures.
3. Foster critical thinking and problem-solving skills in agricultural engineering.

Course Outcomes:

1. Apply laws of mechanics and principles of equilibrium to agricultural systems.
2. Predict behaviour of agricultural structures under different loading conditions.
3. Calculate forces and moments in static systems using appropriate methods.
4. Analyze motion of agricultural machinery components using kinematics and dynamics principles,

Course Content:

Unit 1: *Introduction to Engineering Mechanics covering,* Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its

Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Unit 2:*Basic Structural Analysis covering,* Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit 3: *Virtual Work and Energy Method*- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Unit 4: *Review of particle dynamics*- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit 5: *Introduction to Kinetics of Rigid Bodies covering,* Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

References

1. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, –Dynamics, 9th Ed, Tata McGraw Hill.
2. Andy Ruina and RudraPratap (2011), Introduction to Statics and Dynamics, Oxford UniversityPress.
3. Reddy Vijaykumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics.
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
5. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

AGPC 205 Fluid Mechanics 2L:0T:0P 2 Credits

Course Objective:

1. Understand the fundamental principles governing fluid behavior and flow.
2. Analyze and solve fluid-related problems encountered in agricultural engineering.
3. Develop skills for designing and optimizing fluid systems in agricultural applications.

Course Outcomes:

1. Apply principles of fluid statics and dynamics to analyze fluid behavior.
2. Calculate pressure, velocity, and flow rates in agricultural fluid systems.
3. Design irrigation, drainage, and hydraulic systems for efficient water management.
4. Evaluate the performance of pumps, turbines, and other fluid machinery used in agriculture.

Syllabus Contents:-

Unit 1: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension,
capillarity, Bulk modulus of elasticity, compressibility.

Unit 2: Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Unit 3: 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.

Unit 4: One-, two- and three -dimensional continuity equations in Cartesian coordinates. Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube.

Unit 5: Momentum principle: Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

References:-

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, McGraw Hill.

Department of Agricultural Engineering
Triguna Sen School of Technology
Curriculum for B.Tech.

AGPC206	Thermodynamics	2L:1T:0P	3 Credits

Course Objectives:

1. The fundamentals of Thermodynamics including thermodynamic systems and properties, relationships among the thermos-physical properties,
2. To understand the laws of thermodynamics and applications of these basic laws in thermodynamic systems.
3. This course will provide the essential tools required to study thermodynamic systems in Applied

Course Outcomes

Upon completion of the course students will be able to:

1. Use thermodynamic terminology correctly.

2. Explain fundamental thermodynamic properties.

3. Derive and discuss the first and second laws of thermodynamics.

4. Solve problems using the properties and relationships of thermodynamic fluids.

5. Analyse basic thermodynamic cycles.

6. Students must have understanding of thermodynamic fundamentals before studying their application in applied thermodynamics.

7. The understanding of thermodynamic properties and processes will assist students in other related coursework

Syllabus Content:

Unit 1: System and Concepts of Energy

Thermodynamic system and control volume, Thermodynamic properties, processor and cycles. Homogenous and Heterogeneous systems, Thermodynamic equilibrium, work done by a system. Energy as a property of the system, different forms of stored energy, Energy of an isolated system, Mass balance and energy balance in a simple steady flow process, Energy equation. Available energy, work transfer, heat transfer, different types of work

Unit 2: Temperature & Heat

Zeroth law of thermodynamics, measurement of temperature, comparison of thermometers, Thermocouple, Heat transfer as a path function, specific heat & latent heat, Specific heat of constant volume, Enthalpy, specific heat at constant pressure

Unit 3: First Law of thermodynamics and pure substance and properties

Closed system for undergoing a change of state and cycle, Kinetic Energy, internal energy, Polytropic processes and related numerical, control volume, Steady flow process, variable flow processes, Examples of a variable flow process. P-V diagram for pure substances, p.t. diagram for pure crude-substances, p.v.t. surface, T S diagram for a pure substance, molliar diagram for a pure substance, Quantity of dryness fraction, Thermodynamic properties of steam, steam tables and charts, measurement of steam quality.

Unit 4: Second law of thermodynamics

Difference between heat and work, cyclic heat engine, heat reservoirs, statements of Kelvin plank's, Clausius statement, refrigeration and heat pump, Carnot theorem and Carnot cycle, irreversible heat engine, Reversibility& irreversibility of process and numerical examples.

Unit 5: Boiler and IC Engines

Mountings and accessories, boiler efficiency Steam engines Rabine cycle Indicator diagrams, Steam turbines, first law applied to flow process. Air standard cycles, Ottocycle, Diesel cycle, Joule cycle, Air standard cycle for jet propulsion, Reversed Heat engine cycle

References:

1. 1. N. C. Pandya, C. S. Shah and S. S. Khandare. Heat Engines. (Vol. 1 and 2). Charotar Publishing House
2. D. B. Spalding and E. H. Cole. Engineering Thermodynamics
3. G. A. Hawkins. Engineering Thermodynamics. John Wiley and Sons.
4. P. K. Nag. Engineering Thermodynamics. McGraw Hill.
5. G. J. Van Wylen and R. E. Sonntag. Fundamentals of classical Thermodynamics. John Willey and Sons
6. M. L. Mathur and P. Sharma. I. C. Engines. Dhanpat Rai and Sons
7. W. Paul, Gill James, H. Smith and J. Z. Eugene. Fundamentals of I. C. Engines. Oxford and IBH Publishing Co.

AGPC207	Surveying and levelling	2L:0T:0P	2 Credits

Objectives of the course

Upon completion of this course,

- Students will be able to understand and apply the concept of surveying and levelling on the practical field.
- Students will get familiarized with the equipment's/instruments/tools used in surveying and levelling
- Students will be able to find the errors in levelling and methods to correct them.

Outcomes of the course

- Students gain proficiency in using a variety of surveying instruments and equipment, including total stations, levels, theodolites, GPS devices, and digital leveling

instruments.

- Students learn techniques for collecting, recording, and analyzing surveying data accurately and efficiently
- Students develop skills in creating accurate maps, plans, and drawings using surveying data.

Syllabus Contents

Unit 1: **Introduction to Surveying**

Definition, principles and basic concepts of surveying, classification, basic measurements, units of measurements, plans and maps, types of scales, surveying measurement and errors, scale corrections, accuracy and precision, stages of survey operation.

Unit 2 Principles of chain surveying

Definition, selection of survey station and lines, types of ranging and chaining, types of chains, recording the measurements, offset measurements, cross staff, optical square, prism square, obstacles in chaining and ranging chain and tape corrections.

Unit 3: Traversing

Methods of traversing, prismatic and surveyors compass, angle and bearings, quadrantal systems,local attraction, magnetic declination, dip-traversing, plotting, Bowditch rule, transit rule, errorsin compass survey, limits of accuracy.

Unit 4: Plane tabling

Instruments and accessories, methods and principles, two point, three point problems, errors in plane tabling, minor instruments – hand level, abbey level, clinometers, sextant, planimeter, pentameter, computation of areas – methods.

Unit 5: **Levelling**

Definition, benchmarks types of levels, optical principles, lenses, telescopes, sensitivity of bubble tubes, levelling staves, basic principles of levelling, temporary adjustments, field book entries, reduction of levels, missing entries, types of levelling, simple, differential and profile levelling, cross sectioning.

References

1. R. E. Davis. Elementary Plane Surveying. McGraw Hill
2. A. L. Higgins. Elementary Surveying. McGraw Hill.
3. T.P. Kanetkar & S.V. Kulkarni. Surveying and Levelling. (Part I & II). Griha Prakashan
4. B. C. Punmia. Surveying Vol 1&2. Firewall Media.
5.

AGPC 208	Fluid Mechanics Lab.	2L:0T:0P	2 Credits

Course Objective:

1. Apply theoretical knowledge of fluid mechanics in practical experiments.
2. Develop skills in using laboratory equipment for fluid measurements.
3. Gain hands-on experience in conducting experiments relevant to agricultural fluid systems.

Course Outcomes:

1. Perform experiments to measure properties like viscosity, density, and surface tension of fluids.
2. Analyze fluid flow phenomena using laboratory apparatus such as flow meters and pressure gauges.
3. Interpret experimental data to validate theoretical principles of fluid mechanics.
4. Demonstrate proficiency in experimental techniques for assessing the performance of pumps and other fluid machinery used in agriculture.

Course Content:

1. Measure viscosity of fluids.
2. Study pressure measuring devices.
3. Analyze stability of floating bodies.
4. Investigate hydrostatic forces on flat and curved surfaces.
5. Verify Bernoulli's theorem experimentally.
6. Examine the working principle of Venturi meter.
7. Evaluate the performance of orifice meter.
8. Investigate the effects of jets on surfaces.
9. Visualize flow patterns in ideal flow scenarios.
10. Determine the length of establishment of flow.
11. Analyze velocity distribution in pipes.
12. Study laminar flow characteristics in fluids.

References:-

5. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
6. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
7. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
8. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, McGraw Hill.

AGPC209	Surveying and Leveling Lab.	0L:0T:2P	1 Credit

Course Objectives:

- Provide students with opportunities to conduct field surveys to measure distances, angles, and elevations, and to establish control points for mapping and construction projects.
- Familiarize students with different leveling methods, including differential leveling, trigonometric leveling, and digital leveling, and teach them how to set up and operate leveling equipment.

- Instruct students on how to record surveying data accurately and systematically, and how to organize and document field notes for future reference.

Course Outcomes

Upon completion of this course,

- Students will be able to understand and apply the concept of surveying and levelling onthe practical field.
- Students will get familiarized with the equipment's/instruments/tools used in surveyingand levelling
- Students will be able to find the errors in levelling and methods to correct them

Course Content:

1. Handling of chain and chain accessories, offsetting, acquaintance with field book
2. Ranging out survey line and plotting chain survey
3. Triangulation by chain and offsetting for details for preparation of map of a small area.
4. Plotting of field book, reading for preparation of map – acquaintance with symbols of different objects used in maps and scale of map.
5. Setting up of prismatic compass and measurement of angels.
6. Traversing of a small area with chains and prismatic compass and offsetting for details
7. Plotting of the map with chain and prismatic survey
8. Setting of a 20″ accuracy transit theodolite and measurement of horizontal and vertical angles.
9. Setting up of plane table and offsetting by inter-section method.
10. Plane table traversing.
11. Setting up of dumpy levels and exercise in fly levelling and reciprocal levelling.

Suggested readings

1. R. E. Davis. Elementary Plane Surveying. McGraw Hill
2. A. L. Higgins. Elementary Surveying. McGraw Hill.
3. T. P. Kanetkar and S. V. Kulkarni. Surveying and Levelling. (Part I and II). Griha Prakashan.

AGPC 210	Advanced Workshop Technology	0L:0T:4P	2 Credit

Course Objective:

1. Explore advanced manufacturing techniques and technologies relevant to agricultural engineering.
2. Develop skills in utilizing modern workshop equipment and tools for agricultural applications.

3. Foster innovation and creativity in the design and fabrication of agricultural machinery and components.

Course Outcomes:

1. Demonstrate proficiency in using advanced machining, welding, and fabrication techniques.
2. Apply computer-aided design (CAD) and computer-aided manufacturing (CAM) software for agricultural product development.
3. Design and fabricate prototypes of agricultural machinery components using modern workshop technologies.
4. Evaluate and optimize manufacturing processes to enhance productivity and product quality in agricultural engineering

Syllabus Contents

Conventional Manufacturing processes:

- Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.
- Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.
- Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.
- Additive manufacturing: Rapid prototyping and rapid tooling**.**
- Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Unconventional Machining Processes:

- Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish, Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining.

References

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.

3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing.

Semester IV

COURSE CODE: ASHH251	**COURSE NAME:**	L	T	P	C
	Organizational Behaviour	3	0	0	3
Category of Course: Humanities and Social Sciences including Management courses					
Course Objectives: The objective of the course is to orient the engineering students with the concepts and practical implications of Behavior, personality and attitude of individuals and groups in organization.					
Course Outcomes: After the completion of the course 1. The students will acquire the skills of understanding individual and group behavior, culture, attitude and personality. 2. The students will gain the knowledge of organizational behavior					

Course Contents:

Unit I:

Organisational Behaviour- Concept and Emergence of OB Concept; Historical Background- Hawthorne Studies, Psychological foundations; Models of Organisational Behaviour, Challenges and Opportunities for Organisational Behavior; Ethics and Organisational Behaviour.

Unit II:

Individual Behaviour: Personality, Learning, Values and Attitudes, Perception, Learning Behaviourist, cognitive and social learning; Stress at work. Management's assumptions about people- McGregor's Theory X and Theory Y.

Unit III:

Motivation - Maslow's Need Hierarchy, Herzberg's Two Factors Theory, Vroom's Expectancy Theory; Theory of Intrinsic Motivation by Ken Thomas; Work –Designing for creating motivating Jobs.

Unit IV:

Inter-personal Behaviour: Interpersonal communication and Feedback, Feedback utilisation; Transactional Analysis (TA); Johari Window. Group Behaviour: Group Dynamics, Cohesiveness and Productivity; Group Decision Making; Organisational Politics.

Unit V:

Leadership- Concept and Styles; Fielder's Contingency Model; Leadership Effectiveness; Sources, patterns, levels, and types of conflict; Traditional and modern approaches to conflict; Functional and dysfunctional conflicts; Resolution of conflict. Organisational change- resistance and management

Text Books/ References:

Text Books:

1. Robbins, Stephen P. and Timothy A. Judge: Organisational Behaviour. Prentice -Hall, New Delhi.

2. Aswathappa, K: Organisation Behaviour. Himalaya Publishing House, New Delhi.

Reference books:

1. Singh, K: Organizational Behaviour: Text and Cases. Pearson.
2. Pareek, U. and Khanna, S: Understanding Organizational Behaviour. Oxford University Press.
3. Sharma, R. A: Organisational Theory and Behaviour. Tata McGraw -Hill Publishing Co. Ltd.
4. Sekaran, Uma: Organisational Behaviour: Text and Cases. Tata McGraw-Hill Publishing Co. Ltd.
5. Singh, B. P. and T. N. Chhabra: Organisation Theory and Behaviour. Dhanpat Rai and Co. P. Ltd., New Delhi; 2000.

AGPC 252	Strength of Materials	2L:1T:0P	3 Credit

Course Objective:

1. Understand the behavior of materials under various loading conditions.
2. Analyze and design agricultural structures and components for strength and stability.
3. Develop skills for material selection and optimization in agricultural engineering applications.

Course Outcomes:

1. Evaluate material properties and their implications on structural performance.
2. Calculate stresses and strains in agricultural components subjected to different loads.
3. Design and analyze agricultural structures for strength, stiffness, and durability.

4. Apply knowledge of material behavior to optimize designs for agricultural applications.

Syllabus Contents:-

Unit 1: Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle. (8 lectures)

Unit 2: Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. (8 lectures)

Unit 3: Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double

Unit 4: integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.(8 lectures)

Unit 5: Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at ends, stresses and deflection of helical springs. (8 lectures)

Unit 6: Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure (8 lectures)

References:-

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.

AGPC253	Watershed Hydrology	2L:0T:0P	2 Credits

Course Objectives:

- Gain a comprehensive understanding of the various hydrologic processes that occur within a watershed.
- Assess the quantity and quality of water resources within a watershed.
- Understanding of water dynamics managing water resources sustainably and mitigate the risks associated with hydrologic hazards.

Course Outcomes:

At the end of the course the students should be able to

- To comprehend basic concepts of the hydrologic cycle.
- To analyze precipitation data in detail, including assessment and instruments of precipitation data.
- To understand the concept of hydrograph and unit hydrograph.
- To understand methods to calculate runoff using empirical formulae and the concept of floodrouting.

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Syllabus Contents

Unit 1: Definition, hydrologic cycle and its component, meteorological parameters and theirmeasurement

Unit 2: Types, measurement and analysis, missing data, aerial precipitation, consistency ofrainfall records and frequency analysis

Unit 3: Factors affecting runoff, measurement, methods for estimation of runoff volume and peakrunoff, rating curve, and rainfall-runoff relations

Unit 4: Components of a hydrograph, factors affecting hydrographs, and base flow separation

Unit 5: Theory and assumptions of unit hydrographs, unit hydrographs of different durations,dimensionless hydrograph, synthetic unit hydrograph, and instantaneous unit hydrograph

References

1. K. Subramanyam. Engineering Hydrology, Tata McGraw Hill Publication Co., New Delhi
2. R. K. Sharma. Hydrology and Water Resources Engineering, Dhanpat Rai and Sons,
3. V. T. Chow. Handbook of Applied Hydrology. McGraw Hill Book Co., USA
4. S.K. Garg. Hydrology and Water Resources Engineering, Khanna Publishers, ND.
5. Ghanashyam Das. Hydrology and Soil Conservation Engineering, Prentice Hall of India,Pvt. Ltd, New Delhi

AGPC254	Soil Science and Soil Mechanics	3L:0T:0P	3 Credits

Course Objectives:

- To provide students with a comprehensive understanding of the physical, chemical, and biological properties of soils.
- Learn about the engineering properties of soils, including their classification, compaction characteristics, permeability, and strength.
- Emphasize geotechnical engineering applications of soil mechanics, including earthworks, embankment design, retaining wall design, and ground improvement techniques

Course Outcomes:

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

- Students will get an overview of the origin of soil, an understanding of soil identification and classification.
- Students will know the composition of soil air, the nature of soil aeration, the movement of soil water, the measurement of soil temperature.
- Students will understand soil behavior during compression, compaction and shear

Syllabus Contents

Unit-1: Introduction

Function of soils in our ecosystem, medium for plant growth, engineering medium, soil as a natural body, the soil profile and its layers (horizons), mineral constituents of soil, soil organic matter, weathering of rocks and minerals, physical and chemical weathering, factors influencing soil formation, parental materials, topography, soil formation in action.

Unit 2: Soil Classification, Architecture and its Physical Properties

Concept of individual soils, soil taxonomy, soil orders, entisols, inceptisols, andisols, gelisols, histosols, vertisols, mollisols, oxisols. Lower level categories in soil taxonomy, Soil colour, soil texture, structure, densities, pore spaces of mineral soils, soil properties relevant to engineering uses: preliminary definitions and relationship, determination of index properties, clay mineralogy.

Unit-3: Soil Air, Water, Temperature and Colloid

Soil air: Composition of soil air, air capacity the nature of soil aeration, soil aeration in the field, oxidation-reduction potential, factors affecting soil aeration, wetlands and their poorly aerated soils.

Soil water: Forms of soil water, soil moisture constants, soil water movement, saturated and unsaturated flow, measurement of soil water

Soil temperature: Sources of heat to soil, factors affecting soil temperature, processes affected bysoil temperature, thermal properties of soils, measurement of soil temperature, soil temperature control

Soil colloid: General properties of soil colloids, types of soil colloids, adsorbed cations, fundamentals of layer silicate clay structure, genesis of soil colloids, geographic distribution of clays, sources of charges on soil colloids, soil organism and their role in soil fertility.

Unit-4: Soil Hydraulics and Elasticity Applied to Soil

Permeability, seepage analysis, soil hydraulics, seepage below hydraulic structures, Elements of elasticity, stress distribution

Unit-5: Compressibility, Strength and Stability

Compression and compressibility, one- and three-dimensional consolidation, compaction Shear strength, Mohr's circle of stresses, active and passive earth pressures, retaining walls, stability analysis of earthen slopes, bearing capacity of soils, foundations.

References

1. N. C. Brady and R. W. Ray. The Nature and Properties of Soils. Macmillan

2. T. D. Biswas and S. K. Mukherjee. Text book of Soil Science. McGraw Hill.

3. H. D. Foth. Fundamental of Soil Science. Wiley Eastern.

4. B. C. Punmia., Soil Mechanics and Foundations, Laxmi Publication Pvt. Ltd., NewDelhi

5. S. G. Bowell. Soil Mechanics. Wiley Eastern.

6. Gopalrajan and A. S. R. Rao. Basic and Applied Soil Mechanics.

AGPC255	Farm Power	2L:0T:0P	2 Credits

Course Objectives:

1. To introduce the idea of study of IC engine and engine components their construction.
2. To discuss tractor power outlets, P.T.O. and belt pulley.
3. To study the transmission system and clutch.

Course Outcomes:

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

- Understand the working principle and working of tractor and automobile engine.
- Demonstrate the transmission power from engine to the rear wheels of tractor and automobiles.
- Carry out maintenance and adjustment of tractor systems.

Syllabus Contents :

Unit 1: Sources of farm power -conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. Study of engine components their construction, operating principles and functions.

Unit 2: Engine systems: valves & valve mechanism. Fuel & air supply, cooling, lubricating, ignition, starting and electrical systems. Engine governing systems.

Unit 3: Study of transmission system: Clutch: single and multi-plate clutches and their functions. Gear box: sliding and constant mesh.

Unit 4: Differential, final drive mechanism and wheels. Brake mechanism: Mechanical and hydraulic. Steering: Ackerman and hydraulic. Front axle and wheel alignment, Hydraulic system of tractor: Automatic position and draft control.

Unit 5: Tractor power outlets: P.T.O., belt pulley, drawbar. Introduction to traction mechanics. Tractor chassis mechanics: C.G. determination and weight transfer. Tractor stability: Grade and non-parallel pull, turning at high speed, Ergonomic considerations and operational safety.

References :

1. Liljedahl, J.B., Turnquist, P.K., Smith, D.W. and Hoki, M. 2004. Tractors and their Power Units, 4th Edition. CBS Publishers & Distributors, New Delhi.
2. Mathur, M.L. and Sharma, R.P. 2014. Internal Combustion Engines. Dhanpat Rai Publications (P) Lrd., New Delhi.
3. Goering, C.E. and Hansen, A.C. 2013.Engine and Tractor Power. ASABE, USA.
4. Domkundwar A.V. 1999. A course in internal combustion engines. DhanpatRai& Co. (P) Ltd., Educational and Technical Publishers, Delhi.
5. Jain, S.C. and Rai, C.R. 2012. Farm Tractor: Maintenance and Repair, Standard Publishers and Distributors, New Delhi.
6. Sahay Jagdishwar 2008. Elements of agricultural engineering, Standard Publishers and Distributors, New Delhi.

AGPC256	Post Harvest Operations	2L:0T:0P	2 Credits

Course Objective:

1. To study about the role and importance of post-harvest technology in Indian industry.
2. To study about the various management technologies on pre- harvest and post-harvest of fruits and vegetables.
3. To study about the conventional and modern packaging and storage methods.

Course Outcomes:

Post-harvest technologies constitute an inter-disciplinary science and techniques applied to agricultural commodities after harvest for the purpose of preservation, conservation, quality control/enhancement, processing, packaging, storage, distribution, marketing, and utilization to meet the food and nutritional requirements of consumers in relation to their needs.

Syllabus Contents:

Unit 1: Measurement and analysis of quality of different grains, Optimum harvesting conditions for different crops, principles, selection, operation, maintenance and testing of grains processing equipment and plants, fluidization and mechanical operations in cereal processing.

Unit 2: Hydrothermal treatment & conditioning of grains, Modern paddy and heat parboiling systems, equipment, Advances in heat transfer and fluid flow in grain processing operations. Humidification and dehumidification operations applied to post harvest engineering.

Unit 3: Crop drying principles, moisture migration theories, advances in crop drying theories & mathematical modeling, Crop drying methods/systems and crop dryers-selection, design and testing.

Unit 4: Processes and machines for operations involving cleaning, conditioning, milling, sizing, grading and packaging of cereals (paddy, wheat, maize and millets) and pulses.

Unit 5: Principles and practices of storage - storage losses and their estimation, factors affecting the grain quality in insects, pests and rodents-control, Flow characteristics of granular materials. Types and functional requirements of storage structures-village level and improved structures, godowns and silos, Design of silos, bunkers and godowns - R.C.C. and steel structures, Aeration system for various storage structures, Grain handling equipment and their design and operational features, Management and maintenance of grain storage.

References

1. Brennam, J. G., Butters, J. R., Cowell, N. D and Lilly, A. E. I. (1990). Food EngineeringOperations. Elsevier Science Pub. Co., Inc.
2. Geankoplis, C. J. (2002). Transport Processes and Unit Operations. Prentice Hall ofIndia, New Delhi
3. Heldman, D. R. and Hartel, R. W. (1999). Principles of Food Processing. An Aspen Publications, USA
4. McCabe, W.L., Smith, J. C. and Harriott, P. (1985). Unit operations of chemical Engineering. 4th Ed. McGraw -Hill Book Company, Inc.
5. Sahay, K. M. and Singh, K. K. (2001). Unit Operations of Agricultural Processing.Vikash Publishing House Pvt. Ltd., 2nd Ed., India.

AGPC257	Watershed Hydrology Lab	0L:0T:2P	1 Credit

Course Objectives:

- To study and quantify various hydrological processes occurring within a watershed.
- To assess the health and function of the watershed ecosystem.
- To develop and refine mathematical models that simulate the behavior of water within a watershed.

Course Outcomes:

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

- Identify hydrology and open channel related problems practically.

- Development of a comprehensive hydrological model for a specific watershed.
- Understand and practice basic measurement and data analysis techniques in hydrology

Syllabus Contents

1. Study and use of rain gauge, evaporimeters, anemometer, hygrometer, sunshine recorder instruments
2. Analysis of rainfall data and estimation of average rainfall
3. Study of stream gauging instruments and measurement
4. Ranging out survey line and plotting chain survey.
5. Plotting of the field book, reading for preparation of map-acquaintance with symbols of differentobjects used in maps and scale of map.

References

1. K. Subramanyam. Engineering Hydrology, Tata McGraw Hill Publication Co., New Delhi
2. R. K. Sharma. Hydrology and Water Resources Engineering, Dhanpat Rai and Sons,
3. V. T. Chow. Handbook of Applied Hydrology. McGraw Hill Book Co., USA
4. S.K. Garg. Hydrology and Water Resources Engineering, Khanna Publishers, ND.
5. Ghanashyam Das. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd,New Delhi

AGPC258	Soil Science and Soil Mechanics Lab.	0L:0T:2P	1 Credit

Course Objectives:

- To characterize the physical, chemical, and biological properties of soil samples.
- To investigate the mechanical behavior of soils under different loading and environmental conditions.
- To conduct research aimed at advancing our understanding of soil processes, properties, and behaviors.

Course Outcomes

Upon completion of this course,

- Students will get an overview of the origin of soil, an understanding of soil identification and classification
- Students will know the composition of soil air, the nature of soil aeration, the movement of soil water, measurement of soil temperature

- Students will understand soil behavior during compression, compaction and shear

Syllabus Contents

1. Determination of particle and bulk density of soil.
2. Mechanical analysis of soil by sieving.
3. Hydrometer analysis for grain size distribution.
4. Determination of hydraulic conductivity by constant and variable head permeameter
5. Settlement analysis of soils

Suggested readings

- B. C. Punmia., Soil Mechanics and Foundations, Laxmi Publication Pvt. Ltd., New Delhi
- S. G. Bowell. Soil Mechanics. Wiley Eastern.
- Gopalrajan and A. S. R. Rao. Basic and Applied Soil Mechanics.

AGPC259	Farm Power Lab.	0L:0T:2P	1 Credit

Course Objectives:

1. To study the different engine components.
2. To discuss tractor power outlets, P.T.O. and belt pulley.
3. To study the working principles of various systems of tractor.

Course Outcomes:

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

- Select the appropriate tractor according to the farm size.
- Carry out maintenance and adjustment of tractor systems.

Syllabus Contents

- Introduction to different systems of a CI engine; Engine parts and functions, working principles etc.
- Valve system – study, construction and adjustments.
- Oil & Fuel - determination of physical properties.
- Air cleaning system.
- Fuel supply system of SI engine; Diesel injection system & timing.
- Cooling system, and fan performance, thermostat and radiator performance evaluation.
- Lubricating system & adjustments.
- Starting and electrical system. Ignition system.
- Mechanical power transmission in agricultural tractors, clutch, gear box, differential and final drive,
- Wheels and wheel tread adjustment.
- Brake and its adjustment.

- Steering system. Hydraulic lift and hitch system.

References

1. Liljedahl, J.B., Turnquist, P.K., Smith, D.W. and Hoki, M. 2004. Tractors and their Power Units, 4th Edition. CBS Publishers & Distributors, New Delhi.
2. Mathur, M.L. and Sharma, R.P. 2014. Internal Combustion Engines. Dhanpat Rai Publications (P) Lrd., New Delhi.
3. Goering, C.E. and Hansen, A.C. 2013.Engine and Tractor Power. ASABE, USA.
4. Domkundwar A.V. 1999. A course in internal combustion engines. Dhanpat Rai& Co. (P) Ltd., Educational and Technical Publishers, Delhi.
5. Jain, S.C. and Rai, C.R. 2012. Farm Tractor: Maintenance and Repair, Standard Publishers and Distributors, New Delhi.
6. Sahay Jagdishwar 2008. Elements of agricultural engineering, Standard Publishers and Distributors, New Delhi.

AGPC260	Post Harvest Operations Lab.	0L:0T:2P	1 Credits

Course Objective:

1. To study about the role and importance of post-harvest technology in Indian industry.
2. To study about the various management technologies on pre- harvest and post-harvest of fruits and vegetables.
3. To study about the conventional and modern packaging and storage methods.

Course Outcomes:

- To understand and analyze basic application of post harvest operations.
- To study the working principles of various post harvest and food processing machines.
- Post harvest operations lab constitutes to maintain quality (appearance, texture, flavorand nutritive value), protect food safety, and reduce losses between harvest and consumption.

Syllabus Contents:

1. Determination of moisture content of food grains
2. Measurement of physical properties of food grains.
3. Particle size analysis and energy requirement in communition.
4. Milling of rice, wheat and pulses and estimation of milling yield and performancecharacteristics of equipment used.
5. Colour measurement of foods.
6. Sorption and desorption of grains/bio-materials.
7. Expression/extraction of oils and testing of different rice bran stabilization methods and preparation of valuable products from husk.

References:

1. Brennam, J. G., Butters, J. R., Cowell, N. D and Lilly, A. E. I. (1990). Food Engineering Operations. Elsevier Science Pub. Co., Inc.
2. Geankoplis, C. J. (2002). Transport Processes and Unit Operations. Prentice Hall of India, New Delhi
3. Heldman, D. R. and Hartel, R. W. (1999). Principles of Food Processing. An Aspen Publications, USA
4. McCabe, W.L., Smith, J. C. and Harriott, P. (1985). Unit operations of chemical Engineering. 4th Ed. McGraw -Hill Book Company, Inc.
5. Sahay, K. M. and Singh, K. K. (2001). Unit Operations of Agricultural Processing. Vikash Publishing House Pvt. Ltd., 2nd Ed., India.

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AGMC261	**Environmental Science**	**2L:0T:0P**	**0 Credits**

Course Objective:

- To understanding Environmental Systems
- To identifying Environmental Issues
- To analyzing Human Impacts

Course Outcome

- Students will demonstrate an understanding of key environmental concepts, theories, and principles.
- Students will be able to critically analyze environmental issues, considering multiple perspectives and evaluating the validity of evidence

Syllabus Content

Unit 1: Introduction to Environmental Science

Definition and scope of environmental science. Historical perspectives and major milestones in environmental science. Interdisciplinary nature of environmental science

Unit 2: Ecology and Ecosystems

Principles of ecology, Ecosystem structure and function, Energy flow and nutrient cycling, Biodiversity and conservation.

Unit 3: Earth Systems and Natural Resources

Basic principles of chemistry as applied to environmental systems, Water chemistry and pollution, Air pollution chemistry, Soil chemistry and contamination.

Unit 4: Environmental Pollution

Sources, effects, and control measures of various types of pollution (e.g., air, water, soil, noise). Case studies of significant environmental pollution incidents.

Unit 5: Environmental Impact Assessment

Methods and frameworks for assessing environmental impacts of projects and policies, Environmental impact statement (EIS) process, Environmental Education and Communication.

References:

1. Khopkar S.M., ―Environmental Pollution Analysis‖, New Age International (P) Ltd., New Delhi.
2. Cunningham W.P., Cunningham M.A., ―Principles of Environmental Science‖, Tata McGraw Hill
3. Krishnamoorthy B., ―Environmental Management, Text Book and Cases‖, PHI Learning (P) Ltd.
4. .Chandrappa R., Das D.B., ―Solid Waste Management: Principals and Practice‖
5. Pelczar, M., J.Chan E.C.S. and Krieg, N. R. Microbiology, Tata McGraw Hill, New Delhi.

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THIRD YEAR

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Semester V

COURSE CODE: ASHH301	**COURSE NAME:**	L	T	P	C
	Management- II, (Project Management)	3	0	0	3

Category of Course: Humanities and Social Sciences including Management courses

Course Objectives:

The objectives of this course are to:

1. Make the learners understand the concepts of Project Management for planning to execution of projects.
2. Make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. Enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

Course Outcomes:

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

1.Understand project characteristics and various stages of a project.

2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic. Execution Control.

3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control

4. Apply the risk management plan and analyse the role of stakeholders.

5. Understand the contract management, Project Procurement, Service level Agreements and productivity.

6. Understand the How Subcontract Administration and Control are practiced in the Industry.

Course Contents:

Unit I: Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.

Unit II: Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.

Unit III: Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.

Unit IV: Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management.

Unit V: Post-Project Analysis.

Text Books/ References:

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
2. Lock, Gower, Project Management Handbook.
3. Cleland and King, VNR Project Management Handbook.
4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia
5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
6. S. Choudhury, Project Scheduling and Monitoring in Practice.
7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.
8. John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall, India, 2002.
9. N. J. Smith (Ed), Project Management, Blackwell Publishing, 2002.
10. Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley, 2002.
11. Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley, 2000.

COURSE CODE: ASHH301	**COURSE NAME:**	L	T	P	C
	Management-II (Managing Innovation and Entrepreneurship)	3	0	0	3

Category of Course: Humanities and Social Sciences including Management courses

Objective of Course:

The objective of the course is to enable the learners

1. describe the challenges and requirements put on management, board members and share holders in different development situations
2. analyse and value different business development processes,
3. account for and value the importance of a business plan, how it is designed and applied on a technical development idea
4. plan and implement a buisiness development project in a team
5. describe and discuss the fundamentals of intellectual property rights and legislation, value and comment its importance for companies in different development stages, particularly in companies active within biotech or natural resource management

6. reason and critically value different conditions under which an technical business idea can be developed into an innovation.

Course Outcomes:

On successful completion of the course, the learners will:

1. have knowledge of the key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
2. will have understanding of the key concepts underpinning innovation and the issues associated with developing and sustaining innovation within organisations
3. will be able to Apply new ideas, methods and ways of thinking

Course Contents:

Unit I: Introduction to Entrepreneurship:
Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies. Entrepreneurial growth and development.

Unit II: Creativity and Innovation: Creativity and Innovation:
Concepts Shifting Composition of the Economy Purposeful Innovation & the 7 Sources of Innovative Opportunity The Innovation Process. Innovative Strategies : Strategies that aim at introducing an innovation. Innovation & entrepreneurship: Can they work together? Planning -incompatible with Innovation & entrepreneurship.

Unit III: Entrepreneurial Motivation:
Need for continuous learning & relearning Acquiring Technological Innovation Entrepreneurial motivation (nAch story) Achievement Motivation in Real life. Case Study.

Unit IV: International Entrepreneurship:
Concepts and Nature of International Entrepreneurship. The changing International environment. Ethics and International Entrepreneurship. Strategic Issues in International Entrepreneurship.

Unit V: Problem Identification and Problem Solving:
Problem Identification. Problem solving. Innovation and Diversification.

Text Books/ References:

1. Martin, M.J., 1994, “Managing Innovation and Entrepreneurship in Technology based Firm”, John Wiley.
2. Ettlie, J.E., 2000, “Managing Technology Innovation”, John Wiley & Sons.
3. Drucker, P. F. (2000), “The Discipline of Innovation,” Harvard Business Review, May, (originally published 1985,
May-June, 63(3), 67-72.1
4. Christensen, C. M. and Raynor, M. E. (2003), The Innovator’s Solution: Creating and Sustaining Successful

Growth, Boston, MA: Harvard Business School Press.
5. Drucker, P. F. (1985), Innovation and Entrepreneurship, New York: Harper.
6. Harvard Business Review on Innovation (Collection of articles), Harvard Business School Press (2001).
6. Harvard Business Review on Entrepreneurship (Collection of articles), Harvard Business School Press (1999)
8. Rogers, E.M. (2003), Diffusion of Innovations, 5th ed., New York: Simon and Schuster.

AGPC 302	Kinematics and Theory of Machines	2L:1T:0P	3 Credits

Course Objective:

1. Understand the principles of kinematics and dynamics governing machine motion.
2. Analyze and design agricultural machinery components for optimal performance.
3. Develop skills in applying theoretical concepts to solve practical engineering problems in agriculture.

Course Outcomes:

1. Analyze the motion of machine components using kinematic principles.
2. Design and optimize linkages, gears, and other machine elements for agricultural applications.
3. Calculate velocities, accelerations, and forces in machine systems using dynamic analysis.
4. Apply theoretical knowledge to solve real-world problems related to agricultural machinery design and operation.

Syllabus Contents:-

Unit 1: Classification of mechanisms-Basic kinematic concepts and definitions-Degree of freedom, mobility-Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage-Transmission angle-Description of some common mechanisms- Quick return mechanism, straight line generators-Universal Joint-Rocker mechanisms.

Unit 2: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Coriolis component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation.

Unit 3: Classification of cams and followers-Terminology and definitions-Displacement Diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions specified contour cams- circular and tangent cams- pressure angle and

undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.

Unit 4: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

Unit 5: Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication- friction clutches- belt and rope drives- friction in brakes.

References:-

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors,2005.
2. Cleghorn W.L. , Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

AGPC303	Soil and Water Conservation Engineering	3L:0T:0P	3Credits

Course Objectives:

- To understand and analyse the basic causes of soil erosion
- To study the different types of soil erosion and its causes.
- To understand the suitability of different types of soil conservation structure and their uses.

Course Outcomes:

At the end of the course the students should be able to

- Gain a comprehensive understanding of the principles governing the interaction between soil and water in natural and engineered systems.
- Develop the skills to apply engineering principles and tools to assess, design, and implement soil and water conservation measures.
- Will enhance their critical thinking and problem-solving skills related to soil and water conservation engineering.

Unit 1: ***Soil Erosion Principle***

Effects of soil erosion, causes of soil erosion, types of erosion, factors affecting erosion, erosivity and erodibility, measurement of soil losses

Unit 2: ***Conservation Measures for Agricultural Lands***

Biological and engineering measures, contour farming, strip cropping, contour bunds and graded bunds, conservation measures for hill slopes, design principles of bunds and terraces, vegetative and grassed waterways.

Unit 3: ***Gully Erosion and its Control***

Process of gully development, classification of gullies, planning for gully control, methods of gully control, temporary and permanent structures for gully control

Unit 4: ***Wind Erosion and its Control***

Factors influencing wind erosion, Mechanics of wind erosion, estimation soil losses by wind; wind erosion control, tillage practices, controlling soil factors

Unit 5*: Stream Bank Erosion Control*

Causes of stream bank erosion, methods of controlling stream bank erosion, direct protection works, diversion of runoff

Suggested readings

1. Das, Ghanashyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi
2. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
3. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA
4. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA

AGPC304	Farm Machinery	2L:0T:0P	2 Credits

Course Objectives:

1. To study the different farm machinery implements.
2. To study the working principles of various plant protection equipment.

Course Outcomes:

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

- Select the appropriate farm machinery and matching power source for various farm operations.
- Demonstrate the operation and maintenance of farm machines.
  Generate idea for developing suitable machines for the farm operations for specific tasks.

Syllabus Contents :

Unit 1: Objectives of farm mechanization. Classification of farm machines. Materials of construction & heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics. Performance evaluation, selection and cost analysis.

Unit 2: Tillage; primary and secondary tillage equipment. Forces acting on tillage tools. Hitching systems and controls. Draft measurement of tillage equipment Sowing, planting & transplanting equipment – their calibration and adjustments. Fertilizer application equipment.

Unit 3: Weed control, intercultural implement and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments

Unit 4: Principles & types of cutting mechanisms. Construction & adjustments of shear & impact-type cutting mechanisms. Crop harvesting machinery: mowers, windrowers, reapers, reaper binders and forage harvesters. Forage chopping & handling equipment.

Unit 5: Threshing mechanics & various types of threshers. Threshers, straw combines & grain combines, maize harvesting & shelling equipment. Testing of farm machine. Test codes & procedure. Interpretation of test results. Selection and management of farm machines for optimum performance.

References

1. Srivastava, A.K., Goering, C.E., Rohrbach, R.P. and Buckmaster, D.R. 2013. Engineering Principles of Agricultural Machines, 2nd Edition. ASABE, St. Joseph, USA.
2. Kepner, R.A., Bainer, R. and Berger, E.L. 1978. Principles of Farm Machinery. John Wiley and Sons, New York.
3. Singh, T.P. 2017. Farm Machinery. PHI Learning Pvt. Ltd., Delhi.
4. Singh, S. 2007. Farm Machinery Principles and Applications. ICAR, New Delhi.
5. Michael, A.M. and Ojha, T.P. 2005. Principles of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
6. Dihingia P.C., C.B. Khobragade and Prasanna Kumar G.V. 2022. Concepts of Farm Power and Energy. Today & Tomorrow's Printers and Publishers, New Delhi.

AGPC305	Mechanical Operation in Food Processing	2L:0T:0P	2 Credits

Course Objective:

1. Equip students with foundational knowledge of mechanical unit operations in food processing, focusing on principles, equipment, and applications.

2. Develop practical skills in equipment selection, operation, maintenance, and troubleshooting for efficient and safe food processing.

3. Foster an understanding of quality control, food safety standards, and sustainability considerations within mechanical food processing operations.

Course Outcomes:

- Mechanical operations carried out in food processing: Particle size analysis and energy requirement in size reduction of solid foods;
- Homogenization of milk fat in high pressure homogenizer; milling of grains and recoveryof various products; drag forces on a particle moving in fluid, pneumatic conveying, pressure drop in fixed and fluidized beds of granular materials; flow rate and pressure drop in singlescrew extruder.
- Mechanical separation of solids, liquids and gases: sieving, pressure filtration, centrifugalseparation in centrifuges and cyclones; agitation and mixing of liquids and solids

Syllabus Contents:

Unit 1: Physical characteristics, rheological properties, texture evaluation, mechanical damage, aero and hydro-dynamic characteristics, fractional characteristics, thermal, electrical and optical properties of bio-materials and their application to processing, storage and handling.

Unit 2: Filtration of food; slurry - filter medium and cake resistances; filtration equipment's

Unit 3: Size separation through sieving; particle movement in sediment and centrifugal settling tank; solid bowl and disc bowl centrifuges; Agitation and mixing of liquid foods, powders and pastes.

Unit 4: Material handling system and device in food processing plants; drag and pressure flow mechanisms in screw press and extruder.

Unit 5: Design of machine elements and their selection, Design of grains and other crops processing machine components, food processing systems design involving, conveying, elevating, cleaning, separation, conditioning/parboiling, milling and mixing, Design, laying and drawing of food processing machines and plants, screw, bucket, belt, oscillating vibratory conveyors.

References

1. Brennam, J. G., Butters, J. R., Cowell, N. D and Lilly, A. E. I. (1990). Food EngineeringOperations. Elsevier Science Pub. Co., Inc.
2. Earle, R. L. (1983). Unit operations in Food Processing. Pergamon Press.
3. Henderson, S. and Perry, S. M. (1976) Agricultural Process Engineering. 5th ed. AVIPublishing Co. Inc.
4. McCabe, W.L., Smith, J. C. and Harriott, P. (1985). Unit operations of chemical Engineering. 4th Ed. McGraw -Hill Book Company, Inc.

AGPC306	Soil and Water Conservation Engg. Lab.	0L:0T:2P	1 Credits

Course Objectives:

- Design the temporary soil conservation structure.

- Design the permanent soil conservation structure.
- Design the pond and embankment.

Course Outcomes:

At the end of the course the students should be able to

- Gain experience in implementing various soil and water conservation practices, such as constructing erosion control structures, designing terraces, etc.
- Learn to use specialized equipment and instrumentation to measure soil properties, hydrological parameters, and erosion rates in field and laboratory settings.

  Learn to apply engineering principles, scientific knowledge, and critical analysis to address complex problems related to soil erosion, sedimentation, and water quality degradation

Course Contents

1. Design of contour bund and graded bund
2. Design of bench terraces and grassed waterway
3. Design of temporary gully control structure
4. Design of drop spillway, chute spillway and drop inlet spillway
5. Design of farm pond and earthen embankment

Suggested readings

1. Das, Ghanashyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi
2. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
3. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, New York, USA
4. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA

AGPC307	Farm Machinery Lab	0L:0T:2P	1 Credits

Course Objectives:

1. To study the different farm machinery implements.
2. To study the working principles of various plows.
3. To study the working principle of seed drill and planter.

Course Outcomes:

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

- Select the appropriate farm machinery and matching power source for various farm operations.
- Demonstrate the operation and maintenance of farm machines.
- Generate idea for developing suitable machines for the farm operations for specific tasks.

Syllabus Contents :

- Construction details, adjustments and working of M.B. plow, disc plow and disc harrow and secondary tillage tools.
- Construction and working of rotavator and other rotary tillers.
- Constructional and functional study of different types of seed-drill and planters
- Calibration of seed drills
- Study of sprayers and dusters, measurement of nozzle discharge, field capacity etc.
- Study of Self-propelled rice transplanter
- Weeding equipments and their use
- Study of different types of power operated reapers and threshers
- Measurement of speed and working width
- Field capacity and field efficiency measurement of machines/implements
- Draft and fuel consumption measurement for different implements under different soil conditions

References :

1. Srivastava, A.K., Goering, C.E., Rohrbach, R.P. and Buckmaster, D.R. 2013. Engineering Principles of Agricultural Machines, 2nd Edition. ASABE, St. Joseph, USA.
2. Kepner, R.A., Bainer, R. and Berger, E.L. 1978. Principles of Farm Machinery. John Wiley and Sons, New York.
3. Singh, T.P. 2017. Farm Machinery. PHI Learning Pvt. Ltd., Delhi.
4. Singh, S. 2007. Farm Machinery Principles and Applications. ICAR, New Delhi.
5. Michael, A.M. and Ojha, T.P. 2005. Principles of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
6. Dihingia P.C., C.B. Khobragade and Prasanna Kumar G.V. 2022. Concepts of Farm Power and Energy. Today & Tomorrow's Printers and Publishers, New Delhi.

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AGPC308	Mechanical Operation in Food Processing Lab	0L:0T:2P	1 Credits

Course Objective:

1. Equip students with foundational knowledge of mechanical unit operations in food processing, focusing on principles, equipment, and applications.

2. Develop practical skills in equipment selection, operation, maintenance, and troubleshooting for efficient and safe food processing.

3. Foster an understanding of quality control, food safety standards, and sustainability considerations within mechanical food processing operations.

Course Outcomes:

The Mechanical Operations in Food Processing laboratory course will consist of experiments illustrating the principles of food operations relevant to the study of science and engineering. Thestudents will learn to:

- Estimate drying rate constants of food grains from concentration of reactants/products asa function of time
- Measure molecular/system properties such as flow rate, viscosity, texture, etc.
- Analysed the homogenization of milk fat in high pressure homogenizer; milling of grainsand recovery of various products
- To study the conveyance of food grain and powder in screw and vibratory conveyors

Syllabus Contents:

- Mixing of solids
- Drying of food grains
- Textural analysis of foods Estimation and measurement of flow rate
- Power requirement and pressure developed in single screw
- Homogenization of milk
- Viscosity measurement of liquid foods
- Measurement of flow properties of powders
- Estimation and measurement of flow rate

References

1. Brennam, J. G., Butters, J. R., Cowell, N. D and Lilly, A. E. I. (1990). Food EngineeringOperations. Elsevier Science Pub. Co., Inc.
2. Earle, R. L. (1983). Unit operations in Food Processing. Pergamon Press.
3. Henderson, S. and Perry, S. M. (1976) Agricultural Process Engineering. 5th ed. AVIPublishing Co. Inc.
4. McCabe, W.L., Smith, J. C. and Harriott, P. (1985). Unit operations of chemicalEngineering. 4th Ed. McGraw -Hill Book Company, Inc.

ASHA302	Constitution of India	2L:0T:0P	0Credits

Course Objectives

- 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.

Syllabus Contents

Unit 1: History of Making of the Indian Constitution: History, Drafting Committee (Composition & Working)

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 3: Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit 4: Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit 5: Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative
- CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials.
- Importance of grass root democracy

Suggested Readings

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AGPE311	**Professional Elective-I (Watershed Planning and Management)**	**3L:0T:0P**	**3 Credits**

Course Objectives

- Familiarize with the concept and issues of watershed management. hydrological, ecological, and geomorphological processes occurring within watersheds.
- Acquainted with the different watershed development plans and their objectives.
- To identify and analyze the various threats and challenges facing watersheds

Course Outcomes

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

- Strengthen the knowledge to identify the problem of soil erosion and conservation in watershed management.
- To develop a comprehensive understanding of watershed dynamics.
- To develop the ability to integrate multidisciplinary perspectives into watershed management decision-making processes

Contents:

Unit I

Watershed concept and characteristics, their role in watershed management. Watershed management: definition and concept, principle and components, objectives. Watershed management programs. Watershed delineation, demarcation, and analysis.

Unit II

Soil and water conservation measures for arable lands and non-arable lands. 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- III

Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management.Indigenous soil water conservation measures.

Unit-IV

Hydrologic data for watershed planning, Water budgeting in a watershed. Hydrologic and sediment monitoring of watershed and Reservoir sedimentation.

Unit-V

Benefit cost ratio of watershed development projects and Watershed management work plan, Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management - role of watershed associations, user groups and self-help groups.

References

1. Soil Conservation and Land Management. S. K. Datta, International Book Distributors,Dehradun, 1985
2. Soil and Water Conservation Engg. R. Suresh, Standard Publishers Distributors, Delhi-6,Reprint Edition 2006
3. Watershed Planning and Management. Rajvir Singh. Yash Publishing House, Bikaner. 2000
4. Field Manual on Watershed Management. 2013. B. Venkateswarlu, Mohammed Osman, M.V.Padmanabhan, K. Kareemulla, P.K. Mishra, G.R. Korwar& K.V. Rao, CRIDA, Hyderabad
7. Watershed Management. V.V. DhruvaNarayana G. Sastry& U.S. Patnaik. ICAR,

New Delhi,1997
8. Watershed Management: Guidelines for Indian Conditions. Tideman, E.M., Omega ScientificPublishers, New Delhi. 1996

AGPE312	Dairy Food Technology	3L:0T:0P	3 Credits

Course Objective:

1. To impart knowledge of principles of processing of milk and milk products.

Course Outcomes:

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

1. The Learner will gain basic knowledge of milk and physicochemical aspects along with procurement and transportation methodology and national and international standards.
2. The Learner also will gain the fundamental aspects of testing of milk quality along with sources of contamination and how the milk spoiled.
3. The Learner would have acquired basic knowledge of hygiene, cleaning procedures and application methodology of Pasteurization, standardization, toning, homogenization and cream separation from milk.
4. Understand the application and technology applied for the development of dairy products along with ghee preparation and other milk based dairy products in economic way.

Syllabus Content:

Unit-1

Composition and structure of milk, various properties of milk, production and utilization of milk, influence of raw milk quality, standardization of milk.

Unit-2

Thermal processing of milk: pasteurization, sterilization methods and equipments involved, effects of thermal processing on milk and milk products.

Unit-3

Cream separation, homogenization, introduction to novel methods of milk processing. Processing of: milk powder, concentrated milk, cheese, butter, ice cream, curd, fermented milk, whey, paneer, ghee.

Unit-4

Storage and transportation of milk and milk products, milk reception and storage, packaging, cooling, freezing, refrigeration, cold storage.

Unit-5

Dairy plant engineering and management, process measurements and controls, quality and safety of milk and milk products.

Suggested reading:

1) Britz, T.Z and Robinson, R.K. Advanced Dairy Science and Technology
2) Walstra, P, Wouters, J.T.M and Geurts T.J. Dairy Science and Technology, 2nd Edition
3) Tufail Ahmad. Dairy Plant Engineering and Management
4) Fox, P.F. and McSweeney, P.L.H. Dairy Chemistry and Biochemistry.
5) Sukumar De. Outlines of Dairy Technology

AGPE313	Testing & Evaluation of Tractors & Machines	3L:0T:0P	3 Credits

Course Objective:

1. Understand the principles and techniques of testing and evaluating tractors and agricultural machines.
2. Develop skills in assessing the performance, safety, and efficiency of agricultural machinery.
3. Gain knowledge of regulatory standards and guidelines for tractor and machine testing in agricultural contexts.

Course Outcomes:

1. Conduct performance tests on tractors and agricultural machines to assess power, fuel efficiency, and operational characteristics.
2. Evaluate the safety features and ergonomic design of agricultural equipment to ensure operator well-being.
3. Interpret test data and analyze results to identify areas for improvement in tractor and machine design.
4. Apply knowledge of testing methodologies and standards to ensure compliance with industry regulations and guidelines.

Syllabus Contents

Unit 1: Test code, performance index, selection of machines, testand soil conditions, measurement of power, preparation of data sheet and analysis, Instrumentation for testing and data acquisition.

Unit 2: Ergonomic appraisal of agricultural equipment, Ergonomic assessments, animal and machine performance, Human characteristics, energy demands, environmental factors, safety and comfort.

Unit 3: Test procedures for agricultural hand tools and animal drawn agricultural equipment and implements. Procedure for evaluation of implements for primary tillage, secondary tillage, hand hoes

Unit 4: Procedure for evaluation of seeders, seed drills and planters, transplanters, fertiliser distributors. Procedure for evaluation of knapsack sprayer, field sprayer and dusters,

Unit 5: Testing procedures for power tiller drawn/self-propelled agricultural equipment/ implements, reapers, binders, grain threshers and combine harvesters, maize shellers, decorticators, winnowers.

Unit 6: Testing of farm tractor and power tiller – Tractor test codes: BIS: ISO: ASABE, OECD and SAE.

References:-

1. Smith, D.W., Sims, B.G. and O'Neill, D.H. 1994. Testing and Evaluation of Agricultural Machinery and Equipment: Principles and Practices. FAO, Rome.
2. Goering, C.E. and Hansen, A.C. 2013.Engine and Tractor Power. ASABE, USA.
3. Singh, T.P. 2017. Farm Machinery. PHI Learning Pvt. Ltd., Delhi.
4. Singh, S. 2007. Farm Machinery Principles and Applications. ICAR, New Delhi.

AGPE314	Water Quality Management Practices Teaching	3L:0T:0P	3 Credits

Courses Objectives

- To provide with a comprehensive understanding of water quality parameters and assessment methods used in water quality management.
- To develop water quality monitoring and management plans for aquatic ecosystems and water bodies.
- To promote the implementation of best management practices (BMPs) for water quality improvement and pollution prevention

Course Outcomes

- At the end of the course, students will be
- Aware of the importance and the scope of water quality monitoring and management.
- Able to select water and its characteristics for treatment.
- Acquaint with mathematical interpretation and fundamental expression of pollution transport.

Syllabus Contents

Unit 1: Water quality: Water quality criteria for industrial, drinking, irrigation and aquatic life. Concept of water reuse and recirculation.

Unit 2: Important water quality parameter: pH. Dissolved oxygen, carbon dioxide, Biological Oxygen demand, Chemical oxygen demand and nitrogenous compound

Unit 3: Pond dynamics. Water Treatment Methods: Aeration, nitrogen removal, carbonate system and pH control, solids removal, disinfection and ion exchange

Unit 4: Design and Operation of Water Quality Management System and Equipment: Aerator, mechanical and biological filters, settling basin, water exchange and water reuse system.

Unit 5: Mixing and water circulation in ponds, tanks and raceways. Effects of interacting factors on water quality management

References

1. Timmons. B. Michal, Recirculating Aquacultural System. Ithaca Publishing Company.

2. Lawson, Thomas B., Fundamental of Aquacultural Engineering, Springer.

3. Robert R. Stickney, Aquaculture : An Introductory Text, CABI Publishing

AGPE315	Photovoltaic Technology and Systems	3L:0T:0P	3 Credits

Objective of Course:

- To introduce the basic idea of solar PV Technology: Advantages, Limitations, Current Status of PV technology.
- To discuss fundamental and to application of Application of Solar PV system, solar home lighting system, solar lantern, solar fencing and solar street light.

Course Outcomes:

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

- The course is designed to generate awareness on fundamentals of solar pv systems and basic know how about pv technology and power generation

Syllabus Contents:

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

Converters: DC to DC converter and DC to AC type converter. Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light,

Unit-V

Solar water pumping system, Roof top solar photovoltaic power plant and smart grid.

References :

1. Rai GD. 1998. Non-conventional Sources of Energy. Khanna Pub.
2. Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy: Theory & Practice, Himanshu Publications,
3. Solanki C.S. 2011. Solar Photovoltaic: Fundamentals, Technologies and Applications, PHI Learning Private Ltd.
4. Meinel & Meinel. Applied Solar Energy.
5. Derrick, Francis and Bokalders, Solar Photo-voltaic Products.
6. Rathore N.S., C.B. Khobragade and B. Asnani. 2010. Asnani. Fundamentals of renewable energy sources. Himanshu Publication, Udaipur (Raj.).

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Semester VI

AGPC351	Thermal Operation in Food Processing	3L:0T:0P	3 Credits

Course Objective:

1. Understanding the fundamental principles of heat transfer and thermodynamics as they apply to food processing.
2. Familiarizing students with various thermal processing methods such as pasteurization, sterilization, blanching, and thermal preservation techniques like canning and bottling.
3. Providing practical knowledge of heat exchangers, boilers, retorts, and other thermal processing equipment used in the food industry.
4. Teaching students how to design and optimize thermal processing systems for different food products while ensuring safety, quality, and nutritional integrity.

Course Outcomes:

- Overview of thermal operations carried out in dairy and food processing. Pasteurization and Sterilization: microbial destruction in batch and continuous sterilization; kinetics of loss of nutrients in sterilization;
- UHT processing; action of chemicals on death kinetics of microbes; aseptic packaging; irradiation and microwave processing of foods; Effects of heat, acid and short wave electromagnetic radiation on kinetics of enzyme inactivation.
- Crystallization and Freezing: Planks law and estimation of freezing time of foods; equipment used for freezing water in food for production of crystalline foods

Syllabus Contents:

Unit 1: Fourier's law, heat conduction through composite walls, optimum thickness of insulation, general equation under unsteady sate, Free and forced convection, Newton's law of cooling, film coefficient, correlation of Nusselt number, Prandtl and Reynold's number; Empirical and practical relations for forced convection

Unit 2: Overall heat transfer coefficient, fouling factors, log mean temperature difference, heat exchange mechanism in various types of heat exchangers e.g. tubular, extended surface and plateheat exchangers, effectiveness/NTU relationships

Unit 3: Effect of heat, acid and short wave electromagnetic radiation on kinetics of enzyme inactivation; microbial destruction and nutrients loss in pasteurization, sterilization and UHT processing.

Unit 4: Mechanism of moisture removal in solid and liquid foods during drying; Spray, freeze, roller tray and through-flow drying operations.

Unit 5: Concept of water activity, concentration of liquid foods in batch and continuous type evaporators; Energy saving by use of multiple effect evaporators with mechanical and thermal vapour compression.

References

1. Arora, S.C. and Domkundwar, S. (1994) A Course In Heat and Mass Transfer. Dhanpatrai and Sons, 4th Edition.
2. Chapmen, A. J. (1989) Heat Transfer, 4th Edition
3. Holman, J. P. (1992) Heat Transfer. McGraw Hill Publication
4. Toledo, R. T. (1980) Fundamental of Food Process Engineering. AVI publishing Co., West port.

AGPC352	Machine Design and Drawing	2L:0T:0P	2 Credits

Course Objective:

1. Understand the principles of machine design and drawing for agricultural applications.
2. Develop skills in designing and drafting agricultural machinery components.
3. Foster creativity and innovation in designing efficient and reliable agricultural equipment.

Course Outcomes:

1. Apply engineering principles to design agricultural machinery components considering factors like load, stress, and material selection.
2. Create detailed engineering drawings and schematics for agricultural machinery using drafting software.
3. Analyze and optimize machine designs for performance, reliability, and manufacturability.
   Demonstrate proficiency in communicating design concepts and specifications through engineering drawings and documentation

Syllabus Contents:

Unit 1: Design considerations - limits, fits and standardization, Review of failure theories for static and dynamic loading (including fatigue failure).

Unit 2: Design of shafts under static and fatigue loadings.

Unit 3: Analysis and design of sliding and rolling contact bearings.

Unit 4: Design of transmission elements: spur, helical, bevel and worm gears; belt and Chain drives.

Unit 5: Design of springs: helical compression, tension, torsional and leaf springs.

Unit 6: Design of joints: threaded fasteners, pre-loaded bolts and welded joints.

Unit 7: Analysis and applications of power screws and couplings.

Unit 8: Analysis of clutches and brakes.

References:-

1. Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co. 2007.
2. C. McMohan and J. Browne, CAD/CAM Principles, II edition, Pearson Education, 1999.
3. W. M. Neumann and R.F. Sproul, Principles of Computer Gra[hics, McGraw Hill, 1989.
4. D. Hearn and M.P. Baker, Computer Graphics, Prentice Hall Inc., 1992.

AGPC353	Renewable Energy Technologies	2L:0T:0P	2 Credits

Course Objectives:

1. To study the basic aspects of different renewable energy sources.
2. To study the working principles of different renewable energy equipments.

Course Outcomes:

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

- Understand the working principle and working of various appliances based on renewable energy sources.
- Carry out the task of operation and maintenance of biogas plant, gasifier, solar water heater solar cooker etc.
- Apply the working principle of renewable energy for development of appropriate technologies.

Syllabus Contents :

Unit 1: Solar Energy; Heat transfer processes, radiation estimation and physical conversion, Instruments for measurement. Energy collection and thermal analysis; FPC, ETC, concentrating collectors. Solar thermal energy technology application; direct and indirect heating/cooling, refrigeration solar cooker and Water heater, Solar dryers, Solar green house, Active/passive heating, stills and solar pond. Solar photovoltaic technology; Conversion,

Systems components and integrations, Balance of systems, applications and utilization in agriculture and agro based industries.

Unit 2: Energy from biomass and wastes; Production, distribution, Sources, characterization and properties of waste, composition, treatments, recycling. Biomass conversion technologies.

Unit 3: Thermo-chemical, bio-chemical and agro-chemical technology- Gasification: Updraft, Downdraft and Fluidized Bed Gasification, Producer gas engines applications. Wind energy; Resource estimation, technologies, performance curves, wind farms design and considerations, wind mill parameters, power and torque characteristics; design and performance of rotors, wind mill structure design..

Unit 4: Biogas Production: Types of biogas, biogas engine system for power generation, Liquid fuels; aerobic and aerobic fermentation, ethanol, methanol production process and technologies.

Unit 5: Densification; Types of Densification Devices, Properties of Densified Fuels. and Other Renewable Energy Technologies; Ocean Thermal Energy Conversion, Geothermal, Tidal and Hydro Energy conversion systems

References :

1. Culp, A.W. 1991. Principles of Energy Conversion, McGraw Hill Pub. Co Inc.
2. Odum. H.T. and Odum, E.C. 1976. Energy Basis For Man and Nature. McGraw, Hill Pub. Co. Inc.
3. Garg, H.P. and Praksh J. 1976. Solar Energy- Fundamentals and Applications. Tata McGraw, Hill Pub. Co. Inc.
4. Sukhatmes, S.P. 1997. Solar Energy- Principles of Thermal Collection and Storage, 2nd Edition. Tata McGraw Hill. Pub. Co. Ltd., New Delhi.
5. Rai, G.D. 2001. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
6. Rathore N.S., C.B. Khobragade and B. Asnani. 2010. Asnani. Fundamentals of renewable energy sources. Himanshu Publication, Udaipur (Raj.).

AGFPC354	Irrigation & Drainage Engineering	2L:0T:0P	2 Credits

Course Objectives:

- Optimize water use in agricultural and urban landscapes.
- To improve crop yield and quality through effective irrigation and drainage management.
- To minimize the environmental impact associated with water management practices.

Course Outcomes:

At the end of the course the students should be able to

- Be able to understand the concepts of irrigation and different hydraulic structures and their designs, different channels and other irrigation structures required for irrigation and drainage.
- Able to describe about merits and important points to be considered to select a suitable site for irrigation methods and drainage systems.
- Gives an idea about the layout plan of different types of irrigation methods and drainage systems, Water supply systems and types of irrigation and drainage systems

Syllabus Contents

Unit 1: Water Resource Utilization in India

Sources of water, utilization in various sectors, irrigation potential and scope for further development and significant issues, Techniques of water distribution in the farm, Irrigation projects, Duty and Delta, factor affecting of duty, Quality of irrigation water, Water requirements to the crop.

Unit 2: Irrigation Pump

Indigenous water lifts, positive displacement pumps, centrifugal pumps, vertical turbine pumps, submersible pumps, propeller and mixed flow pumps, jet pumps, airlift pumps, Pump efficiency and economics of irrigation pumping plants, Net positive suction head, Pump characteristic curve.

Unit 3: Soil-plant-water Relationships

Water relation of soils, measurement of soil moisture, infiltration, water requirement of crops, consumptive use and evapotranspiration, Factor affecting consumptive use, Estimation of consumptive use, Irrigation efficiencies, irrigation scheduling, Optimum utilisation of irrigation water, Transpiration, Consumptive irrigation requirement, Net irrigation requirement, Soil- moisture-irrigation relationship,

Unit 4: Measurement of Irrigation Water and its Application

Methods of water measurement, weirs, gravity and non-gravity weir, parshall flumes, orifices and meter gates, methods of irrigation water application, water conveyance and control structures, Barrage, Layout of diversion head works and its components.

Unit 5: Drainage of Agricultural Lands

Drainage problems, causes and effect of water logging, prevention and control of drainage requirements of various crops, types of drainage systems, Land grading and land preparation for irrigation and drainage, design of irrigation channel, Tile drains , Layout of tile drains, Drainage coefficient, Leaching requirements of soil, Water logging control.

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi

2. Garg, S. K. Irrigation Engineering and Hydraulic Structures. Khanna Publisher.
3. Sharma, R.K., Text book of Irrigation Engineering and Hydraulic Structures, Oxford and IBKPublishing House, New Delhi.
4. Punmia, B.C., and B.B. Pande, ‒Irrigation and Water Power Engineering‖, Laxmi Publication Pvt. Ltd., New Delhi.
5. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA

AGPC355	Aquacultural Engineering	3L:0T:0P	3 Credits

Course Objectives:

- To promote sustainable aquaculture practices that balance economic viability with environmental and social responsibility.
- Learn to apply engineering principles and techniques to address the technical challenges associated with aquaculture production
- To promote sustainable aquaculture practices that balance economic viability with environmental and social responsibility.

Course Outcomes:

At the end of the course the students should be able to

- To understand hydrological information for design and operation of aquaculture systems.
- Outline the concept and flow types, properties and phenomenon in aquacultural system and quality management.
- Acquaint and equip with the selection, planning and process for design of farm, aquacultural system and quality management.

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Syllabus Contents

Unit 1- Open Channel Hydraulics

Open channel flow, pipe flow, type of open channel flows, open channel and their properties, velocity distribution in open channels, local phenomenon in open channel flow, Critical flow, Continuity, Manning's Equation, Flow Measurement Flumes and Weirs, In-Situ Instrumentation Pipe flow: Minor and Major Losses, Design Considerations,

Unit 2 – Water Quality Management Practices

Chemical equilibrium, important water quality parameter; pH, carbon dioxide, nitrogenous compounds, nitrogen cycle, phosphorous cycle, BOD, COD, DO, C:N ratio, fertilization andliming of pond. Tanks and Piping, Pumps and Motors, Filters and Filtration, Physical

(Screen/Overflow/Sand or Rock), Biological (e.g. Filter beds, RBC's, PAS applications, etc.)

Unit 3 – Planning and Design of Aquaculture Project

Selection of suitable site for aquacultural project, topography, type of soil and its quality, water supply, drainage, environmental considerations, process of farm design, computations for water requirement, seepage and evaporation, types of ponds and their designs, dykes, pump fed farm, tide fed farm, Flow-Through or Fixed Systems, Production Ponds, Polyculture with aquatic plants(e.g. Crawfish/Rice), Cages Recreational Ponds

Unit 4 – Design of Aquaculture Facilities

Aerator, need of aeration, types of aerators: Diffuser aerator, Propeller-aspirator pump aerator, paddle wheel aerator and cascade aerator, design of surface water aeration system, recirculating aquaculture systems, component of recirculating aquaculture system, advantages and disadvantages of recirculating aquaculture system,

Unit 5- Hatchery

Type of hatchery, component of hatchery, design and construction of carp hatchery, design of commercial freshwater prawn hatchery, Natural seed resources, site selection and collectionmethods, Health management in hatcheries.

References

1. Chow, Ven TE, Open Channel Hydraulics, McGraw-Hill International BOOK Company.

2. Lawson, Thomas B., Fundamental of Aquacultural Engineering, Springer

3. Boyd, C.E. and Tuker C.S. Pond Aquaculture Water Quality Management, Springer.

Timmons. B. Michal, Recirculating Aquacultural System. Ithaca Publishing Company

AGPC356	Thermal Operation in Food Processing Lab	0L:0T:2P	1 Credits

Course Objectives:

1. Understanding the fundamental principles of heat transfer and thermodynamics as they apply to food processing.

2. Familiarizing students with various thermal processing methods such as pasteurization, sterilization, blanching, and thermal preservation techniques like canning and bottling.

3. Providing practical knowledge of heat exchangers, boilers, retorts, and other thermal processing equipment used in the food industry.

4. Teaching students how to design and optimize thermal processing systems for different

food products while ensuring safety, quality, and nutritional integrity.

Course Outcomes:

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

- Understand the broad principles of thermal operations in food processing.
- Understand comparison study of drying and dehydration phenomena.
- Be able to apply various types of heat processing employed by the food industry

Syllabus Contents:

1. Canning of foods
2. Spray of liquid foods
3. Vacuum drying of food
4. Tray drying of foods
5. Freeze drying of foods
6. Z-factor analysis
7. Freezing/chilling of food materials
8. Thin layer drying characteristics of crops and other bio-materials

References

1. Brennam, J. G., Butters, J. R., Cowell, N. D and Lilly, A. E. I. (1990). Food EngineeringOperations. Elsevier Science Pub. Co., Inc.
2. Henderson, S. and Perry, S. M. (1976) Agricultural Process Engineering. 5th ed. AVIPublishing Co. Inc.
3. McCabe, W.L., Smith, J. C. and Harriott, P. (1985). Unit operations of chemicalEngineering. 4th Ed. McGraw -Hill Book Company, Inc.

AGPC 357	Machine Design and Drawing Lab	0L:0T:2P	1 Credits

Course Objective:

1. Apply theoretical knowledge of machine design in practical design projects.
2. Develop skills in creating detailed engineering drawings for agricultural machinery components.
3. Gain hands-on experience in using design software and workshop equipment for prototyping.

Course Outcomes:

1. Create engineering drawings and models for agricultural machinery components using drafting software.
2. Design and prototype agricultural equipment parts considering factors like material selection, strength, and manufacturability.
3. Evaluate and refine design prototypes based on testing and feedback.
4. Demonstrate proficiency in translating design concepts into practical, manufacturable solutions for agricultural engineering applications.

Syllabus Contents

- Engineering Graphics Software; -Spatial Transformations; Orthographic Projections.
- Model Viewing; Co-ordinate Systems; Multi-view Projection.
- Exploded Assembly; Model Viewing; Animation.
- Spatial Manipulation; Surface Modelling.
- Solid Modelling.
- Preparation of engineering drawings of machine / implement components.

References:-

1. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; 1989.
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.
3. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
4. Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
5. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998.

AGPC358	Renewable Energy Technologies Lab	0L:0T:2P	1 Credits

Course Objectives:

1. To study the working principle of different instruments.
2. To study the working of various appliances based on renewable energy.

Course Outcomes:

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

- Understand the working principle and working of various appliances based on renewable energy sources.
- Carry out the task of operation and maintenance of biogas plant, gasifier, solar water heater solar cooker etc.
- Apply the working principle of renewable energy for development of appropriate technologies..

Syllabus Contents :

- Evaluation of solar thermal devices; Solar cooker, water heater, dryer, still, solar pond, solar green house.
- Solar Photovoltaic cell characteristics, Analysis of SPV system for home lighting, remote electrification, SPV pumping system.
- Characterization of biomass; Proximate and Ultimate
- Calorific value estimation of biomass

- Biogas and producer gas and Design and benefit analysis of community biogas plant
- Study of ethanol.
- Design and efficiency testing of wind energy conversion devices; water pumping, electricity generation
- Study of solar devices.

References :

1. Culp, A.W. 1991. Principles of Energy Conversion, McGraw Hill Pub. Co Inc.
2. Odum. H.T. and Odum, E.C. 1976. Energy Basis For Man and Nature. McGraw, Hill Pub. Co. Inc.
3. Garg, H.P. and Praksh J. 1976. Solar Energy- Fundamentals and Applications. Tata McGraw, Hill Pub. Co. Inc.
4. Sukhatmes, S.P. 1997. Solar Energy- Principles of Thermal Collection and Storage, 2nd Edition. Tata McGraw Hill. Pub. Co. Ltd., New Delhi.
5. Rai, G.D. 2001. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
6. Rathore N.S., C.B. Khobragade and B. Asnani. 2010. Fundamentals of renewable energy sources. Himanshu Publication, Udaipur (Raj.).

AGPC359	Irrigation & Drainage Engineering Lab.	0L:0T:2P	1 Credit

Course Objectives:

- To familiarize students with various Irrigation & Drainage Engineering equipments.
- To provide students with hands-on experience in using irrigation equipment and techniques commonly used.

Course Outcomes:

At the end of the course the students should be able to

- Gain practical knowledge about irrigation techniques and their designs.
- Gain knowledge of drainage techniques and their field uses.
- Able to understand how to determine soil moisture content, evapotranspiration
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Syllabus Contents

1. Field and laboratory demonstration of hydro-met observatory, lysimeter, soil moisturemeasuring equipment, flow measurement devices.
2. Measurement of soil moisture by different soil moisture measuring instruments
3. Measurement of infiltration rate, computation of evaporation and transpiration
4. Measurement of advance and recession in border irrigation and estimation of irrigationefficiency
5. Determination of crop water requirement and irrigation scheduling

6. Measurement of uniformity coefficient of drip irrigation method
7. Measurement of uniformity coefficient of sprinkler irrigation method
8. Design of surface drainage systems and subsurface drainage systems
9. Determination of drainage coefficient
10. Land grading and land levelling methods

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. Garg, S. K. Irrigation Engineering and Hydraulic Structures. Khanna Publisher.
3. Sharma, R.K., Text book of Irrigation Engineering and Hydraulic Structures, Oxford and IBKPublishing House, New Delhi.
4. Punmia, B.C., and B.B. Pande, ‒Irrigation and Water Power Engineering‖, Laxmi Publication Pvt. Ltd., New Delhi.
5. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA
6. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice HallInc. New Jersey, USA

AGPE351	Professional Elective II (**Refrigeration and Air Conditioning**)	**3L:0T:0P**	**3 Credits**

Course Objectives

- To familiarize with the terminology associated with refrigeration systems and airconditioning
- To understand basic refrigeration processes
- To understand the basics of psychrometry and practice of applied psychrometrics
- To acquire the skills required to model, analyse and design different refrigeration as well asair conditioning processes and components

Course Outcomes:

At the end of the course the student should able to

1. Students gain comprehensive knowledge in thermodynamics, heat transfer, and fluid mechanics, enabling them to design, install, and maintain refrigeration and air conditioning systems effectively.
2. Students are equipped to implement eco-friendly refrigerants, design energy-efficient systems, and optimize cooling processes, contributing to environmental sustainability efforts and minimizing greenhouse gas emissions in HVAC operations.

Syllabus Contents

Unit-1: Classification of refrigeration systems; Ozone depletion and global warming issues

Unit-2: Advanced vapour compression cycles, Refrigerants and their mixtures: properties andcharacteristics.

Unit-3: System components: Compressors, Condensers, Expansion devices and Evaporators-Performance matching of components of refrigeration systems.

Unit-4: Advanced sorption refrigeration systems and their components.

Unit-5: Review of Psychrometry and Air-conditioning processes-Comfort air conditioning andCooling load calculations, Applications of AC systems - Concept of enthalpy potential - Air washers, Coolingtowers, Evaporative condensers, Cooling and dehumidifying coils.

References

1. Gosney, W.B, Principles of Refrigeration, Cambridge University Press, 1982.
2. Stoecker, W.F. and Jones, J.W., Refrigeration and Air conditioning, Tata McGraw Hill,1986.
3. Arora, C.P., Refrigeration and Air conditioning, Tata McGraw Hill, 2nd Edition, 2000.
4. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rdEdition, Prentice Hall, 1998.

AGPE352	Professional Elective II (**Advanced Farm Power**)	**3L:0T:0P**	**3 Credits**

Course Objective:

1. Explore advanced concepts and technologies in farm power and machinery.
2. Develop skills in the selection, operation, and maintenance of modern farm power equipment.
3. Foster innovation and sustainability in farm power systems for efficient agricultural practices.

Course Outcomes:

1. Analyze and select appropriate farm power sources and machinery for specific agricultural tasks.
2. Implement advanced techniques for optimizing the performance and energy efficiency of farm power systems.
3. Evaluate the environmental impact of farm power operations and propose sustainable solutions.
4. Demonstrate proficiency in troubleshooting and maintaining advanced farm power equipment to ensure reliability and productivity.

Syllabus Contents

Unit 1: Hydraulic system circuits, design and selection of hydraulic system components, automatic draft and position control system. Hydrostatic transmission, Power steering

Unit 2: Tractor chassis mechanics, hitching systems, 3-point hitch linkage design, hydraulic control of tractors, Determination of CG and moment of inertia, Dynamic stability and tractive ability of tractor, Tyre selection.

Unit 3: Recent trends in tractor design, emissions and control of pollutants, Design of mechanical steering and brake system of tractor, hydraulic brake system, Steering geometry and stability during turning

Unit 4: Introduction of traction devices, tyres-types, function and size, their selection; mechanics of traction devices. Deflection between traction devices and soil, slippage and sinkage of wheels, evaluation and prediction of traction performance, design of traction and transport devices.

Unit 5: Ergonomics in tractor system design, noise and vibration effects, Design of operators' seat and suspension, work-place area and controls.

References:-

1. Liljedahl, J.B., Turnquist, P.K., Smith, D.W. and Hoki, M. 1999. Tractors and their Power Units. Wiley, New York.
2. Mathur, M.L. and Sharma, R.P. 1994. Internal Combustion Engines. DhanpatRai and Sons, New Delhi.
3. Goering, C.E. and Hansen, A.C. 2013. Engine and Tractor Power. ASABE, USA.
4. Lal, R. and Datta, A.C. 1979. Agricultural Engineering (through worked examples). SarojParkashan, Karta.
5. Upadhyaya, S.K. 2013. Advances in Soil Dynamics. ASABE, St. Joseph, USA.

AGPE353	Professional Elective II (**Food Packaging Technology**)	**3L:0T:0P**	**3 Credits**

Objective of Course:

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

- To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Outcomes:

At the end of the course the student should able

1. Understand the principles and fundamentals of food packaging technology, including packaging materials, packaging formats, and packaging processes.
2. Learn about the factors influencing food packaging selection, such as product characteristics, shelf-life requirements, transportation considerations, regulatory compliance, and consumer preferences.

3. Develop practical skills in designing, selecting, and implementing appropriate packaging solutions for different food products, considering factors like barrier properties, sustainability, branding, and convenience.

Syllabus Contents

Unit 1:
Definitions, objectives and functions of packaging and packaging materials; Packaging requirements and selection of packaging materials; Types of packaging materials: Paper: pulping, fibrillation and beating, types of papers and their testing methods; Glass: composition, properties, types of closures, methods of bottle making; Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminium containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.

Unit 2:
Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods, selection and design of packaging material for different foods.

Unit 3:
Food packaging systems: Different forms of packaging such as rigid, semi rigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

Unit 4:
Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink-packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines; carton making machines.

References

1. Crosby NT.1981. *Food Packaging: Aspects of Analysis and Migration Contaminants*. App. Sci. Publ.
2. Kadoya T. (Ed). 1990. *Food Packaging*. Academic Press.
3. Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
4. Palling SJ. (Ed). 1980. *Developments in Food Packaging*. App. Sci. Publ.
5. Painy FA. 1992. *A Handbook of Food Packaging*. Blackie Academic.
6. Sacharow S & Griffin RC. 1980. Principles of Food Packaging. AVI Publ.
7. Stanley S & Roger CG.1970. *Food Packaging*. AVI Publ.

AGPE354	Professional Elective II	**3L:0T:0P**	**3 Credits**

	(**Planning and Design of Aquaculture Project**)		

Courses Objectives

- Develop the ability to assess and select suitable sites for aquaculture projects based on environmental, geographical, and socioeconomic factors.
- Gain proficiency in designing and integrating aquaculture production systems with appropriate technologies to optimize resource use efficiency and productivity.
- Acquire knowledge and skills in conducting feasibility studies and developing comprehensive business plans for aquaculture projects.

Courses Outcomes

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

- Finalize the project site for Aquaculture design the aquaculture Farm.
- Generate scenarios of protection of coastline- structure and forces acting on them.
- Address the pertinent coastal protection planning for design of aquaculture farm

Syllabus Contents

Unit 1: Selection of Aquacultural Project Site - Water Supply, Soil Type, Topography, Drainage.

Unit 2: Computations for Water Requirement, Seepage and Evaporation, Seed Requirement, Seed Availability.

Unit 3: Environmental Considerations, Tidal Effects, Effects of Flood and Cyclone, Requirements of Manpower, Energy and Equipment. Proposed Cultural Practices and Calculations for Expected Productions.

Unit 4: Market Study and Evaluation of Economic Viability of the project. Society and Social Benefits, Project Layout

Unit 5: Types of Ponds and their Designs, Flow Scheme for Water Supply and Drainage, Flow Channel Design, Inlet and Outlet Designs.

References

1. Lawson, Thomas B., Fundamental of Aquacultural Engineering, Springer.
2. J.F. Muir and R.J. Roberts, In Recent advances in aquaculture, Croom Helm
3. T.V.R. Pillay M.N. Kutty., Aquaculture: Principles and Practices.

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Semester VII

AGPC401	**Land and Water Resource Management**	**3L:0T:0P**	**3 Credits**

Course Objectives:

- To promote the sustainable use of land and water resources.
- To conserve and preserve natural habitats, biodiversity, and ecosystem services associated with land and water resources.
- To adopt an integrated approach that considers the interconnectedness of land, water, and other natural resources.

Course Outcomes:

At the end of the course the students should be able to

- Learn the different land suitability and capability classifications of soil and its framework for evaluation.
- Assess the potential of groundwater and surface water resources including the different mathematical techniques about sustainable yields of the water resources.
- Assess the different salt-related problems and methods to control them

Syllabus Contents

Unit 1: Land Resources for Agriculture

Land classification, Land capability classification, United States department of agriculturesystem, land evaluation, the FAO framework for land evaluation

Unit 2: Groundwater and Wells

Subsurface distribution of water, geologic formation of groundwater supply, types of aquifers, investigation of groundwater development, Hydraulics of wells

Unit 3: Design and Construction of Wells

Location of wells, drilling methods, construction of strainer type wells, cavity wells and openwells, development of tubewells, testing of tubewells

Unit 4: Farm Ponds

Types of ponds, design of farm ponds, site selection, capacity of the pond, design ofembankment, seepage through embankments, spillway and outlet

structures.

Unit 5: Salt Problems in Soil and Water

Salt affected soils, classification of salt affected soils, quality of irrigation waters, salt balance inirrigated lands, reclamation of salt affected soils

References

1. Suresh, R. Soil and Water Conservation Engineering. Standard Publishers, and Distributors,New Delhi
2. G. O. Schwab, D. D. Fangeir, W. T. Edminister and R.K. Frevert. Soil and WaterConservation Engineering, John Wiley and Sons.
3. V.V.N. Murty. Land and Water Management Engineering. Kalyani Publisher, Ludhiana, India
4. V.V.N. Murty and D. K. Takeuchi, Land and Water Development for Agriculture in Asia Pacific Region. Oxford and IBH Publishing Co. New Delhi.

AGPC402	Fruits and Vegetable Processing	2L:1T:0P	3 Credits

Couse Objective:

1. To provide knowledge about useful processing of fruits & vegetables, their nutritive value and composition.
2. Handling, transportation and storge of fruits and vegetable.
3. To teach product life cycle.
4. To learn food chemistry behind the processing and preservation.
5. To analyze the effect of various processing techniques on quality of products.
6. To impart basic knowledge about processing, preservation, packaging, storage and other quality aspects of the fruits and vegetables.

Course Outcomes:

- To reduce wastage and losses: Fruit and vegetable industry is the backbone of horticulture industry as it takes care of all possible waste that occurs in spite of improvement inthe distribution and marketing of fresh produce
- To generate employment: Processing of fruits and vegetables being a labour intensive helps to generate both direct and indirect employment for the masses.
- To add variety to the diet: Value addition/processing make the food more attractive and palatable.
- To ensure nutritional security

Syllabus Contents:

Unit 1: Unit operations in primary and secondary processing; processing technologies,

equipment and systems such as cleaning, grading, pretreatment

Unit 2: Principles and techniques in preservation of foods and vegetables-cold storage, freezing, addition of chemicals, dehydration and canning, packaging. Manufacturing methods of major horticultural and plantation crop products-juices, pickles, jams, jellies, marmalades, tea, coffeeprocessing

Unit 3: Quality; packaging of processed products; utilization and management of byproducts; storage of milled products; BIS standards for various processed products; layout and design of processing systems

Unit 4: Seed processing with reference to drying, cleaning, processing and treatment of seed packaging, post harvest control of insect, pest and fungi in storage

Unit 5: Packaging, seed testing, seed germination and vigour, maintenance and distribution of breeders seed

References

1. J. J. Asiedu. Processing tropical crops. ELBS Macmillan.
2. A. Chakraverty. Post Harvest Technology of cereals, Pulses and oilseeds. 3rd OxfordIBH Publishing Co. Pvt. Ltd.
3. D.A. Dendy and B.J. Dobraszczyk. Cereals and Cereal products: Chemistry andTechnology. Aspen publishers, Maryland
4. B. Godon and C. Williams. Primary cereal processing: A comprehensive source book
5. B.R. Greg, A.G. Law, S.S. Virdi and J.S. Balis, Seed Processing. Avion Printers, ND.

AGPR404	Project- I	**0L:0T:10P**	**5 Credits**

Course Objectives:

- To address a specific challenge or requirement within the agricultural sector using engineering principles and techniques.
- To demonstrate how engineering principles can be applied to address real-world challenges in agriculture.

Course Outcome:

- Student will be able to
- Develop a novel solution or technology to address the identified agricultural challenge or requirement.
- To design new machinery, creating innovative irrigation systems, developing automation solutions, or implementing advanced techniques for crop management.

Guidelines: Start by identifying a problem or an area where improvement is needed in agriculture. This could be related to crop cultivation, irrigation, machinery, processing, storage, or any other aspect of agricultural production. Conduct thorough research on the problem or opportunity you've identified. Look into existing solutions, technologies, and practices. Understand the scientific principles behind agricultural processes related to your project. Clearly define the objectives of your project. What do you aim to achieve? Your objectives should be specific, measurable, achievable, relevant, and time-bound (SMART).

AGPE401	Professional Elective III (**Environmental Engineering Fundamentals**)	**3L:0T:0P**	**3 Credits**

Course Objective:

1. Understand the fundamental principles and concepts of environmental engineering.
2. Explore the relationship between human activities and environmental sustainability.
3. Develop skills in analyzing and addressing environmental challenges through engineering solutions.

Course Outcomes:

1. Apply principles of environmental science to assess and mitigate pollution sources.
2. Design systems for water and wastewater treatment to protect human health and the environment.
3. Analyze the impacts of human activities on air quality and propose strategies for pollution control.
4. Evaluate the sustainability of engineering projects and practices in the context of environmental conservation.

Syllabus Contents

Unit 1: Introduction to environmental engineering, Domains of environmental engineering, History of environmental engineering, Environmental issues of emerging concern, laws and regulations, Environmental engineering management, Development of environmental regulations, environmental legislation in India, environmental ethics.

Unit 2: Ecology and the environment, Ecosystems, Nutrient cycles, Biodiversity, Ecology and the environment, Limnology, Water budget, Population growth.

Unit 3: Overview of chemistry, Mass relationships, Units of measurement, Equilibrium, Acid-base reactions, Solubility reactions, Redox reactions, Chemical reaction rates; Mass balance.

Unit 4: Overview of microbiology, Microbes in the environment, Microbes in engineering systems, Microbial energetic, Microbial growth kinetics, Microbial genetics; Microbial diseases.

Unit 5: Environmental quality, Water pollution (Organic pollutants, Inorganic pollutants, Physical pollutants), Water pollution (Oxygen sag curve), Air pollution (Greenhouse gases; Hazardous gases), Pollution control (Wastewater treatment), Pollution control (Water treatment; Desalination & Membranes; Land-based treatment)

References:

1. Davis M.L., Cornwell D.A., ―Introduction to Environmental Engineering‖, Tata McGraw Hill Education (P) Ltd., New Delhi
2. De A.K., ―Environmental Chemistry ", New Age International (P) Ltd., New Delhi.

3. Khopkar S.M., ―Environmental Pollution Analysis‖, New Age International (P) Ltd., New Delhi.
4. Cunningham W.P., Cunningham M.A., ―Principles of Environmental Science‖, Tata McGraw Hill
5. Krishnamoorthy B., ―Environmental Management, Text Book and Cases‖, PHI Learning (P) Ltd.
6. Chandrappa R., Das D.B., ―Solid Waste Management: Principals and Practice‖
7. Pelczar, M., J.Chan E.C.S. and Krieg, N. R. Microbiology, Tata McGraw Hill, New Delhi.
8. Droste R.L., ―Theory and Practice of Water and Wastewater Treatment‖, Wiley India (P) Ltd.
9. Dara S.S., ―A Textbook of Environmental Chemistry and Pollution Control‖, S. Chand and Company Ltd., New Delhi.

AGPE402	Professional Elective III **(Food Fermentation Technology)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

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

- To understand the principles of food fermentation technology
- To study the types of starters used in Food Industry
- To study the production of various fermented food

Course Outcomes:

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

1. Gain a thorough understanding of the principles and mechanisms of food fermentation, including microbial metabolism, fermentation kinetics, and the role of microorganisms in food transformation.

2. Learn about the various types of fermentation processes used in food production, including lactic acid fermentation, alcoholic fermentation, acetic acid fermentation, and mold fermentation, and their applications in producing fermented foods such as yogurt, cheese, sauerkraut, kimchi, bread, and fermented beverages.

3. Develop practical skills in controlling fermentation processes, including inoculum preparation, fermentation vessel design, process monitoring, pH control, temperature regulation, and post-fermentation processing, to ensure product safety, quality, consistency, and sensory attributes.

Syllabus Contents

Unit 1:

Fermentation, types of fermentation, Fermentation Pathways for Industrial Products: Biochemical pathways of metabolic reactions for utilization of carbon sources and formation of different metabolites by microorganisms; Strain Development -Various techniques of modifying the strains for increased production of industrial products. Use of chemicals, UV rays, genetic engineering to produce newer strains.

Unit 2:

Typical media, Media formulation: -Carbon Source, Nitrogen source, Minerals, Growth Factors, Buffers, Precursors and Inhibitors, O_2 requirement and antifoams.

Unit 3:

Fermenter design, Instrumentation and control, Types of fermenters (Shake flask, Batch/stir tank, Continuous, Bubble column, airlift and Tower fermenter), Types of fermentation processes, aeration and agitation (The oxygen requirement for industrial fermentation, Determination of KLa values).

Unit 4:

Downstream Processing: Various equipment for product recovery; micro-filters and Ultrafiltration systems for separation of cells and fermentation medium and for concentration of medium containing product; chromatographic systems of separation; extraction of product with solvent; evaporation and crystallization; centrifugation, different types of centrifuges; drying techniques; instrumentation and controls.

Unit 5:

Fermentative Production: a) **Foods**: Processes for preparing fermented products including Yogurt (curd) and other Traditional Indian Products like idli, dosa, dhokla, shrikhand,., Soya based products like soya sauce, natto,., , Cheese.; Alcoholic Beverages based on fruit juices (wines), cereals (whisky, beer, vodka,), sugar cane (rum) Process description, quality of raw materials, fermentation process controls. b) **Industrial chemicals**: Fermentative Production of Organic acids

References

1. Shikha,O, K Tiwari, Brijesh K (Eds.). 2016. Novel Food Fermentation Technologies. Springer International Publishing
2. Stanbury, P.F.,A. Whitaker and S.J. Hall ,.2016, Principles of Fermentation Technology Butterworth-Heinemann, Elsevier publishers
3. Vogel, H.C. and C.L. Todaro, 2005 Fermentation and Biochemical Engineering Handbook : Principles, Process Design and Equipment , 2nd Edition, Standard Publishers.
4. El-Mansi, E.M.T, 2007, Fermentation Microbiology and Biotechnology 2nd Edition, CRC / Taylor & Francis.
5. Joshi, V.K. and Ashok Pandey, 1999, Biotechnology: Food Fermentation, Microbiology, Biochemistry and Technology , Vol. I & vol. II Educational Publisher.
6. Peppler, H.J. and D. Perlman, 2004, Microbial Technology : Fermentation Technology , 2nd Edition, Vol. II Academic Press / Elsevier.

AGPE403	Professional Elective III **(Open Channel Hydraulics & Coastal Engineering)**	**3L:0T:0P**	**3 Credits**

Courses Objectives

- Understanding the principles and theories governing the flow of water in open channels.
- Analyzing and designing hydraulic structures such as channels, canals, culverts, etc.
- Applying computational tools and models to solve practical engineering problems related to open channel hydraulics.

Course Outcomes

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

- Acquire insight about the open channel and their properties.
- Acquaint and equip with the hydraulics of surface water flow phenomenon in open channels.
- Capable to analyze flow profile analysis

Syllabus Contents

Unit 1: Open Channel and their Properties, Energy and Momentum Principle, Critical flow, Uniform Flow, Design of Channels for Uniform flow.

Unit 2: Gradually Varied Flow, Flow Profile Analysis, Flow Over Spillway, Hydraulic Jump, Flow Through Non-prismatic Channel, Gradually Varied Unsteady Flow.

Unit 3: Equilibrium and Dynamic Theory of Tides, Types of Tides and Tidal Theory, Tidal Propagation in the Channel, Estuaries and Coastal Inlets, Tidal Mixing.

Unit 4: Properties of Ocean Water, Provinces of Ocean, Generation and Prediction of waves, Propagation and Transformation of Waves, Longshore Currents, Rip Current, Littoral Transport,

Unit 5: Artificial Protection of Coastline- Structure and forces acting on them, Coastal Protection Planning for Design of Aquacultural Farm.

References

1. Chow, Ven TE, Open Channel Hydraulics, McGraw-Hill International book Company.
2. Kamphuis, J.W. Introduction to coastal engineering and management. Advance series in ocean engineering.
3. Pillay, TVR and Kutty. M N. Aquaculture: Principles and Practices

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AGPE404	Professional Elective III **(Bio-Energy Systems: Design and Applications)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

- To introduce the basic idea of biomass preparation techniques and harnessing of biomass.
- To discuss fundamental and to application of producer gas – type, operating principle and gasifier fuels.

Course Outcomes:

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

- The main objective of this course is to provide fundamentals of utilization of crop residues and agro industrial waste for energy production through different conversion routes and to understanding the
- Biofuels system, renewable feedstock and their production so that following the completion of this course, students will have the expertise to solve agro industrial, social, and environmental problems with appropriate techniques and tools

Syllabus Contents :

Unit-I

Fermentation processes and its general requirements. An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

Unit-II

Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying).

Unit-III

Thermo-chemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application for shaft power generation, thermal application and economics.

Unit-IV

Trans-esterification for biodiesel production.

Unit-V

A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.

References :

1. British BioGen. 1997, Anaerobic digestion of farm and food processing practices-Good practice guidelines, London, available on www.britishbiogen.co.UK.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Centre for biomass energy. 1998. Straw for energy production; Technology-Environment- Ecology. Available: www.ens.dk.
4. Rathore N.S., C.B. Khobragade and B. Asnani. 2010. Asnani. Fundamentals of renewable energy sources. Himanshu Publication, Udaipur (Raj.).

AGPE405	Professional Elective- IV **(Planning and Design of Aquaculture Facilities)**	**3L:0T:0P**	**3 Credits**

Courses Objectives

- Understanding principles and criteria involved in designing aquaculture facilities.
- Familiarize students with the various types of equipment used in aquaculture operations.
- Instill a strong understanding of safety protocols and practices.

Course Outcomes

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

- Design the aquaculture farms.
- Calculate the water holding capacity of Aquaculture Farms.
- Decide suitable the nature of water flow for fisheries

Syllabus Contents

Unit 1: Tanks and Raceways: Type, Uses and Design and Selection Criteria in Aquacultural Farms.

Unit 2: Water Circulation Systems: Type and Material of Construction

Unit 3: Design and construction of enclosures for mariculture operations, pens, cages, raceways, flow through systems and re-circulatory systems. Selection of materials for mariculture facilities. Sea farming, site selection and structures. Cage farming

Unit 4: Carp Hatchery: Component of carp hatchery, Design, Construction and Operation, Fish Seed Transport.

Unit 5: Fresh Water Prawn Hatchery: Component of carp hatchery Design, Construction and Operation

References

1. Thomas B Lawson. Fundamentals of Aquaculture Engineering
2. Wheaton, F.W. Aquaculture Engineering 1942 Wiler Inter-science publication
3. Santhosh Kumar Garg. Water supply Engineering

AGPE406	Professional Elective- IV **(Tea Technology)**	**3L:0T:0P**	**3 Credits**

Course Objectives:

- To gain knowledge of tea plant cultivation techniques, including soil requirements, planting methods, pruning, and pest management, to ensure optimal tea plant health and yield.
- To gain Comprehensive Knowledge of Tea Processing
- Understanding of Quality Control and Assurance of Tea
- Understanding of Tea Marketing and Trade:

Course Outcomes:

At the end of this course students will demonstrate the ability to

- understand the basiccriteria to select the land for tea plantation.
- Understand and be able to apply the concept of irrigation and drainage, types of irrigation methods used for tea estates.
- Understand variety and type of tea and their manufacturing process.
- The students will be able to evaluate the performance of various tea processing unit operations

Syllabus Contents

Unit 1: Land Preparation and Transplantation

Field selection, Physical land preparation, Type of soil and climatic conditions suitable forgrowing tea, Soil testing and analysis, Methods of transplanting, Practice for planting, Methods of propagation, Nutrient management in tea plantation, Methods of fertilization and micro nutrients application, Shade and shade trees.

Unit 2: Irrigation systems for tea plantation

The interaction effects of soil type, level of the land and water availability on the plant growth

and its yield, Timing and methods of determination of irrigation requirements, Design and maintenance, Irrigation practices in young tea, Selection of appropriate Drainage system and design.

Unit 3: Tea Processing

Types and grades of tea, Flavor profile of tea, Suitable environment for manufacturing, Methods and equipment for production, plucking, types of plucking, plucking table, pruning, types of pruning, Types of tea processing, Unit operations for tea processing, CTC and Orthodox tea processing.

Unit 4: Human Resource Management

Principle of management, Employment issues, Selecting and Hiring processes, Orientation and training programme, Employee Separation and the impact of downsizing and outsourcing, Maslow's hierarchy of needs theory, Goal setting theory, Labour-Management relations.

Unit 5: Waste utilization and management

Introduction, Causes and effects of tea waste, Factory tea waste, Decaffeinated tea waste, Method of tea waste disposal and management, Rules and regulation for sale of tea waste.

References

1. Collin. Tea Production and Processing. J.W. Publication
2. Baruah. The tea industry in Assam. Eastern Publication

AGPE407	Professional Elective- IV **(Earth Moving Machinery)**	**3L:0T:0P**	**3 Credits**

Course Objective:

1. Understand the principles and operation of earthmoving machinery in construction and agricultural contexts.
2. Develop skills in selecting, operating, and maintaining various types of earthmoving equipment.
3. Explore safety considerations and environmental impacts associated with earthmoving operations.

Course Outcomes:

1. Identify different types of earthmoving machinery and their applications in construction and agriculture.
2. Operate earthmoving equipment safely and efficiently, considering factors such as terrain and load capacity.
3. Analyze site conditions and select appropriate earthmoving machinery for specific tasks..

Syllabus Contents

Unit 1: Types of earth moving machinery, Crawler tractor: Differential, brake, clutch, suspension, track assembly.

Unit 2: Study of bulldozer, grubber, ditcher, excavator, and their applications in agricultural operations.

Unit 3: Machinery for grading, terracing, gully control, land levelling, ditch making etc. Principles of operation of shovels, excavators.

Unit 4: Application of hydraulic system in earth moving machinery. Repair and maintenance of hydraulic system, Trouble shooting, repair and maintenance of earth moving machinery.

Unit 5: Production in Earth moving machinery, cost of operation, and management of earth moving machines.

References:-

1. De, Amitosh. 2015. Latest Development of Heavy Earth Moving Machinery. Galgotia Publications Pvt. Ltd., New Delhi.
2. Herbert L. Nichols, Jr. 2005. Moving the Earth: The Workbook of Excavation, 5th Edition. McGraw-Hill, New York.
3. Borshchow, T., Mansurou, R. and Sergeev, V. 1988. Land Reclamation Machinery, MIR Publication, Moscow.
4. Alekseeva, T.V. 1985. Machines for Earthmoving Work: Theory and Calculations. Amerind Publishing Co., New York.

AGPE408	Professional Elective- IV **(Food Chemistry and Microbiology)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

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

- To acquaint with properties and role of various constituents in foods, interaction and changes during processing
- To acquaint with importance of various foods and nutrients in human nutrition.
- To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food

Course Outcomes:

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

1. Understand the fundamental principles of food chemistry, including the composition, structure, properties, and reactions of carbohydrates, lipids, proteins, vitamins, minerals, and other food components.

2. Gain knowledge of food microbiology, including the diversity, morphology, physiology, and metabolism of foodborne microorganisms, as well as their roles in food spoilage, foodborne illnesses, and food safety.
3. Develop an integrated understanding of the relationship between food chemistry and microbiology, including the effects of processing, preservation, storage, and handling on food composition, microbial growth, and the overall safety, quality, and shelf-life of food products.

Syllabus Contents

Unit 1
Definition and importance; major food constituents and their physicochemical properties; role of water in food. Carbohydrates, proteins and lipids: classification, physical, chemical, nutritional, and functional properties and their structural correlations; auto-oxidation of lipids and rancidity.

Unit 2:
Properties of minerals, vitamins, pigments, anti-oxidants, flavor components, allergens, toxins and anti-nutritional factors in foods; Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods.

Unit 3:
Food groups and their typical composition; essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; digestion, absorption, transport and metabolism of nutrients in human system; protein quality evaluation.

Unit 4:
Growth and survival of microorganisms in foods; spoilage organisms of milk, fruits, vegetables, grains and oilseeds, meat and poultry; Physical and chemical methods to control microorganisms. Biochemical changes caused by microorganisms; Microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganisms; Food poisoning and food borne infections; Microbial toxins.

Unit 5:
Food hygiene and sanitation: Contamination during handling and processing and its control; indicator organisms; Rapid methods in detection of microorganisms.

Unit6:
Food Fermentations; Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages.

References

1. Belitz HD.2005. Food Chemistry. Springer Verlag.
2. Owen R. Fennema ,2006, Food Chemistry, Academic Press.

3. Meyer LH. 1987. Food Chemistry. CBS publishers and Distributors, New Delhi.
4. Fennema OR.1996. Food Chemistry. Marcel Dekker.
5. Prescott LM Harley JP and Klein DA (2006). Microbiology (7th edition) McGraw Hill, Newyork.
6. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.
7. Vijaya Ramesh,K. (2007) Food Microbiology. MJP publishers, 2007.
8. Dubey, R.C. and Maheswari, D.K. (2008) Text book of Microbiology. S Chand Publishing.

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Semester VIII

AGPE451	Engineering Properties of Food Materials	2L:0T:0P	2Credits

Objective of Course:

- At the end of this course, students will be able to
- Select the appropriate building materials for various applications
- Design the beam, columns, roof etc. for various strictures.
- Design the farm house, cattle shed and various storage structures for the farm.

Couse Outcome:

- Understand the physical, chemical, and mechanical properties of food and their handling and storage.
- Determine the porosity and roundness of fruits and vegetables. Apply the knowledge of properties in the designing of food processing equipment.
- Gain practical knowledge of food properties.
- Develop the conceptual knowledge of food properties which can be utilized at industrial level..

Syllabus Contents

Unit 1:
Physical characteristics of different food grains, fruits and vegetables; Shape and size, description of shape and size, volume and density, porosity, surface area. Rheology; ASTM standard, terms, physical states of materials, classical ideal material, rheological models and equations, viscoelasticity, creep-stress relaxation, Non-Newtonian fluid and viscometry, rheological properties, force, deformation, stress, strain, elastic, plastic behaviour.

Unit 2:
Contact stresses between bodies, Hertz problems, firmness and hardness, mechanical damage, dead load and impact damage, vibration damage, friction, effect of load, sliding velocity, temperature, water film and surface roughness. Friction in agricultural materials, rolling resistance, angle of internal friction, angle of repose, flow of bulk granular materials, aero dynamics of agricultural products, drag coefficients, terminal velocity.

Unit 3:
Thermal properties: Specific heat, thermal conductivity, thermal diffusivity, methods of determination, steady state and transient heat flow.

Unit 4:
Electrical properties; Dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant, method of determination, energy absorption from high frequency electric field.

Unit 5:

Application of engineering properties in design and operation of agricultural equipment and structures.

References

1. Bourne, M. C. (1982). Food texture and viscosity - concept and measurement. New York: Academic Press (ed).
2. Gunasekaren, S., & Ak, M. M. (2003). Cheese Rheology and Texture (CRC Press ed.). London: CRC Press.
3. Huilgol, R.; Phan-Thien, N. (1997). Fluid mechanics of viscoelasticity. Elsevier. Prentice, J. (1992).
4. Dairy rheology - a concise guide. VCH Publishers

AGPR452	Project- II	0L:0T:12P	6 Credits

Course Objectives:

To apply engineering solutions to improve agricultural processes, enhance productivity, optimize resource utilization, or solve problems related to agricultural machinery, irrigation systems, post-harvest technology, or other relevant areas.

Course Outcome:

Student will be able

- To design and develop new machinery, creating innovative irrigation systems, developing automation solutions, or implementing advanced techniques for crop management.
- To facilitate the transfer of technology and knowledge from the laboratory to the field by ensuring that the developed solution is practical, scalable, and accessible to farmers.
- To use the engineering principle for contributing to the sustainability, efficiency, and resilience of agricultural systems.
- To evaluate the impact of the project outcome on agricultural practices, economic viability, and societal benefits.

Guidelines:

After Identify the Problems or Opportunity and define objectives in previous semester, research work can be continued in this semester as per the plan. Developed machine or design can be evaluated for estimating its performance, effectiveness, and any potential limitations or drawbacks. Collect data to support your findings.

Department of Agricultural Engineering
Triguna Sen School of Technology
Curriculum for B.Tech.

AGPE451	Professional Elective- V **(Agricultural Business Management)**	**3L:0T:0P**	**3 Credits**

Course Objectives:

- To develop an understanding of agricultural markets, including commodity markets, input markets, and consumer markets.
- To provide students with an understanding of the global and local agribusiness environment.
- To develop strategic planning skills for agricultural businesses, including setting goals, formulating strategies, and implementing action plans.

Course Outcomes:

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

- Acquire the knowledge of labour, marketing and financial management
- Develop the interest in running a small agri-business enterprise.
- Understand various agricultural extension activities and programmes

Syllabus Contents

Unit 1: ***Introduction:*** Basics of agri-business management, planning, organising, controlling and leading, Forecasting for agri-business, location and layout of facilities, work force management, Quality management and maintenance, financial analysis of agri-business, process strategy, inventory management, Knowledge management, organizational behavior, human resource management

Unit 2: ***Marketing****:* Core concepts: needs & Maslow's hierarchy of needs, wants, demands, products, utility, value, satisfaction, exchange, transactions, relationships, markets; management: production concept, product concept, selling concept, marketing concept; planning and process: SBU identification, SWOT analysis, marketing mix, resource allocation; industrial markets; segmentation variables in consumer and industrial markets; state of branding in agro and food sectors; pricing strategies and programs; product life cycle.

Unit 3: ***Finance****:* Elements of engineering economics; balance sheet & loss and profit accounts; agricultural finance, institutional and non-institutional credits; principles of farm finance – need for specialised agencies for agricultural credit, risk involved in finance, recovery of loans, supervision, linking credit with marketing management of agricultural credit

Unit 4: ***Agrarian Economics:*** Quantitative techniques for agri-business, rural credit, agri- finance, micro-finance, WTO, cost and financial analysis, agri-insurance, custom hiring and agro- service centres, cooperative and contact farming, agricultural policy, business statistics, farm business organisations, labour management, business policy analysis – concepts and methods, leadership, motivation.

Unit 5: ***Agril Extension:*** Definitions, philosophy and scope of agricultural extension,

basic principles and their applications to agricultural engineering, Role and quality of extension workers, Various extension agencies, their functions and mode of working with reference to agricultural engineering, Extension programme planning and its importance, extension need for farm implements and machinery, soil and water engineering, farm structures and post harvest technology. Transfer of technology, training and visit system, monitoring of extension activities and feed back.

References

1. Wills, W.J. 1979. An introduction to agri-business management, 2nd Edition. Vero MediaInc.
2. Megginson, L.C., Byrd, M.J. and Meginson, W.L. 2012. Small business management:AnEntrepreneur's Guidebook, 7rg Edition. McGraw Hill Education, New York.
3. Truet, L.J. and Truett, D.B. Managerial Economics, 8th Edition. John Willey and Sons.

AGPE452	Professional Elective- V **(Food Safety and Quality Assurance)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

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

- To acquaint with food quality parameters and control systems, food standards, regulations, specifications

Course Outcomes:

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

1. Understand the principles and regulations governing food safety and quality assurance, including Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP), and relevant national and international food safety standards.

2. Gain knowledge of the various factors affecting food safety and quality throughout the food production chain, including raw material sourcing, processing, packaging, storage, distribution, and retailing, and learn to implement effective control measures to prevent hazards and ensure product integrity.

3. Develop practical skills in conducting risk assessments, implementing quality management systems, conducting audits and inspections, managing food safety incidents and recalls, and maintaining documentation and records to comply with regulatory requirements and industry standards while meeting consumer expectations for safe and high-quality food products

Syllabus Contents :

Unit-I

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory vis-à-vis instrumental methods for testing quality.

Unit-II

Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labelling issues; International scenario, international food standards.

Unit-III

Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety. IPR and Patent.

References :

1. Amerine MA, Pangborn RM & Rosslos EB. 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
2. Early R.1995.*Guide to Quality Management Systems for Food Industries*. Blackie Academic.
3. Furia TE.1980. *Regulatory Status of Direct Food Additives*. CRC Press.
4. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwoood.
5. Krammer A & Twigg BA.1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
6. Macrae R, Roloson R & Sadlu MJ. 1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XVI. Academic Press.
7. Piggot J.R. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
8. Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill. Export/Import policy by Govt. of India.

AGPE453	Professional Elective- V **(Instrumentation and Control)**	**3L:0T:0P**	**3 Credits**

Courses Objectives

- To provide a basic knowledge about measurement systems and their components
- To learn about various sensors used for measurement of mechanical quantities
- To integrate the measurement systems with the process for process monitoring and control

Course Outcomes

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

- Gain a deep understanding of various types of instruments used for measuring and monitoring physical parameters.
- Develop skills in system integration and automation, enabling them to design and implement automated control systems for various applications.
- Capable of analyzing industrial processes, identifying opportunities for automation and optimization, and designing control systems that improve efficiency, safety, and reliability.

Syllabus Contents

Unit-1: Measurement systems and performance – accuracy, range, resolution, error sources; Introduction to functional elements of instruments. Active and passive transducers, Analog and digital modes. Static and dynamic characteristics of instruments.

Unit-2: Strain and stress, strain relationship, strain gauges. Mechanical, optical, electrical acoustical and pneumatic etc. and their use. Various methods of determining strain/stress experimentally. Strain gauges: types and their application in two and three dimensional force measurement.

Unit-3: Instrumentation system elements – sensors for common engineering measurements; Measuring devices for displacement (linear and rotational), velocity, force, torque and shaft power. Devices for measurement of temperature, relative humidity, pressure, flow, sound and vibration. Measuring instruments for calorific value of solid, liquid and gaseous fuels.

Unit-4: Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric; Recording devices and their types. Data acquisition system, micro computers, data storage and their application.

Unit-5: Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers. System models, transfer function and system response, frequency response; Nyquist diagrams and their use.

References

1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 2008

AGPE454	Professional Elective- V **(Building Materials & Structural Design)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

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

- Select the appropriate building materials for various applications
- Design the beam, columns, roof etc. for various strictures.
- Design the farm house, cattle shed and various storage structures for the farm.

Course Outcomes:

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

1. Understand the properties, characteristics, and behavior of various building materials commonly used in construction, including concrete, steel, timber, masonry, and composites.

2. Develop proficiency in structural design principles and methodologies, including analysis of loads, structural stability, strength of materials, and structural dynamics, to ensure the safety, stability, and durability of built structures.

3. Apply knowledge of building materials and structural design principles to design and analyze structural elements and systems, such as beams, columns, slabs, foundations, and frames, considering factors such as building codes, environmental conditions, sustainability, and economic feasibility.

Syllabus Contents

Unit 1:

Properties and classification of conventional building materials, like bricks, lime, cement, sand, coarse aggregates, timber, asbestos, glass etc. Classification of seasoning and preservation of timbers.

Unit 2:

Use of materials like plywood, asbestos, plastic and PVC, glass, aluminium etc. in buildings and sheds. Use of fly ash and fly ash products in construction and waterproofing materials for concrete. Constructional elements such as brick work, stone work, mortar, concrete, plastering, painting, ceiling, roofing etc.

Unit 3:

Concept of determinate and indeterminate structures, moments of inertia of sections, bending moment and shear force diagrams and design of steel and concrete beams.

Unit 4:

Design of steel and R.C.C. columns and column footings. Design of roof slabs, roof trusses. Partitions and bracings for sheds, concept of Ferro-cement structures like grain containers used in agricultural work.

Unit 5:

Structural details of underground and overhead liquid containers, silos, cold storage structures and open web structures. Design of farm house, cattle shed, farm fence etc.

References

1. Instrumentation and control systems by W. Bolton, 2 nd edition, Newnes, 2008
2. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV, Mechanical Measurements (6 th Edition) 6 th Edition, Pearson Education India, 2007

3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, 5th Edition, McGraw-Hill: New York, 1999.

AGPE455	Professional Elective- V **(Renewable Power Sources)**	**3L:0T:0P**	**3 Credits**

Objective of Course:

- To introduce the basic idea of fuel cell, biogas, solar thermal and photovoltaic Systems.
- To discuss fundamental and to application of biomass and wind power generation system.

Course Outcomes:

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

- The course enables the student to outline the power generation potential from various renewable energy sources.
- Familiar with the concept of performance and evaluation of all devices

Syllabus Contents :

Unit-I

Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Fundamentals of hydrogen and fuel cell technology.

Unit-II

Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste. Use of different commercial sized biogas plant.

Unit-III

Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant, fundamentals of ocean thermal energy conversion technology and fundamentals of magneto hydro dynamic.

Unit-IV

Wind farms. Aero-generators. Wind power generation system.

Unit-V

Power generation from biomass (gasification). Power generation from briquettes.

References :

1. Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.
2. Rathore N. S., Kurchania A. K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
3. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

4. Rathore N.S., C.B. Khobragade and B. Asnani. 2010. Asnani. Fundamentals of renewable energy sources. Himanshu Publication, Udaipur (Raj.).
5. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , MechanicalMeasurements(6thEdition) 6th Edition, Pearson Education India, 2007
6. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, 5thEdition, McGraw-Hill: New York, 1999.

Department of Agricultural Engineering
Triguna Sen School of Technology
Assam University Silchar