Three-Year Diploma Programme

Diploma

Agricultural Engineering

Faculty of Engineering and Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering and Technology
Diploma in Agricultural Engineering

1. Vision of the Department

To build sound agricultural engineers with an essence of humanity and the enrichment of society by effective teaching learning process, technical activities and study beyond curriculum.

2. Mission of the Department

M1 To produce good quality agricultural engineers with leadership skills and ethical values to serve the society by organizing expert lectures, seminars, industrial visits.
M2 To develop the required manpower in the field of agricultural engineering suitable for research and education, extension, government agency, private industries, Agro-industries, NGOs etc.
M3 To assist farmers in reducing the cost of cultivation through better utilization of efficient farm machinery, soil and water conservation, irrigation management, value addition through farm level processing, post-harvest technology; protective cultivation and use of renewable energy ultimately help the farmers to increase their earnings.

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the B.Tech. Agricultural Engineering curriculum enables graduates to attain.

PEO 1	To develop technical skills (critical investigation, communication, analytical and computer) and human relations skills (group dynamics, team building, organization and delegation) to enable students to transform the acquired knowledge into action.
PEO 2	To inculcate critical analysis and communication skills into students to effectively present their views, both in writing and through oral presentations.
PEO 3	To provide an environment for exploring the Research & Development attitude, to help the students in Research and Development field.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	**Problem analysis:**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PLO 3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PLO 4	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	**Environment and sustainability:**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	Graduates will demonstrate an understanding and proficiency in integrating engineering principles in soil and water conservation, Farm machinery,

	irrigation, renewable energy, and Food processing, to develop sustainable and efficient agricultural systems.
PSO 2	Graduates will apply precision agriculture, renewable energy sources, and modern farm machinery for environmentally sustainable and resource-efficient agricultural processes.

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	18
Semester-2	21
Semester-3	23
Semester-4	23
Semester-5	24
Semester-6	18
Total Credits:	**127**

Category wise Credit distribution of the programme	
Category	**Credit**
Major Core	55
Minor Stream	0
Multidisciplinary	54
Ability Enhancement Course	00
Skill Enhancement Courses	18
Value added Courses	0
Total Credits:	**127**

7. Program Curriculum

Semester 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	03601121	Applied Mathematics	3	3	0	-
2	03601123	Applied Physics	2	2	-	-
3	03601124	Applied Physics Lab	1	-	2	-
4	03601125	Soil Science & Agriculture for Engineers	3	3	-	-
5	03601126	Soil Science & Agriculture for Engineers Lab	1	-	2	-
6	03605101	Environmental Science	0	2	-	-
7	03607151	Fundamentals of Electrical and Electronics Engineering	3	2	-	1
8	03607152	Fundamentals of Electrical and Electronics Engineering Lab	1	-	2	-
9	03609101	Engineering Graphics	1	1	-	-
10	03609102	Engineering Graphics Lab	2	-	4	-
11	03693103	Communication Skills - I	1	1	-	-
		Total	**18**	**14**	**10**	**1**
Semester 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
12	03601171	Engineering Mathematics-I	3	2	-	1
13	03601173	Surveying and Levelling	2	2	-	-
14	03601174	Surveying and Levelling Lab	1	-	2	-
15	03601175	Engineering Physics	3	3	-	-
16	03601176	Engineering Physics Lab	1	-	2	-
17	03601177	Engineering Chemistry	3	3	-	-
18	03601178	Engineering Chemistry Lab	1	-	2	-

19	03605151	Engineering Mechanics	3	3	-	-
20	03605152	Engineering Mechanics Lab	1	-	2	-
21	03609154	Engineering Workshop Practice	2	-	4	-
22	03693153	Communication Skills - II	1	1	-	-
		Total	**21**	**14**	**12**	**1**
Semester 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
23	03601215	Engineering Mathematics-II	4	3	-	1
24	03601217	Fluid Mechanics and Open Channel Hydraulics	2	2	-	-
25	03601218	Fluid Mechanics and Open Channel Hydraulics Lab	1	-	2	-
26	03601219	Thermodynamics, Refrigeration and Air Conditioning	2	2	-	-
27	03601220	Thermodynamics, Refrigeration and Air Conditioning Lab	1	-	2	-
28	03601221	Soil and Water Conservation Engineering	2	2	-	-
29	03601222	Soil and Water Conservation Engineering Lab	1	-	2	-
30	03601223	Farm Power Engineering	2	2	-	-
31	03601224	Farm Power Engineering Lab	1	-	2	-
32	03601225	Watershed Hydrology	1	1	-	-
33	03601226	Watershed Hydrology Lab	1	-	2	-
34	03601227	Food Engineering	3	3	-	-
35	03606102	Introduction to IT Systems Lab	2	-	4	-
		Total	**23**	**15**	**14**	**1**
Semester 4						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**

36	03601265	Farm Machinery and Implements	3	3	-	-
37	03601266	Farm Machinery and Implements Lab	1	-	2	-
38	03601267	Non-Conventional Energy Sources	3	3	-	-
39	03601268	Non-Conventional Energy Sources Lab	1	-	2	-
40	03601269	Post-Harvest Technology	3	3	-	-
41	03601270	Post-Harvest Technology Lab	1	-	2	-
42	03601271	Theory of Machines	2	2	-	-
43	03601273	Strength of Material	1	1	-	-
44	03601274	Strength of Material Lab	1	-	2	-
45	03601275	Irrigation Technology	3	3	-	-
46	03601276	Irrigation Technology Lab	1	-	2	-
47	03601277	Heat and Mass Transfer	2	2	-	-
48	03693251	Employability Skills	1	1	-	-
		Total	**23**	**18**	**10**	**0**

Semester 5

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
49	03601313	Farm Tractor Systems and Controls	2	2	-	-
50	03601314	Farm Tractor Systems and Controls Lab	1	-	2	-
51	03601315	Agricultural Process Engineering	3	3	-	-
52	03601316	Agricultural Process Engineering Lab	1	-	2	-
53	03601317	Entrepreneurship Development and Business Management	3	3	-	-
54	03601319	Dairy Engineering	2	2	-	-
55	03601321	Ground Water and Drainage Engineering	2	2	-	-
56	03601322	Ground Water and Drainage Engineering Lab	1	-	2	-
57	03601323	Watershed Management	2	2	-	-

58	03601324	Watershed Management Lab	1	-	2	-
59	03601325	Agricultural Structures	2	2	-	-
60	03601326	Agricultural Structures Lab	1	-	2	-
61	03601327	Design and Maintenance of Green House	2	2	-	-
62	03601328	Design and Maintenance of Green House Lab	1	-	2	-
Total			**24**	**18**	**12**	**0**
Semester 6						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
63	03601354	Industrial and Field Training cum Project Work	18	-	36	-
Total			**18**	**0**	**36**	**0**

Semester 1

a. **Course Name:** Applied Mathematics
b. **Course Code:** 03601121
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** This subject equips engineering students with essential mathematical tools for solving problems in fields like mechanics, circuits, and data analysis.
e. **Course Learning Objective:**

CLOBJ 1	To understand and apply concepts of permutations, combinations, and binomial theorem in problem-solving.
CLOBJ 2	To learn trigonometric identities and their application in engineering problems.
CLOBJ 3	To grasp vector algebra, including vector operations, dot, and cross products, with real-world applications.
CLOBJ 4	To explore complex numbers, their representations, and operations, with an emphasis on engineering applications.

f. **Course Learning Outcomes:**

CLO 1	Apply algebraic methods like permutations, combinations, and binomial theorems to solve engineering problems.
CLO 2	Use trigonometric identities and transformations effectively in solving practical engineering tasks.
CLO 3	Perform vector operations and apply vector algebra in engineering contexts, including using dot and cross products.
CLO 4	Analyze complex numbers, statistics, and probability to handle engineering-related calculations and problems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit-I Algebra: Permutations and Combinations, Value of npr and nCr, its properties and simple problems. Binomial theorem (without proof) for positive integral index (expansion and general term); Binomial theorem for any index (expansion only) first and second binomial approximation with application to engineering problems. Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors). Logarithm: general properties of logarithms, calculations of engineering problems using log tables Unit-II Trigonometry: Addition and subtraction formulae, product formulae and their application in engineering problems. Transformation from product to sum or difference of two angles or vice versa, multiple and submultiple angles. Conditional identities, solution of triangles (excluding ambiguous cases). Unit-III Vector Algebra: Definition of vector and scalar quantities, Addition and subtraction of vectors, dot product and cross product of two vectors, Thumb rule, Angle between two vectors, Application of dot and cross product in engineering problems, scalar triple product and vector triple product. Unit-IV Complex Numbers: Definition of a complex number, real and imaginary parts of a complex number, Polar and Cartesian representation of complex number, Conjugate of complex number, Geometric representation of complex numbers and their operations, Modules and Amplitude form. Unit-V Statistics and Probability: Measures of central tendency (Mean, median and mode), evaluation mean deviation and standard deviation. Probability: definition and laws on probability.	**100%**	**45**
		100%	**16**

i. Text Book and Reference Book:

1. Applied Mathematics, Vol-2 By ss Sabharwal and others
2. Applied Mathematics by WR Neelkanth
3. Applied Mathematics, Vol-1 By Sabharwal and others

a. **Course Name:** Applied Physics
b. **Course Code:** 03601123
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** This course provides foundational knowledge of applied physics, focusing on key concepts which are essential for various engineering and technological applications.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of units, dimensions, and physical quantities.
CLOBJ 2	Apply Newton's laws of motion to solve basic problems related to force and momentum.
CLOBJ 3	Analyze work, power, energy, and their practical applications in mechanics.
CLOBJ 4	Explore the properties of matter, fluid dynamics, and heat transfer processes.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in using dimensional analysis for unit conversion and problem-solving.
CLO 2	Solve practical problems involving forces, work, energy, and motion using physics principles.
CLO 3	Analyze and interpret data related to fluid dynamics and properties of matter.
CLO 4	Apply heat transfer principles in real-world situations using appropriate methods and techniques.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Units, Dimensions and Measurements: Physical quantities, Fundamental and derived units, Systems of units (FPS, CGS, MKS and SI units), Dimensions and dimensional formulae of physical quantities velocity, acceleration, momentum, force, impulse, work, power, energy, surface, tension, coefficient of viscosity and strain), Dimensional equations and their applications, conversion from one unit to another unit for density, force, pressure, work, power, energy, velocity, acceleration, Limitations of dimensional analysis. Force and Motion: Scalar and vector quantities - examples, addition and multiplication (scalar product and vector product) of vectors, Force, parallelogram law of forces (only statement) Newton's Laws of motion - concept of momentum, Newton's laws of motion and their applications, determination of force equation from Newton's second law of motion; Newton's third law of motion conversion of momentum, impulse and impulsive forces, simple numerical problems based on third law. Work, Power and Energy, Work: definitions and its SI units, Work done in moving an object on horizontal and inclined plane, (incorporating frictional forces), Power: definitions and its SI units, calculation of power in simple cases, Energy: Definitions and its SI units: Types: Kinetic energy and Potential energy, with examples and their derivation, Principle of conservation of mechanical energy (for freely falling bodies) Properties of Matter: Elasticity: definition of stress and strain, Different types of modulus of elasticity, Explanation of stress-strain diagram, Pressure:-its units, gauge pressure, absolute pressure, atmospheric pressure, Bourdon's pressure, manometers and barometer gauges, Surface tension: -its units, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension, Viscosity: Viscosity and coefficient of viscosity: Terminal velocity, Stoke’s law effect of temperature on viscosity, application in hydraulic systems. Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold’s number. Gravitation and satellites: Kepler's law of planetary motion, Newton's law of gravitation, Escape velocity (derivation), Satellites, Geostationary satellite, Transfer of Heat:	**100%**	**32**

	Principles of measurement of temperature and different scales of temperature, Difference between heat and temperature Modes of transfer of heat (conduction, convection and radiation with examples), Coefficient of thermal conductivity, determination of thermal conductivity of good conductor (Searle's method) and bad conductor (Lee's disc method).		
		100%	**32**

i. Text Book and Reference Book:

1. Basic Applied Physics by RK Gaur; Dhanpat Rai Publications
2. Applied Physics Vol. I,; TTTI Publication Tata McGraw Hill, Delhi
3. Comprehensive Practical Physics - Volume I and II by IN Jaiswal; Laxmi Publishers
4. Numerical Problems in Physics - Volume I and II by RS Bharaj; Tata McGraw Hill
5. Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
6. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
7. A Text Book of Optics (TextBook) by Subramanian and Brij Lal
8. Physics Laboratory Manual by PK Palanisamy; Scitech Publications
9. Fundamentals of Physics by Resnick and Halliday; Asian Books Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi Engineering Hydrology (TextBook) K. Subramanya; Tata McGraw Hill Pub. Co. New Delhi

a. **Course Name:** Applied Physics Lab
b. **Course Code:** 03601124
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** This course provides foundational knowledge of applied physics, focusing on key concepts which are essential for various engineering and technological applications.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of units, dimensions, and physical quantities.
CLOBJ 2	Apply Newton's laws of motion to solve basic problems related to force and momentum.
CLOBJ 3	Analyze work, power, energy, and their practical applications in mechanics.
CLOBJ 4	Explore the properties of matter, fluid dynamics, and heat transfer processes.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in using dimensional analysis for unit conversion and problem-solving.
CLO 2	Solve practical problems involving forces, work, energy, and motion using physics principles.
CLO 3	Analyze and interpret data related to fluid dynamics and properties of matter.
CLO 4	Apply heat transfer principles in real-world situations using appropriate methods and techniques.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Basic Applied Physics by RK Gaur; Dhanpat Rai Publications
2. Applied Physics Vol. I,; TTTI Publication Tata McGraw Hill, Delhi
3. Comprehensive Practical Physics - Volume I and II by IN Jaiswal; Laxmi Publishers
4. Numerical Problems in Physics - Volume I and II by RS Bharaj; Tata McGraw Hill
5. Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
6. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
7. A Text Book of Optics (TextBook) by Subramanian and Brij Lal
8. Physics Laboratory Manual by PK Palanisamy; Scitech Publications
9. Fundamentals of Physics by Resnick and Halliday; Asian Books Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi Engineering Hydrology (TextBook) K. Subramanya; Tata McGraw Hill Pub. Co. New Delhi

i. Experiment List:

Sr. No.	Experiment
1	To find the thickness of wire using a screw gauge
2	To find volume of solid cylinder and hollow cylinder using a vernier caliper
3	To determine the thickness of glass strip and radius of curvature of a concave surface using a spherometer
4	To find the surface tension of a liquid by capillary rise method
5	To determine and verify the time period of cantilever by drawing graph between load (w) and depression (D)
6	To verify triangle and parallelogram law of forces
7	To determine force constant of a spring using Hook's Law
8	To find the moment of inertia of a flywheel

a. **Course Name:** Soil Science & Agriculture for Engineers
b. **Course Code:** 03601125
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The subject "Soil Science & Agriculture for Engineers" is designed to equip engineering students with fundamental knowledge of soil properties, agricultural practices, and their applications in engineering projects.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with an understanding of the fundamental properties and classification of soils, enabling them to apply this knowledge in the engineering and agricultural context.
CLOBJ 2	To introduce principles of agronomy, focusing on crop classifications, weather impacts, and effective crop management techniques for increased productivity.
CLOBJ 3	To develop an understanding of horticulture, including crop cultivation, propagation, and post-harvest techniques, aiming at efficient land use and sustainable agricultural practices.
CLOBJ 4	To familiarize students with essential plant nutrients, fertilizers, and soil amendments, guiding them to enhance soil health and agricultural output through informed engineering decisions.

f. **Course Learning Outcomes:**

CLO 1	Understand the nature, origin, and classification of soils and their impact on engineering applications.
CLO 2	Identify and apply soil physical properties for practical problem-solving in agriculture and land management.
CLO 3	Analyze soil-water-plant relationships and their significance in irrigation and water conservation.
CLO 4	Evaluate the role of soil fertility and nutrient management for sustainable agricultural practices.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Soils**: Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders; important soil physical properties; and their importance; soil particle distribution; soil texture, soil structure, soil as a 3-phase system, bulk density, particle density, moisture content, porosity, degree of saturation, moisture holding capacity, soil water movement, saturated and unsaturated flow. Soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acid, saline and sodicsoils; quality or irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils. **Agronomy:** Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilth and its characteristics. Soil water plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping. **Horticulture**: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.	**100%**	**45**
		100%	**45**

i. Text Book and Reference Book:

1. Nature and properties of soils by Brady Nyle C and Ray R Well; Pearson Education Inc., New Delhi.
2. Fundamentals of Soil Science Indian Society of Soil Science; IARI, New Delhi
3. A. Textbook of Pedology Concepts and Applications by Sehgal J; Kalyani Publishers, New Delhi
4. Introduction to Soil Physics by Hillel D; Academic Press, London
5. Chemistry of Soil E.E. Bear
6. Principles of Agronomy T. Y. Reddy and G. H. Shankara Reddy; Kalyani Publishers
7. Fundamentals of Agronomy Rajat D; Kalyani Publishers
8. Principles and Practices of Agronomy S. S. Singh; Kalyani Publishers
9. Introductuion of Agronomy V. W. Vaidya and K. R. Shahastrabudher
10. Principles of Horticulture Prasad and Kumar; Agrobios, Jodhpur

a. **Course Name:** Soil Science & Agriculture for Engineers Lab
b. **Course Code:** 03601126
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The subject "Soil Science & Agriculture for Engineers" is designed to equip engineering students with fundamental knowledge of soil properties, agricultural practices, and their applications in engineering projects.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with an understanding of the fundamental properties and classification of soils, enabling them to apply this knowledge in the engineering and agricultural context.
CLOBJ 2	To introduce principles of agronomy, focusing on crop classifications, weather impacts, and effective crop management techniques for increased productivity.
CLOBJ 3	To develop an understanding of horticulture, including crop cultivation, propagation, and post-harvest techniques, aiming at efficient land use and sustainable agricultural practices.
CLOBJ 4	To familiarize students with essential plant nutrients, fertilizers, and soil amendments, guiding them to enhance soil health and agricultural output through informed engineering decisions.

f. **Course Learning Outcomes:**

CLO 1	Understand the nature, origin, and classification of soils and their impact on engineering applications.
CLO 2	Identify and apply soil physical properties for practical problem-solving in agriculture and land management.
CLO 3	Analyze soil-water-plant relationships and their significance in irrigation and water conservation.
CLO 4	Evaluate the role of soil fertility and nutrient management for sustainable agricultural practices.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Nature and properties of soils by Brady Nyle C and Ray R Well; Pearson Education Inc., New Delhi.
2. Fundamentals of Soil Science Indian Society of Soil Science; IARI, New Delhi
3. A. Textbook of Pedology Concepts and Applications by Sehgal J; Kalyani Publishers, New Delhi
4. Introduction to Soil Physics by Hillel D; Academic Press, London
5. Chemistry of Soil E.E. Bear
6. Principles of Agronomy T. Y. Reddy and G. H. Shankara Reddy; Kalyani Publishers
7. Fundamentals of Agronomy Rajat D; Kalyani Publishers
8. Principles and Practices of Agronomy S. S. Singh; Kalyani Publishers
9. Introductuion of Agronomy V. W. Vaidya and K. R. Shahastrabudher
10. Principles of Horticulture Prasad and Kumar; Agrobios, Jodhpur
11. Principles of Horticulture Denison
12. Horticultural Science J Janick; W.H.Freeman & Co Ltd
13. Plant Propogation : Principles and Practices Hartmen and KesterDelhi

i. Experiment List:

Sr. No.	Experiment
1	Identification of rocks and minerals and Examination of soil profile in the field.
2	Collection of Soil Sample and Determination of moisture content, bulk density, Particle density, porosity of soil, Soil texture and particle size distribution.
3	Determination of organic carbon of soil, Nitrogen, Phosphorus and Potassium.
4	Determination of EC, pH, ESP, SAR, RSC.
5	Identification of nutrient deficiency symptoms of crops in the field and their varieties seeds and weeds.
6	Fertilizer application and weed control methods.
7	Judging maturity time for harvesting of crop.
8	Study of seed viability and germination test.
9	Identification and description of important fruit, Flowers and vegetables crops.
10	Study of different garden tools.
11	Preparation of nursery bed.
12	Practices of pruning and training in some important fruit crops.

a. **Course Name:** Environmental Science
b. **Course Code:** 03605101
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The course fosters awareness and equips learners with practical skills to address pressing environmental issues such as global warming, pollution control, and resource management.
e. **Course Learning Objective:**

CLOBJ 1	To understand the structure of ecosystems and their biotic and abiotic components, including material cycles and energy flow.
CLOBJ 2	To examine various types of pollution, their sources, and control methods for air, water, soil, and noise pollution.
CLOBJ 3	To explore renewable energy sources, their mechanisms, and their role in mitigating environmental impacts.
CLOBJ 4	To comprehend solid waste management practices and strategies for dealing with hazardous waste.

f. **Course Learning Outcomes:**

CLO 1	Explain the components and functioning of ecosystems.
CLO 2	Analyze the causes and effects of different types of pollution.
CLO 3	Demonstrate knowledge of renewable energy technologies and their environmental benefits.
CLO 4	Apply principles of solid waste management in real-world scenarios.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**0**	**20**		**-**	**-**	**-**	**40**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Ecosystem** Structure of ecosystem, Biotic & Abiotic components, Food chain and food web Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion**.**	**15%**	**4**
2	**Air and Noise Pollution** Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler, Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.	**22%**	**8**
3	**Water and Soil Pollution** Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.	**24%**	**8**
4	**Renewable Sources of energy** Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.	**24%**	**8**
5	**Solid Waste management** Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.	**15%**	**4**
		100%	**32**

i. Text Book and Reference Book:

1. Principles of Solar Engineering Yogi Goswami D., Frank Kreith, Jan F. Kreider; Taylor & Francis, 2003; Second
2. Environmental Studies M.P. Poonia, S.C. Sharma; Khanna Publishing House, NewDelhi; 2017
3. Renewable Energy Sources Twidell J.W. and Weir. A; EFN Spon Ltd
4. Environmental Sciences Daniel B Botkin & Edward A Keller,; John Wiley & Sons
5. Air Pollution M. N. Rao and H. V. N. Rao; Tata McGraw-Hill Publishing Company
6. Environmental Pollution Control Engineering Rao C.S; 2nd edition
7. Solid Waste Treatment and Disposal G. Tchabanoglous; McGraw Hill Pub.

a. **Course Name:** Fundamentals of Electrical and Electronics Engineering
b. **Course Code:** 03607151
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The subject introduces key concepts such as passive and active components, digital electronics, and machines, forming the basis for more advanced studies in electrical and electronics engineering.
e. **Course Learning Objective:**

CLOBJ 1	To introduce students to essential electrical and electronic components, such as resistors, capacitors, and transistors, and their functional roles in circuits.
CLOBJ 2	To familiarize students with semiconductor components and digital electronics concepts, including logic gates and number systems, for building basic digital circuits.
CLOBJ 3	To enable students to analyze electric circuits, applying fundamental laws such as Ohm's law and Faraday's law for problem-solving in AC and DC systems.
CLOBJ 4	To provide a basic understanding of electrical machines, transformers, and motors, explaining their construction, operation, and key equations.

f. **Course Learning Outcomes:**

CLO 1	Understand the working principles of passive and active electronic components and their real-world applications.
CLO 2	Perform basic operations with different number systems and logic gates used in digital electronics.
CLO 3	Analyze and solve problems related to AC/DC circuits and electrical power generation.
CLO 4	Demonstrate knowledge of magnetic circuits, transformers, and electrical machines, along with their principles and operations.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**1**	**-**	**3**	**20**	**-**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Overview of Electronic Components & Signals** Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current source, independent/dependent voltage current sources.	**15%**	**6**
2	**Introduction of Semiconductor Components** P-N junction diode, V-I Characteristics of P-N junction Diode, Zener Diode, Classification of Transistor, Transistor construction, Types of transistors (NPN & PNP)	**10%**	**5**
3	**Overview of Digital Electronics** Number systems, Base Conversion -BINARY -DECIMAL -HEX -OCTAL, Complements - 2' and 10's Complement -1's and 9's Complement, Binary addition, subtraction, multiplication and division Logic Gates -Basic Gates (AND, OR, Not), Universal Gates (NAND and NOR Gate), Complementary Gates-(EX-OR, EX-NOR), De-Morgan's Theorems, Adder and Subtractor, Multiplexer and De-multiplexer.	**25%**	**10**
4	**Electric Circuit** Generation of electricity, Different terms related to electric circuit, Concept of AC and DC, Concept of 1-phase and 3-phase supply, Electrical circuit elements – Resistor Inductor and Capacitor, Resistor in series and parallel, Ohm's law and its limitations, Factors affecting the value of resistance	**20%**	**8**
5	**Magnetic Circuit** Terms Related to magnetic circuit, Terms Related to AC circuit, Faraday's Law, Fleming's law, Lenz's Law, Hysteresis loop (B/H Curve), Types of Induced EMF, Comparison between Electric and Magnetic Circuit	**20%**	**8**
6	**Transformer and Machines** General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations of motors.	**10%**	**5**
		100%	**42**

i. Text Book and Reference Book:

1. Basic Electrical Engineering Ritu Sahdev; Khanna Publishing House
2. Basic Electrical Engineering Mittle and Mittal; McGraw Education
3. Fundamentals of Electrical Engineering Saxena, S. B. Lal; Cambridge University Press
4. Electrical Technology Vol-1 Theraja, B. L.; S. Chand, New Delhi
5. Principles of Electronics V.K. Mehta; S. Chand and Company

a. **Course Name:** Fundamentals of Electrical and Electronics Engineering Lab
b. **Course Code:** 03607152
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The subject introduces key concepts such as passive and active components, digital electronics, and machines, forming the basis for more advanced studies in electrical and electronics engineering.
e. **Course Learning Objective:**

CLOBJ 1	To introduce students to essential electrical and electronic components, such as resistors, capacitors, and transistors, and their functional roles in circuits.
CLOBJ 2	To familiarize students with semiconductor components and digital electronics concepts, including logic gates and number systems, for building basic digital circuits.
CLOBJ 3	To enable students to analyze electric circuits, applying fundamental laws such as Ohm's law and Faraday's law for problem-solving in AC and DC systems.
CLOBJ 4	To provide a basic understanding of electrical machines, transformers, and motors, explaining their construction, operation, and key equations.

f. **Course Learning Outcomes:**

CLO 1	Understand the working principles of passive and active electronic components and their real-world applications.
CLO 2	Perform basic operations with different number systems and logic gates used in digital electronics.
CLO 3	Analyze and solve problems related to AC/DC circuits and electrical power generation.
CLO 4	Demonstrate knowledge of magnetic circuits, transformers, and electrical machines, along with their principles and operations.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Basic Electrical Engineering Ritu Sahdev; Khanna Publishing House
2. Basic Electrical Engineering Mittle and Mittal; McGraw Education
3. Fundamentals of Electrical Engineering Saxena, S. B. Lal; Cambridge University Press
4. Electrical Technology Vol-1 Theraja, B. L.; S. Chand, New Delhi
5. Principles of Electronics V.K. Mehta; S. Chand and Company

i. Experiment List:

Sr. No.	Experiment
1	Determine the permeability of magnetic material by plotting its B-H curve.
2	Measure voltage, current and power in 1-phase circuit with resistive load.
3	Measure voltage, current and power in R-L series circuit.
4	Determine the transformation ratio (K) of 1-phase transformer.
5	Connect single phase transformer and measure input and output quantities.
6	Identify various active and passive electronic components.
7	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.
8	Use multimeter to measure the value of given resistor. Determine the value of given resistor using digital multimeter to confirm with colour code.
9	Test the performance of PN-junction diode.
10	Test the half wave rectifier using CRO.
11	Test the Bridge rectifier and capacitor filter using CRO.
12	Test the performance of Zener diode.
13	Identify the pins of IC 741.
14	Test the performance of CE NPN transistor.
15	Test the performance of transistor amplifier circuit.

a. **Course Name:** Engineering Graphics
b. **Course Code:** 03609101
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** It equips students with the ability to visualize, communicate, and interpret technical designs, essential for creating and understanding engineering drawings, which are a universal language in the industry.
e. **Course Learning Objective:**

CLOBJ 1	To develop students' competency in using drawing equipment, understanding types, and applying them effectively in technical drawing tasks.
CLOBJ 2	To guide students in following standard practices for drawing layouts, ensuring accurate scaling and proper dimensional representation according to given engineering scenarios.
CLOBJ 3	To enable students to grasp various types of projections, including orthographic and isometric, and apply these methods to translate 3D objects into 2D drawings.
CLOBJ 4	To teach students the step-by-step process of geometric constructions and the drawing of engineering curves such as conics and cycloids, which are critical in machine design and manufacturing processes.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in selecting and using various drawing equipment, instruments, and materials effectively.
CLO 2	Develop and implement standard practices for planning, layout, and scaling in technical drawings.
CLO 3	Accurately construct geometric figures, including angles, polygons, and curves, using appropriate methods.
CLO 4	Apply principles of orthographic and isometric projections to convert pictorial views into accurate technical representations.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**20**	**-**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Drawing equipments, instruments and materials. Equipments-types, specifications, method to use them, applications. Instruments-types, specifications, methods to use them and applications. Pencils-grades, applications, types of points and applications. Other materials-types and applications.	**4%**	**1**
2	Planning, Layout And Scalling Of Drawing Follow and apply standard practice as per bureau of I.S. for planning and layout, Choose appropriate scale factor for the drawing as per given situation	**4%**	**0**
3	Lines, Lettering and dimensioning Different types of lines. Vertical capital and lower case letters. Inclined capital and lower case letters. Numerals and Greek alphabets. Dimensioning methods. Aligned method. Unilateral with chain, parallel, progressive and combined dimensioning.	**4%**	**0**
4	Geometric Construction Geometric construction related with line like bisecting a line, to draw perpendicular with a given line, divide a line, etc. Geometric construction related with angle like bisect an angle, trisect an angle, etc. To	**7%**	**2**
5	Construct polygon. Triangle, Square / Rectangle, Pentagon with special method. d: Hexagon with special method. To draw tangents. Geometric construction related with circle & arc.	**22%**	**3**
6	Engineering Curves Conic sections: Concept and understanding of focus, directrix, vertex and eccentricity and drawing of conic sections.Using various methods, understand construction of : Ellipse. Parabola. Hyperbola. Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid) Involutes. Involutes of a circle, Involutes of a polygon, Spiral (Archimedean spiral only).	**25%**	**2**
7	Projection Of Points, Lines And Planes Reference planes, orthographic projections. Concept of quadrant.1st angle and 3rd angle projection and their symbols. Projection of points. Projection of lines – determination of true length and inclinations for following cases. Line parallel to one or both the plane. Line perpendicular to one of the plane. Line inclined to one plane and parallel to another. Line inclined to both the planes. Projection of Planes: Types of planes, Projection of planes parallel to one of the reference planes, Projection of plane inclined to one reference plane and perpendicular to another, Projection of planes inclined to both reference planes.	**22%**	**3**
8	Orthographic Projections Types of projections-orthographic, perspective, isometric and oblique: concept and applications. Various term associated	**12%**	**3**
		100%	**16**

i. Text Book and Reference Book:

1. ENGINEERING GRAPHICS P. J. Shah; S. Chand & Co., New Delhi Publications.
2. A Text Book of Engineering Graphics P.J.Shah; S.Chand & Company Ltd., New Delhi
3. Engineering Drawing P.J.Shah.; S.Chand, New Delhi

a. **Course Name:** Engineering Graphics Lab
b. **Course Code:** 03609102
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** It equips students with the ability to visualize, communicate, and interpret technical designs, essential for creating and understanding engineering drawings, which are a universal language in the industry.
e. **Course Learning Objective:**

CLOBJ 1	To develop students' competency in using drawing equipment, understanding types, and applying them effectively in technical drawing tasks.
CLOBJ 2	To guide students in following standard practices for drawing layouts, ensuring accurate scaling and proper dimensional representation according to given engineering scenarios.
CLOBJ 3	To enable students to grasp various types of projections, including orthographic and isometric, and apply these methods to translate 3D objects into 2D drawings.
CLOBJ 4	To teach students the step-by-step process of geometric constructions and the drawing of engineering curves such as conics and cycloids, which are critical in machine design and manufacturing processes.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in selecting and using various drawing equipment, instruments, and materials effectively.
CLO 2	Develop and implement standard practices for planning, layout, and scaling in technical drawings.
CLO 3	Accurately construct geometric figures, including angles, polygons, and curves, using appropriate methods.
CLO 4	Apply principles of orthographic and isometric projections to convert pictorial views into accurate technical representations.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**100**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. ENGINEERING GRAPHICS P. J. Shah; S. Chand & Co., New Delhi Publications.
2. A Text Book of Engineering Graphics P.J.Shah; S.Chand & Company Ltd., New Delhi
3. Engineering Drawing P.J.Shah.; S.Chand, New Delhi

i. Experiment List:

Sr. No.	Experiment
1	**USE OF DRAWING INSTRUMENTS** Teacher will demonstrate: Use of drawing instruments, Planning and layout as per IS, Scaling technique. Draw following: - Drawing horizontal, vertical, 30 degree, 45 degree, 60 & 75 degrees lines using Tee and Set squares/ drafter, Types of lines, Types of dimensioning. Alphabets & numerical (Vertical & inclined as Per I.S.).
2	**GEOMETRIC CONSTRUCTION** Drawing of set of lines with different conditions (Two problems). Drawing Polygons (Three Problems). Drawing circles and arcs with different geometric. Conditions and with line constraints (Three problems).
3	**ENGINEERING CURVES – I** Construction of ellipse using any two methods from arc of circle method, four centre method, rectangular method, eccentricity method and concentric circle method. Construction of parabola with any one method from rectangular method, tangent method and eccentricity method. Construction of hyperbola with any one method from eccentricity method and rectangular method. Construction of spiral.
4	**ENGINEERING CURVES – II** Construction of cycloid. Construction of hypocycloid & epicycloids. Construction of involute (circle). Construction of involute (polygon).
5	**PROJECTIONS OF POINTS AND LINE** Draw projection of points-For 10 various conditions (One problem). Draw projection of lines with different conditions (Four problems).
6	**PROJECTIONS OF PLANE** Draw projection of different planes with different conditions (triangle, square / rectangular, pentagonal / hexagonal, and circular -one for each) (Four problems).
7	**ORTHOGRAPHIC PROJECTIONS** Draw Orthographic projections of different objects (Two problems) (Draw four views of each object).
8	**ISOMETRIC DRAWINGS** Draw isometric drawings from given orthographic views (Three problems).

a. **Course Name:** Communication Skills - I
b. **Course Code:** 03693103
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** The "Communication Skills" course is designed to equip students with essential skills for effective communication in both personal and professional contexts.
e. **Course Learning Objective:**

CLOBJ 1	Develop the ability to communicate effectively in diverse scenarios, fostering teamwork and collaboration among peers.
CLOBJ 2	Encourage logical reasoning and creativity through activities like debates and role plays that require quick thinking and adaptability.
CLOBJ 3	Equip students with the skills to write various types of letters and comprehend texts, ensuring clarity and appropriateness in their written communication.
CLOBJ 4	Provide a foundational understanding of communication principles, barriers, and effective strategies for diverse communication contexts.

f. **Course Learning Outcomes:**

CLO 1	Explain the key concepts of communication and identify barriers to effective interaction.
CLO 2	Demonstrate the use of soft skills in professional scenarios through role-play and group discussions.
CLO 3	Critically assess different types of letters and their purposes in real-world contexts.
CLO 4	Develop and deliver impromptu speeches that effectively engage an audience on diverse topics.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Ice Breaker + Introducing your Friend** This is one activity which will build the bond between the students i the class and work as a team in the task given to them. The students will be asked to introduce their new best friend in the class. This will ensure that the bond being created here will stay strong and also breaks the ice between them.	**5%**	**1**
2	**Picture Connector** In this class the students will be trained to form a logical connection between a set of pictures which will be shared with This geared towards building creativity and presentation skills.	**5%**	**1**
3	**Crazy Scientist** The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	**5%**	**1**
4	**Shopping Role Play** This activity topic gears towards making students do role play based on shopping scenarios. It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it.	**5%**	**1**
5	**Grammar** Parts of speech, Active and Passive voice, Tenses.	**20%**	**10**
6	**Communication: Theory & Practice** Basics of communication: Introduction, meaning, definition, Process of communication. Types of communication: Formal, Informal, Verbal/Non verbal and Written barriers to effective communication. 7 Cs of effective communication: (considerate, concrete concise, clear, complete, correct and courteous). Technical Communication	**12%**	**5**
7	**Soft Skills for Professional Excellence** Introduction : Soft skills and hard skills, Importance of soft skills.	**12%**	**2**
8	**Debate** Students are trained to let go of inhibitions and come forward and speak openly on passionate topics. The students will be divided into teams and made to share their ideas and views on the topics.	**5%**	**1**
9	**Extempore** To change the average speakers in the class to some of the best Orator. This will be done by making the students give variety of impromptu speeches in front of the class.	**5%**	**1**
10	**Letter Writing** Types of letters-Inquiry letter, Order letter, Complaint letter, Adjustment, Request letter, Recommendation letter. Format of letters.	**12%**	**2**
11	**Reading Comprehension** Dabbawalahs, A Snake in the grass, Internet – Dr. Jagdish Joshi	**14%**	**5**
		100%	**32**

i. Text Book and Reference Book:

1. Technical Communication: Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press
2. An An English grammar : comprehending the principles and rules of the language, illustrated by appropriate Englis grammar: comprehending the principles and rules of the language, illustrated by appropriate exercises, and a key to the exercises (v.1) Murray, Lindley; York England : Printed by Thomas Wilson & Sons, for Longman, Hurst, Rees, Orme, and Brown ; and Dart; Fourth edition
3. Active English Juneja & Qureshi; Macmillan

Semester 2

a. **Course Name:** Engineering Mathematics - I
b. **Course Code:** 03601171
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** Engineering Mathematics-I equips students with foundational mathematical tools essential for solving complex engineering problems.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with a strong understanding of matrix theory, including determinants, rank, and eigenvalues, to solve linear equations and systems efficiently.
CLOBJ 2	To teach students the principles of differential calculus, enabling them to differentiate functions and solve problems involving maxima, minima, and expansion series.
CLOBJ 3	To introduce students to integral calculus and develop their ability to compute integrals using substitution, by parts, and partial fractions, along with solving double and triple integrals.
CLOBJ 4	To familiarize students with vector calculus and key vector operations, fostering a deeper comprehension of theorems like Stoke's and Green's, applicable to engineering problems.

f. **Course Learning Outcomes:**

CLO 1	Apply matrix operations and theorems to solve linear systems and compute determinants.
CLO 2	Differentiate various algebraic, trigonometric, and logarithmic functions and apply them to real-world engineering problems.
CLO 3	Integrate functions using standard techniques and solve definite integrals in complex engineering scenarios.
CLO 4	Analyze and compute vector operations like gradient, divergence, and curl in engineering contexts.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**1**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit-I Matrices: Determinants and Matrices - expansion of determinants (up to third order) using sarrus rule, Properties of determinants, solution of equations (up to 3 unknowns) by Cramer's rule. Definition of matrix, addition, subtraction, and multiplication of matrices (up to third order). Elementary transformations, rank of a matrix, reduction to normal form, Gauss-Jordon method to find inverse of a matrix, Eigen values and Eigen vectors, Cayley-Hamilton theorem, diagonalization of matrices, Echelon form, Solution of linear equations, using Cayley-Hamilton theorem to find inverse of A. Unit-II Differential calculus: Definition of derivative, differentiation of standard function by first principle, Rule of Differentiation, Differentiation of algebraic, trigonometric, Exponential, Logarithmic, Taylor's and Maclaurin's expansions; indeterminate form; partial differentiation, maxima, and minima. Unit-III Integral calculus: Integration as inverse operation of differentiation, Integration of simple functions, Integration by substitution, by parts and by partial fractions (for linear factors only), Definite integral: Definition, Properties of Definite integral, Odd and Even functions, double and triple integrals, Beta and Gama functions. Unit-IV Vector calculus: Differentiation of vectors, scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of a vector point function, Stoke's, divergence and green's theorems (without proofs).	**100%**	**32**
		100%	**32**

i. Text Book and Reference Book:

1. Differential Calculus By Shantinarayan | S.Chand Publication
2. Higher Engineering Mathematics By B. S. Grewal | Khanna Publications
3. A Text Book of Vector by Narayan Shanti | S. Chand and Co. Ltd. New Delhi

a. **Course Name:** Surveying and Levelling
b. **Course Code:** 03601173
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** This subject equips students with the skills to measure land, determine boundaries, and produce accurate topographical maps.
e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles and classification of surveying techniques, including chain surveying, compass survey, and cross staff survey.
CLOBJ 2	Develop the ability to perform precise measurements and eliminate errors in both linear and angular surveys.
CLOBJ 3	Gain practical experience in using surveying instruments such as theodolites, total stations, and electronic devices for advanced surveying tasks.
CLOBJ 4	Acquire knowledge of contouring, computation of areas, and volumes, as well as the setting of curves, necessary for large-scale civil engineering projects.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in fundamental surveying and levelling techniques.
CLO 2	Apply principles of error elimination and correction in linear and angular measurements.
CLO 3	Utilize modern surveying instruments like Total Station and GPS effectively.
CLO 4	Interpret and produce contour maps and calculate areas and volumes from surveyed data.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Surveying**: Introduction, classification and basic principles, Linear measurements. Chain surveying. Cross staff survey, Compass survey. Planimeter, Errors in measurements, their elimination and correction. Plane table surveying. Levelling, leveling difficulties and error in leveling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves. Total station, Electronic Theodolite. Introduction to GPS surve	**100%**	**32**
		100%	**32**

i. Text Book and Reference Book:

1. Surveying Vol. I By Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain | Laxmi Publication | 16th Edition
2. Surveying and Levelling Vol. I By Arora K. R | Standard Publications, Delhi
3. Surveying and levelling Vol-I By T. P. Kanetkar & S. V. Kulkarni | Puna Vidyarthi Griha Prakashan

a. **Course Name:** Surveying and Levelling Lab
b. **Course Code:** 03601174
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** This subject equips students with the skills to measure land, determine boundaries, and produce accurate topographical maps.
e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles and classification of surveying techniques, including chain surveying, compass survey, and cross staff survey.
CLOBJ 2	Develop the ability to perform precise measurements and eliminate errors in both linear and angular surveys.
CLOBJ 3	Gain practical experience in using surveying instruments such as theodolites, total stations, and electronic devices for advanced surveying tasks.
CLOBJ 4	Acquire knowledge of contouring, computation of areas, and volumes, as well as the setting of curves, necessary for large-scale civil engineering projects.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in fundamental surveying and levelling techniques.
CLO 2	Apply principles of error elimination and correction in linear and angular measurements.
CLO 3	Utilize modern surveying instruments like Total Station and GPS effectively.
CLO 4	Interpret and produce contour maps and calculate areas and volumes from surveyed data.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Surveying Vol. I By Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain | Laxmi Publication | 16th Edition
2. Surveying and Levelling Vol. I By Arora K. R | Standard Publications, Delhi
3. Surveying and levelling Vol-I By T. P. Kanetkar & S. V. Kulkarni | Puna Vidyarthi Griha Prakashan

i. Experiment List:

Sr. No.	Experiment
1	Chain survey of an area and preparation of map
2	Compass survey of an area and plotting of compass survey
3	Plane table surveying
4	Levelling L section and X sections and its plotting
5	Contour survey of an area and preparation of contour map
6	Introduction of software in drawing contour
7	Theodolite surveying; Ranging by Theodolite, Height of object by using Theodolite; Setting out curves by Theodolite
8	Minor instruments
9	Use of total station

a. **Course Name:** Engineering Physics
b. **Course Code:** 03601175
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** By grasping these principles, students will be better equipped to solve practical engineering problems and innovate in areas such as telecommunications, electronics, and material sciences.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with a comprehensive understanding of magnetic materials and electromagnetic induction, enabling them to apply these concepts in designing electric motors and transformers.
CLOBJ 2	To enhance students' knowledge of optical phenomena, enabling them to analyze and apply the principles of reflection, refraction, and diffraction in lenses and fiber optics systems.
CLOBJ 3	To introduce students to the fundamental principles of semiconductor physics, including the energy band theory and doping mechanisms, and their application in electronic components like diodes and transistors.
CLOBJ 4	To equip students with the foundational concepts of wave motion, laser operation, and optical fibers, fostering their ability to solve complex engineering challenges in telecommunications and medical equipment.

f. **Course Learning Outcomes:**

CLO 1	Understand the behaviour of magnetic materials and their applications in electrical devices.
CLO 2	Analyze light properties and optical phenomena such as reflection, refraction, and interference.
CLO 3	Explain the working principles of semiconductors and their role in modern electronics.
CLO 4	Apply the fundamentals of wave motion, sound, and lasers to practical engineering systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit – 1 Magnetic Materials: Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and their units. Dia, Para, Ferro magnetic materials. Electromagnetic Induction, Lenz's law and its Applications, Alternating current and its waveform Unit-2 Optics Properties of Light, Electromagnetic spectrum, Reflection, refraction, snell's law, diffraction, polarization, interference of light, constructive and destructive interference (Only definitions), Physical significance of refractive index, dispersion of light. Total internal reflection Reflection from spherical mirror, idea of real and virtual image, lens formula. Unit 3 Semiconductor Physics: Energy band in solids (Idea only). Introduction to semiconductor in terms of energy band diagram, its properties, intrinsic and extrinsic semiconductor, Doping material (impurity) trivalent and pentavalent. P-type and N-type semiconductor. P-N junction. Unit– 4 Waves and sound: Wave motion, amplitude, period, frequency and wavelength, relation between velocity, frequency and wavelength. Transverse and longitudinal wave. Propagation of sound, Expression for velocity of sound, Newton's Formula for velocity. Unit– 5 Laser and Fiber Optics: Spontaneous and Stimulated emission Einstein A and B coefficients Population inversion He – Ne and Ruby Lasers. Optical fiber – Physical structure and basic theory Optical fiber mode types Input and output characteristics of optical fiber and applications. Unit– 6 Luminescence: Illumination laws of illumination Luminous flux Luminous Intensity Candle Power	**100%**	**45**
		100%	**45**

i. Text Book and Reference Book:

1. X-Ray Structure Determination: A Practical Guide By Stout, G.H. and Jensen, L.H., | John Wiley and Sons, New York | 2nd Ed
2. A text book of Engg. Physics, By M. N. Avadhanulu | S. CHAND & COMPANY LTD-NEW DELHI | 8
3. Concept of modern physics By Arthur Beiser | McGraw-Hill | 6th Edition

a. **Course Name:** Engineering Physics Lab
b. **Course Code:** 03601176
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** By grasping these principles, students will be better equipped to solve practical engineering problems and innovate in areas such as telecommunications, electronics, and material sciences.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with a comprehensive understanding of magnetic materials and electromagnetic induction, enabling them to apply these concepts in designing electric motors and transformers.
CLOBJ 2	To enhance students' knowledge of optical phenomena, enabling them to analyze and apply the principles of reflection, refraction, and diffraction in lenses and fiber optics systems.
CLOBJ 3	To introduce students to the fundamental principles of semiconductor physics, including the energy band theory and doping mechanisms, and their application in electronic components like diodes and transistors.
CLOBJ 4	To equip students with the foundational concepts of wave motion, laser operation, and optical fibers, fostering their ability to solve complex engineering challenges in telecommunications and medical equipment.

f. **Course Learning Outcomes:**

CLO 1	Understand the behaviour of magnetic materials and their applications in electrical devices.
CLO 2	Analyze light properties and optical phenomena such as reflection, refraction, and interference.
CLO 3	Explain the working principles of semiconductors and their role in modern electronics.
CLO 4	Apply the fundamentals of wave motion, sound, and lasers to practical engineering systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. X-Ray Structure Determination: A Practical Guide By Stout, G.H. and Jensen, L.H., | John Wiley and Sons, New York | 2nd Ed
2. A text book of Engg. Physics, By M. N. Avadhanulu | S. CHAND & COMPANY LTD-NEW DELHI
3. Concept of modern physics By Arthur Beiser | McGraw-Hill | 6th Edition

i. Experiment List:

Sr. No.	Experiment
1	To study P-N junction in forward bias.
2	To find the Wavelength of Laser.
3	To Find Numerical aperture of given optical fiber.
4	To determine material constant and band gap of the given semiconductor material.
5	To measure dielectric constant of given samples of dielectric material.
6	To determine the frequency of the A.C. with the help of a Sonometer.
7	To verify Ohm's law by plotting graph between current and potential difference.
8	To verify laws of resistances in series and parallel combination.

a. **Course Name:** Engineering Chemistry
b. **Course Code:** 03601177
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** Engineering Chemistry is a vital subject that bridges the gap between theoretical chemistry and practical engineering.
e. **Course Learning Objective:**

CLOBJ 1	To introduce students to the fundamentals of the phase rule, phase diagrams, and their application to engineering problems, such as material stability and selection.
CLOBJ 2	To provide comprehensive knowledge on fuels, including their classification, properties, calorific value, and significance in energy generation and conservation.
CLOBJ 3	To familiarize students with the properties of colloids and enzymes, focusing on their industrial applications, particularly in fermentation and catalysis processes.
CLOBJ 4	To develop an understanding of corrosion mechanisms, water hardness, and their prevention methods, with an emphasis on maintaining the integrity of industrial equipment and enhancing sustainability.

f. **Course Learning Outcomes:**

CLO 1	Apply the phase rule and interpret phase diagrams for one and two-component systems.
CLO 2	Understand fuel characteristics and calculate the calorific value using Dulong's formula.
CLO 3	Classify colloids and describe the role of enzymes in catalysis and fermentation processes.
CLO 4	Identify methods to prevent corrosion and explain the impact of water hardness on industrial systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Unit I Phase Rule1.1 Introduction ′phase rule 1.2 Explanation of terms: Phase, Component, Degree of Freedom 1.3 Mathematical statement of Phase rule (Gibbs Phase rule) 1.4 Construction of Phase diagram. 1.5 One component system- Water system 1.6 Two component system classification 1.6.1 Lead-silver system 1.6.2 Phase rule Application	**10%**	**6**
2	Unit-II Fuels and Calorific value:2.1 Introduction-Fuel 2.2 Characteristics of Good fuel 2.3 Classification of Fuels 2.4 Calorific Value 2.4.1 Units of Calorific Value 2.4.2 Dulong Formula for Calorific Value and example 2.4.2 Higher Calorific Value and Lower Calorific Value	**10%**	**4**
3	Unit-III Colloids and Enzymes:3.1Colloids-Definition 3.2 Classification of colloids-lyophilic and lyophobic sols 3.3 Properties of colloidal systems 3.4 Enzymes Definition 3.4.1 Characteristics of Enzymes 3.4.2 Some example of Enzyme Catalyze reaction 3.5 Manufacturing of Ethanol and acetic acid by fermentation method (definition of fermentation, Factors affecting process of fermentation).	**10%**	**4**
4	Unit-IV Corrosion and its prevention:4.1 Corrosion ′Definition 4.2 Causes of Corrosion-factors affecting rate of corrosion. 4.3 Types of Corrosion 4.3.1 Pitting Corrosion 4.3.2 Water line Corrosion 4.3.3 Crevice corrosion 4.3.4 Soil Corrosion 4.3.5 Erosion corrosion 4.3.6 Microbiological corrosion 4.4 Method to Prevent corrosion 4.4.1 Modification of environment, Modification of the properties of metal, Use of prot ective coatings. Anodic and cathodic protection, Modification in design and choice of material	**10%**	**5**
5	Unit-V Water Hardness:5.1 Water Types and types of hardness 5.2 Units of Hardness 5.3 Effect of hard water 5.3.1 Scale and sludge formation and itś Prevention 5.3.2 Priming and foaming and itś prevention. 5.3.3 Caustic embrittlement and itś prevention. 5.4 Boiler corrosion and its prevention	**10%**	**4**
6	Unit-VI Analytical Methods:6.1 Thermal Methods of analysis 6.2 Thermo gravimetric methods 6.3 Polarographic methods	**10%**	**4**
7	Unit-VII Nuclear Chemistry:7.1 Introduction-Radioactivity 7.2 Types of Radioactive decay 7.3 Nuclear radiation detectors 7.4 Analytical application of nuclear radiation	**10%**	**5**
8	Unit- VIII Food Chemistry:8.1 Principles of food chemistry 8.2 Introduction to lipids, proteins, carbohydrates, vitamins, food preservators, colouring and flavouring reagents of food	**10%**	**7**
9	Unit-IX Lubricants:9.1 Introduction-Lubricants 9.2 Classification of lubricants - Solid lubricants Semi-solid lubricants, Liquid lubricants, Synthetic oils 9.2 Mechanism of lubrication- Fluid film Lubrication And Boundary lubrication 9.3 Properties of Lubricants and their test 9.3.1 Viscosity and viscosity index 9.3.2 Flash point and fire point 9.3. 3 Pour point and cloud point 9.3.4 oiliness 9.3.5 Chemical Properties of lubricants like 9.3.6 Saponification value 9.3.7 Neutralization	**10%**	**3**

	number 9.3.8 Emulsification number		
10	Unit- X Polymers:10.1 Introduction 'Polymer and Polymerisation 10.2 Types of Polymerization ′ Addition and Condensation Polymerization 10.3 Properties and uses of Polymers 10.4 Methods to determine the molecular weight of polymer 10.4.1 Number Average molecular mass 10.4.2 Weight average molecular mass 10.4.3 Viscosity average molecular mass	**10%**	**4**
		100%	**46**

i. Text Book and Reference Book:

1. ENGINEERING CHEMISTRY By JAIN & JAIN | DHANPAT RAI
2. A Text Book of Polytechnic Chemistry By V.P. Mehta | Jain Brothers

a. **Course Name:** Engineering Chemistry Lab
b. **Course Code:** 03601178
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** Engineering Chemistry is a vital subject that bridges the gap between theoretical chemistry and practical engineering.
e. **Course Learning Objective:**

CLOBJ 1	To introduce students to the fundamentals of the phase rule, phase diagrams, and their application to engineering problems, such as material stability and selection.
CLOBJ 2	To provide comprehensive knowledge on fuels, including their classification, properties, calorific value, and significance in energy generation and conservation.
CLOBJ 3	To familiarize students with the properties of colloids and enzymes, focusing on their industrial applications, particularly in fermentation and catalysis processes.
CLOBJ 4	To develop an understanding of corrosion mechanisms, water hardness, and their prevention methods, with an emphasis on maintaining the integrity of industrial equipment and enhancing sustainability.

f. **Course Learning Outcomes:**

CLO 1	Apply the phase rule and interpret phase diagrams for one and two-component systems.
CLO 2	Understand fuel characteristics and calculate the calorific value using Dulong's formula.
CLO 3	Classify colloids and describe the role of enzymes in catalysis and fermentation processes.
CLO 4	Identify methods to prevent corrosion and explain the impact of water hardness on industrial systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. ENGINEERING CHEMISTRY By JAIN & JAIN | DHANPAT RAI
2. A Text Book of Polytechnic Chemistry By V.P. Mehta | Jain Brothers

i. Experiment List:

Sr. No.	Experiment
1	Find out concentration of given acidic solution using standard solution of Base.
2	Standardize KMnO4 solution by preparing standard oxalic acid and to estimate ferrous ions.
3	Standardize Na2S2O3 solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4	Determine the viscosity of given substance by using Oswald's Viscometer.
5	Purification of organic compound by recrystallization method.
6	Determine PH-Values of given samples of Solution by using Universal Indicator and PH paper.
7	To determine melting point of given substance by Thiele's tube.
8	Prepare (any one) polystyrene, urea formaldehyde, phenol formaldehyde and its Characterization.
9	To determine the hardness of water in a given unknown water sample by EDTA method.
10	Determine percentage of moisture in given sample of coal by proximate analysis.

a. **Course Name:** Engineering Mechanics
b. **Course Code:** 03605151
c. **Prerequisite:** Knowledge of Applied science.
d. **Rationale:** Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.

e. **Course Learning Objective:**

CLOBJ 1	To introduce students to the fundamental concepts of mechanics, including statics and dynamics, and their significance in engineering applications.
CLOBJ 2	To develop the ability to analyze forces, resolve forces into components, and apply laws such as Lami's Theorem for force systems.
CLOBJ 3	To equip students with skills to determine the centroid and center of gravity of simple geometric figures and composite solids.
CLOBJ 4	To provide practical understanding of friction, lifting machines, and energy concepts in engineering, focusing on equilibrium and mechanical advantage analysis.

f. **Course Learning Outcomes:**

CLO 1	Understand the basic principles of mechanics and their applications in engineering problems.
CLO 2	Analyze forces and equilibrium in structures, including beams and solids.
CLO 3	Calculate the centroid and center of gravity of geometric shapes and composite bodies.
CLO 4	Apply the principles of friction, motion, and energy in solving engineering mechanics problems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Basics of Mechanics** Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.	10%	2
2	**Centroid and Centre of Gravity** Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) Centroid of composite figures composed of not more than three geometrical figures. Centre of Gravity of simple solids (Cube, cuboids, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.	10%	6
3	**Coplanar Concurrent Forces** Force – Unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Newton's first,second and third Law of motion Principle of transmissibility of force, Principle of superposition of force, Force system and its classification. Lami's Theorem – statement and explanation, Application for various engineering problems. Resolution of a force .Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon offorces.	25%	10
4	**Equilibrium and Coplanar Non Concurrent Forces** Types of Equilibrium, Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing equilibrium. Moment and couple, Varignon's Theorem. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load. Beam reaction graphically for simply supported beam subjected to vertical point loadsonly	25%	10
5	**Friction** Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Ladder Friction, Engineering Problems.	10%	6
6	**Simple Lifting Machine** Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of	20%	8

	machines, Work – work done , force displacement diagram, Power , Engineering Problems Energy – Kinetic & Potential energy and Engineering Problems. Law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines.		
		100%	**42**

i. Text Book and Reference Book:

1. Applied Mechanics by H. J. Shah and S. B. Junarkar | Charotar publication
2. A Text Book of Engineering Mechanics by Bansal R K | Laxmi Publishers, New Delhi.
3. Engineering Mechanics by J.L. Meriam, and L.G.Kraige | John Wiley and sons, New York.
4. Engineering Mechanics by S.S. Bhavikatti and K. G. Rajashekarappa | Wiley 'Eastern Ltd

a. **Course Name:** Engineering Mechanics Lab
b. **Course Code:** 03605152
c. **Prerequisite:** Knowledge of Applied science.
d. **Rationale:** Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.

e. **Course Learning Objective:**

CLOBJ 1	To introduce students to the fundamental concepts of mechanics, including statics and dynamics, and their significance in engineering applications.
CLOBJ 2	To develop the ability to analyze forces, resolve forces into components, and apply laws such as Lami's Theorem for force systems.
CLOBJ 3	To equip students with skills to determine the centroid and center of gravity of simple geometric figures and composite solids.
CLOBJ 4	To provide practical understanding of friction, lifting machines, and energy concepts in engineering, focusing on equilibrium and mechanical advantage analysis.

f. **Course Learning Outcomes:**

CLO 1	Understand the basic principles of mechanics and their applications in engineering problems.
CLO 2	Analyze forces and equilibrium in structures, including beams and solids.
CLO 3	Calculate the centroid and center of gravity of geometric shapes and composite bodies.
CLO 4	Apply the principles of friction, motion, and energy in solving engineering mechanics problems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**100**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Applied Mechanics by H. J. Shah and S. B. Junarkar | Charotar publication
2. A Text Book of Engineering Mechanics by Bansal R K | Laxmi Publishers, New Delhi.
3. Engineering Mechanics by J.L. Meriam, and L.G.Kraige | John Wiley and sons, New York.
4. Engineering Mechanics by S.S. Bhavikatti and K. G. Rajashekarappa | Wiley 'Eastern Ltd

i. Experiment List:

Sr. No.	Experiment
1	**Law of Parallelogram.** Verify and calculate resultant force through Law of Parallelogram.
2	**Triangle Law of Forces.** Verify and calculate resultant force through triangle Law of Forces.
3	**Lami's Theorem** Verify and calculate resultant force through Lami's Theorem.
4	**Polygon Law of Forces** Verify and calculate resultant force through Polygon Law of Forces.
5	**Reactions in beam through Graphical & analytical method** Verify reactions in beam through Graphical & analytical method
6	**Co efficient of Sliding Friction and angle of repose** Calculate Co efficient of Sliding Friction and angle of repose for different surfaces – Wood, Glass
7	**Simple machines** To find out efficiency, velocity ratio and M.A for differential wheel and axle
8	**Simple screw jack.** To find out efficiency, velocity ratio and M.A for simple lifting machine using simple screw jack.
9	**Centroid and Centre of Gravity** Solve numerical problems on Centroid and Centre of Gravity.

a. **Course Name:** Engineering Workshop Practice
b. **Course Code:** 03609154
c. **Prerequisite:** Learn about fundamental of mechanical and electrical engineering.
d. **Rationale:** Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops.
e. **Course Learning Objective:**

CLOBJ 1	To familiarize students with different hand tools, materials, and techniques used in carpentry, smithy, and fitting jobs, enabling them to create simple joints and components.
CLOBJ 2	To provide hands-on experience in performing welding, soldering, and plumbing operations, focusing on safety and accuracy during construction and repair tasks.
CLOBJ 3	To develop competency in using electrical tools, cables, switches, and protective devices through practical demonstration and application in real-world wiring setups.
CLOBJ 4	To equip students with the knowledge to interpret electrical symbols and diagrams, allowing them to effectively plan and execute various domestic and industrial wiring projects.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in basic carpentry, smithy, and fitting techniques.
CLO 2	Utilize various welding, soldering, and plumbing tools effectively and safely.
CLO 3	Identify and operate electrical installation tools and measuring instruments.
CLO 4	Apply knowledge of domestic wiring systems and protective devices in practical scenarios.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**100**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Mechanical workshop practice By K.C. John
2. A Textbook of Electrical Workshop Practices By Dr. Umesh Rathore | S.K. Kataria & Sons
3. A Course in Workshop Technology By Raghuwamsi B S | Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982
4. Workshop Practice Manual By K. Venkat Reddy | BS Publications
5. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House
6. Comprehensive Workshop Technology By S.K. Garg | Laxmi publications

i. Experiment List:

Sr. No.	Experiment
1	**To A Perform a Job in Carpentry Shop.** Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc., Types of woods and their applications., Types of carpentry hardware 's and their uses., Demonstration of carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, etc., Preparation of wooden joints., Safety precautions.
2	**To A Perform a Job in Tim Smithy.** Concept and conversions of SWG and other gauges in use., Use of wire gauge., Types of sheet metal joints and applications., Types, sketch, specification, material, applications and methods of using tin smithy tools-hammers, stakes, scissors/snips, etc., Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining., Preparation of tin smithy job., Safety precautions
3	**To Perform a Job on Fitting Practice.** Sketch, specification and applications of fitting work holding tools-bench vise, V-block with clamp and C-clamp., Sketch, specification , material ,applications and methods of using fitting marking and measuring tools-marking table, surface plate, angle plate, universal cribbing block, try-square, scriber, divider, centre punch, letter punch, callipers, Vernier calliper, etc., Types, sketch, specification , material , applications and methods of using of fitting cutting tools hacksaw, chisels, twist drill, taps, files, dies., Types, sketch, specification, material, applications and methods of using of fitting finishing tools-files, reamers., Sketch, specification and applications of miscellaneous tools-hammer, spanners, screw drivers sliding screw wrench., Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping., Preparation of simple and male- female joints., Safety precautions.
4	**To Perform a Job on Soldering**
5	**To Perform a Job on Welding.** Demonstration of different welding tools / machines., Demonstration on Arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding., One simple job involving butt and lap joint., Safety precautions.

6	**To Perform a Job on plumbing.** Types, specification, material and applications of pipes., Types, specification, material and applications of pipe fittings., Types, specifications, material, applications and demonstration of pipe fitting tools., Demonstration of pipe fitting operationssuch as marking, cutting, bending, threading, assembling, dismantling, etc., Types and application of various spanners such as flat, fix, ring, box, adjustable, etc., Preparation of pipe fitting jobs., Safety precautions.
7	**To Perform a Job on Sheet Metal Practice.**
8	**Identify Different symbol used in electrical installation and prepare sheet.** Demonstration of electrical symbol used in domestic or industrial wiring., Demonstration of electrical wiring tools and accessories., Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter., Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Techometer, Tester etc.
9	**Identify the different tools used in electrical installation.** Demonstration of electrical wiring tools and accessories.
10	**Demonstration of measuring instrument Voltmeter, Ammeter, Wattmeter.** Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter
11	**Demonstration of testing instruments: Multi meter, Clip-on meter, Megger, Line tester.** Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Techometer, Tester etc.
12	**Demonstration of different cables used in electrical installation.** Single core cable, multicore cable, single strand wire, multi strand wire, shielded wire.
13	**Demonstration of different switches used in electrical installation.** Demonstration of different switches like Toggle switch, Rotary switches, Push button switch etc.
14	**Demonstration of protective devices: fuse, MCB, ELCB.** Demonstration of protective devices like fuse, MCB, ELCB.
15	**Identify different types of domestic wirings.** Demonstration on one lamp controlled by one Switch., Demonstration on Staircase wiring., Demonstration on connection of Tube light Wiring., Demonstration on different earthing used in electrical installation.

a. **Course Name:** Communication Skills - II
b. **Course Code:** 03693153
c. **Prerequisite:** Knowledge of English Language.
d. **Rationale:** Basic Communication skills are essential for all Diploma Engineers.
e. **Course Learning Objective:**

CLOBJ 1	To enhance students' ability to engage in effective listening by recognizing different types of listening and overcoming barriers to comprehension.
CLOBJ 2	To expand students' vocabulary and introduce them to the nuances of language usage through various linguistic tools such as idioms, phrasal verbs, and homographs.
CLOBJ 3	To familiarize students with phonetic symbols and sound patterns, enabling accurate word transcription and improved pronunciation.
CLOBJ 4	To build students' speaking skills through classroom activities that promote effective communication, public speaking, and participation in formal events like debates and extempore.

f. **Course Learning Outcomes:**

CLO 1	Students will differentiate between hearing and listening, applying effective listening techniques.
CLO 2	Students will identify and use appropriate vocabulary, including synonyms, antonyms, and homophones.
CLO 3	Students will understand the basics of phonetics, including word transcription and pronunciation.
CLO 4	Students will develop confidence in public speaking and formal communication.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**100**	**-**	**-**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Listening Skills** Listening Process and Practice - Introduction, importance of good Listening Skills, difference between listening andhearing, types of listening, Barriers to effective Listening, traits of a good listener.	15%	6
2	**Listening Skills – Questions** With audio aids, Students will be able to listen to dialogues, improve in gathering information and to summarize the content. To listen and understand day-to-day conversations and to solve questions based on audio files.	10%	1
3	**Building Vocabulary** Synonyms, Antonyms, Homophones, Homonyms, Homographs, Phrasal verbs, idioms & phrases, One word substitution.	15%	1
4	**Introduction to Phonetics** Sounds: Consonant, Vowel, Diphthongs, transcription of words(IPA) weak forms, syllable division, word stress, intonation and voice.	15%	6
5	**Speaking Skill Building Introduction** To enable students to eliminate stage fright and engage in conversation with others.	5%	2
6	**Speaking Skill Building Activity** Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems.	5%	3
7	**Tourism Pitch** Classroom activity which helps students to express their feelings and experiences in English. Encouraging students to overcome stage fear.	5%	1
8	**Lifeboat** Classroom Activity to encourage Communication and Convincing Skills.	5%	1
9	**Reporter** Classroom activity to encourage Communication and Convincing Skills.	5%	1
10	**Paragraph Jumble** Enhance the skill of writing by completing the paragraph in appropriate and sensible form.	5%	4
11	**Life Skills** Self Awareness, Sympathy, Empathy, Emotional Intelligence.	5%	4
12	**Reading Comprehension** A Day's Wait- Ernest Hemingway, My Lost Dollar - Stephen Leacock.	10%	2
		100%	32

i. Text Book and Reference Book:

1. Technical Communication: Principles And Practice By Sangeetha Sharma, Meenakshi Raman | Oxford University Press
2. Effective Technical Communication By Dr. Bharti Kukreja, Dr. Anupama Jain | S.K. Kataria & Sons | 1st
3. Active English By Juneja & Qureshi | Macmillan

Semester 3

a. **Course Name:** Engineering Mathematics-II
b. **Course Code:** 03601215
c. **Prerequisite: Understanding of calculus basics (from Engineering Mathematics-1)**
d. **Rationale:** Engineering Mathematics-2 plays a crucial role in shaping an engineer's ability to model, analyze, and solve practical problems encountered in various engineering fields.
e. **Course Learning Objective:**

CLOBJ 1	Understand and apply various methods to solve first-order and higher-order ordinary differential equations (ODEs).
CLOBJ 2	Grasp the fundamental concepts of complex analysis, including analytic functions, Cauchy-Riemann equations, and contour integration.
CLOBJ 3	Analyze and decompose periodic functions into their Fourier series components and understand their applications in solving physical problems.
CLOBJ 4	Formulate and solve basic types of partial differential equations (PDEs), including heat, wave, and Laplace equations, using appropriate methods.

f. Course Learning Outcomes:

CLO 1	Solve linear and nonlinear ordinary differential equations using methods such as separation of variables, integrating factors, and Laplace transforms.
CLO 2	Apply theorems of complex analysis, such as Cauchy's Integral Theorem and Residue Theorem, to evaluate integrals and solve complex variable problems.
CLO 3	Expand periodic functions into Fourier series and apply this technique to solve boundary value problems in engineering and physics.
CLO 4	Solve classical PDEs using separation of variables and Fourier methods, and interpret the solutions in physical contexts like heat conduction and wave propagation.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	

3	**1**	**-**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Ordinary differential equations** Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, Differential equations of higher orders, methods of finding complementary functions and particular integrals, method of variation of parameters, Cauchy's and Legendre's linear equations, simultaneous linear differential equations with constant coefficients.	**30**	**18**
2	**Functions of a Complex variable:** Limit, continuity and analytic function, Cauchy-Riemann equations, Harmonic functions.	**20**	**12**
3	**Fourier series** Infinite series and its convergence, periodic functions, Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series, Fourier Sine and Cosine Series, Fourier series for function having period 2L, Elimination of one and two arbitrary function.	**30**	**18**
4	**Partial differential equations** Formation of partial differential equations Higher order linear partial differential equations with constant coefficients, solution of non-linear partial differential equations, Charpit's method.	**20**	**12**
		100	**60**

i. Text Book and Reference Book:

1. **A Text Book of Matrices**
   By Narayan Shanti | S. Chand and Co. Ltd. New Delhi, Pub. Year 2004
2. **Higher Engineering Mathematics**
   By Grewal B S | Khanna Publishers Delhi, Pub. Year 2004
3. **Engineering Mathematics**
   By Ramana B V | Tata McGraw-Hill. New Delhi, Pub. Year 2004

j. List of Tutorial

1. Tutorials on solution

Tutorials on solution of ordinary differential equations of first and higher orders. Legendre's differential equations, Convergence of infinite series. Fourier series, Cauchey-Riemann equations, harmonic functions, Solution of partial differential equations

a. **Course Name:** Fluid Mechanics and Open Channel Hydraulics
b. **Course Code:** 03601217
c. **Prerequisite:** A basic understanding of **Physics** (specifically mechanics) to grasp fundamental principles like forces and pressure.
d. **Rationale:** Fluid Mechanics and Open Channel Hydraulics is an essential course for civil and mechanical engineering students, particularly for those focusing on hydraulics, water resource management, and infrastructure design. Understanding fluid behavior in both confined (pipes) and unconfined (open channels) environments is crucial for designing efficient systems for water distribution, flood control, and irrigation.
e. **Course Learning Objective:**

CLOBJ 1	Understand the physical properties of fluids and analyze the stability and behavior of submerged and floating bodies.
CLOBJ 2	Grasp the principles of fluid flow patterns, velocity fields, and apply the continuity equation in various fluid flow problems.
CLOBJ 3	Apply Bernoulli's theorem and principles of laminar and turbulent flow in pipes to analyze fluid behavior under dynamic conditions.
CLOBJ 4	Design and evaluate open channel flows using standard formulas like Manning's and Chezy's for practical engineering applications.

f. **Course Learning Outcomes:**

CLO 1	Calculate pressure forces on surfaces, determine buoyancy, meta-centric height, and evaluate the stability of submerged and floating bodies in static fluid conditions.
CLO 2	Analyze fluid motion using the Eulerian and Lagrangian approaches, construct flow nets, and apply these concepts to solve practical fluid flow problems.
CLO 3	Use Bernoulli's equation and principles of laminar and turbulent flow to compute fluid discharge, velocity, and energy losses in pipe networks and through devices like orifices and weirs.
CLO 4	Design and analyze open channel flows by applying formulas like Chezy's and Manning's, accounting for velocity and pressure profiles, and understanding hydraulic losses.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Properties of fluids** Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies;	25	8
2	**Kinematics of fluid flow**Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow.	25	7
3	**Dynamics of fluid flow** Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar flow: Stress strain relationships, discharge, average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy's Equation, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Flow through orifices (Measurement of Discharge, Measurement of Time),Flow through Mouthpieces, Flow over Notches , Flow over weirs, Chezy's formula for loss of head in pipes	40	12
4	**Open channel design and hydraulics** Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels.	10	3
		100	30

i. Text Book and Reference Book:

1. **A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines**
   By Khurmi R .S. | S. Chand & Company Limited, New Delhi, Pub. Year 1970
2. **Hydraulics and Fluid Mechanics**
   By Modi P.N. and Seth S.M. | Standard Book House, Delhi, Pub. Year 1973

3. **Open Channel Hydraulics**
   By Chow V.T. | McGraw Hill Book Co., New Delhi, Pub. Year 1983
4. **Fluid Mechanics and Hydraulics**
   By Jagdish Lal | Metropolitan Book Co.Pvt. Ltd., New Delhi, Pub. Year 1985

a. **Course Name:** Fluid Mechanics and Open Channel Hydraulics Lab
b. **Course Code:** 03601218
c. **Prerequisite:** A basic understanding of **Physics** (specifically mechanics) to grasp fundamental principles like forces and pressure.
d. **Rationale:** Fluid Mechanics and Open Channel Hydraulics is an essential course for civil and mechanical engineering students, particularly for those focusing on hydraulics, water resource management, and infrastructure design. Understanding fluid behavior in both confined (pipes) and unconfined (open channels) environments is crucial for designing efficient systems for water distribution, flood control, and irrigation.
e. **Course Learning Objective:**

CLOBJ 1	Understand the physical properties of fluids and analyze the stability and behavior of submerged and floating bodies.
CLOBJ 2	Grasp the principles of fluid flow patterns, velocity fields, and apply the continuity equation in various fluid flow problems.
CLOBJ 3	Apply Bernoulli's theorem and principles of laminar and turbulent flow in pipes to analyze fluid behavior under dynamic conditions.
CLOBJ 4	Design and evaluate open channel flows using standard formulas like Manning's and Chezy's for practical engineering applications.

f. **Course Learning Outcomes:**

CLO 1	Calculate pressure forces on surfaces, determine buoyancy, meta-centric height, and evaluate the stability of submerged and floating bodies in static fluid conditions.
CLO 2	Analyze fluid motion using the Eulerian and Lagrangian approaches, construct flow nets, and apply these concepts to solve practical fluid flow problems.
CLO 3	Use Bernoulli's equation and principles of laminar and turbulent flow to compute fluid discharge, velocity, and energy losses in pipe networks and through devices like orifices and weirs.
CLO 4	Design and analyze open channel flows by applying formulas like Chezy's and Manning's, accounting for velocity and pressure profiles, and understanding hydraulic losses.

g. **Teaching & Examination Scheme:**

Teaching Scheme	**Evaluation Scheme**

L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. **A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines**
   By Khurmi R .S. | S. Chand & Company Limited, New Delhi, Pub. Year 1970
2. **Hydraulics and Fluid Mechanics**
   By Modi P.N. and Seth S.M. | Standard Book House, Delhi, Pub. Year 1973
3. **Open Channel Hydraulics**
   By Chow V.T. | McGraw Hill Book Co., New Delhi, Pub. Year 1983
4. **Fluid Mechanics and Hydraulics**
   By Jagdish Lal | Metropolitan Book Co.Pvt. Ltd., New Delhi, Pub. Year 1985

i. Experiment List:

1.	Study of manometers and pressure gauges.
2.	Verification of Bernoulli's theorem.
3.	Determination of coefficient of discharge of venturi-meter and orifice meter.
4.	Determination of coefficient of friction in pipeline.
5.	Determination of coefficient of discharge for rectangular and triangular notch.
6.	Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice.
7.	Determination of coefficient of discharge for mouth piece.
8.	Study of current meter.

a. **Course Name:** Thermodynamics, Refrigeration and Air Conditioning

b. **Course Code:** 03601219

c. **Prerequisite:** A fundamental understanding of Physics, particularly concepts related to energy, heat, and work.

d. **Rationale:** This course provides students with essential knowledge of thermodynamics and its applications in refrigeration and air conditioning systems. The principles of energy conservation, heat transfer, and system efficiency are foundational in engineering, particularly in designing heating, cooling, and refrigeration systems.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental laws of thermodynamics, including the first and second laws, and apply them to analyze thermodynamic processes.
CLOBJ 2	Grasp the concept of entropy and the limitations of the first law, applying the second law of thermodynamics to various thermodynamic cycles and systems.
CLOBJ 3	Understand the history, principles, and methods of producing cooling, and calculate the performance of refrigeration and air conditioning systems.
CLOBJ 4	Identify and describe the working principles of the main components in refrigeration and air conditioning systems, such as compressors, condensers, and evaporators.

f. **Course Learning Outcomes:**

CLO 1	Analyze thermodynamic systems, cycles, and processes using the first law of thermodynamics, including non-flow and steady-flow processes.
CLO 2	Apply the second law of thermodynamics and entropy concepts to solve problems related to heat engines, refrigerators, and heat pumps, and evaluate the efficiency of various thermodynamic cycles.
CLO 3	Calculate the coefficient of performance (COP) of refrigeration systems and interpret T-s and p-h diagrams for vapor compression and absorption refrigeration cycles.
CLO 4	Design and evaluate refrigeration and air conditioning systems by selecting appropriate components (compressors, condensers, etc.) and ensuring efficient duct design and air distribution for various applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**BASICS OF THERMODYNAMICS AND 1ST LAWOF THERMODYNAMICS** Thermodynamic System, flow and non-flow processes, properties, process, cycle, thermodynamic equilibrium, Quasi-static Process, Zeroth Law of thermodynamics, Work and Heat transfer. First Law of thermodynamics, internal energy, proof of internal energy as a point function, Application of first law in heating and expansion of gases in non-flow processes. First law applied to steady flow processes.	15	5
2	**SECOND LAW OF THERMODYNAMICS AND ENTROPY** Second law of thermodynamics: Limitations of the First Law, Thermal Reservoir, Heat Engine, Heat pump and Refrigerator, Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements, Carnot cycle, Otto cycle and Diesel cycle. Entropy: Clausius theorem, Entropy - as a property, the inequality of Clausius.	15	4
3	**FUNDAMENTAL AND HISTORY OF REFRIGERATION AND AIR CONDITIONING** Brief history and need of refrigeration and air conditioning, methods of producing cooling, ton of refrigeration, COP.	5	2
4	**REFRIGERANTS** History of refrigerant development, classifications, desirable properties, environmental issues, secondary refrigerants, future industrial refrigerants.	5	1
5	**VAPOUR COMPRESSION REFRIGERATION SYSTEM** Reversed Carnot cycle and its limitation, Ideal VCR system with p-h and T-s diagram and it's COP.	5	1
6	**VAPOUR ABSORPTION REFRIGERATION SYSTEMS**Basic Vapour absorption refrigeration system and its COP equation.	5	2
7	**COMPONENTS OF REFRIGERATION SYSTEM** Types, construction and working of Compressor, Condenser, Expansion device and Evaporator.	5	2

8	**PSYCHROMETRY** Dalton's law of partial pressure, Properties of moist air, temperature and humidity measuring instruments, psychrometric chart and elementary psychometric process.	**10**	**3**
9	**AIR CONDITIONING SYSTEMS** Classifications, window air conditioning systems, split air conditioning systems, packaged air conditioning plant, central air conditioning systems.	**10**	**3**
10	**DUCT DESIGN AND AIR DISTRIBUTION** Duct design methods such as velocity reduction method, equal friction method & static regain method and Air distribution.	**10**	**3**
11	**APPLICATIONS OF REFRIGERATION AND AIR CONDITIONING** Comfort Air conditioning: Residential air conditioning, commercial air conditioning, and industrial air conditioning. Industrial Refrigeration: Chemical and process industries, automotive, dairy plants, petroleum refineries. food processing and food chain and miscellaneous	**15**	**4**
		100	**30**

i. Text Book and Reference Book:

1. **A Course in Thermodynamics and Heat Engines**
   By Kothandaraman C P Khajuria P R and Arora S C
2. **Engineering Thermodynamics**
   By Khurmi R S.
3. **Thermodynamics and Heat Power Engineering.**
   By Mathur M L and Mehta F S.
4. **Thermal Engineering**
   By P.L. Ballaney | Khanna Publishers
5. **Engineering Thermodynamics**
   By P.K. Nag | Tata McGraw Hill

a. **Course Name:** Thermodynamics, Refrigeration and Air Conditioning Lab
b. **Course Code:** 03601220
c. **Prerequisite:** A fundamental understanding of Physics, particularly concepts related to energy, heat, and work.
d. **Rationale:** This course provides students with essential knowledge of thermodynamics and its applications in refrigeration and air conditioning systems. The principles of energy conservation, heat transfer, and system efficiency are foundational in engineering, particularly in designing heating, cooling, and refrigeration systems.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental laws of thermodynamics, including the first and second laws, and apply them to analyze thermodynamic processes.
CLOBJ 2	Grasp the concept of entropy and the limitations of the first law, applying the second law of thermodynamics to various thermodynamic cycles and systems.
CLOBJ 3	Understand the history, principles, and methods of producing cooling, and calculate the performance of refrigeration and air conditioning systems.
CLOBJ 4	Identify and describe the working principles of the main components in refrigeration and air conditioning systems, such as compressors, condensers, and evaporators.

f. **Course Learning Outcomes:**

CLO 1	Analyze thermodynamic systems, cycles, and processes using the first law of thermodynamics, including non-flow and steady-flow processes.
CLO 2	Apply the second law of thermodynamics and entropy concepts to solve problems related to heat engines, refrigerators, and heat pumps, and evaluate the efficiency of various thermodynamic cycles.
CLO 3	Calculate the coefficient of performance (COP) of refrigeration systems and interpret T-s and p-h diagrams for vapor compression and absorption refrigeration cycles.
CLO 4	Design and evaluate refrigeration and air conditioning systems by selecting appropriate components (compressors, condensers, etc.) and ensuring efficient duct design and air distribution for various applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**		
L	**T**	**P**	**C**	**Internal Evaluation**	**ESE**	**Total**

				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. **A Course in Thermodynamics and Heat Engines**
   By Kothandaraman C P Khajuria P R and Arora S C
2. **Engineering Thermodynamics**
   By Khurmi R S.
3. **Thermodynamics and Heat Power Engineering.**
   By Mathur M L and Mehta F S.
4. **Thermal Engineering**
   By P.L. Ballaney | Khanna Publishers
5. **Engineering Thermodynamics**
   By P.K. Nag | Tata McGraw Hill

i. Experiment List:

Sr. No.	Experiment
1	Exercise based on basic concepts of thermodynamics.
2	Exercise based on concepts of first law of thermodynamics for non-flow processes.
3	Exercise based on concepts of first law of thermodynamics for steady flow processes.
4	Exercise based on second law of thermodynamics.
5	Exercise based on concept of entropy.
6	To study the different air refrigeration system.
7	Performance on vapour compression test rig.
8	Performance on vapour absorption refrigeration system
9	Performance on water cooler test rig.
10	Study different Psychrometric process and charts.
11	Performance of window air conditioner test rig.
12	Study on repair and maintenance of refrigeration and air-conditioning systems.
13	Visit to chilling or ice making and cold storage plants.

a. **Course Name:** Soil and Water Conservation Engineering
b. **Course Code:** 03601221
c. **Prerequisite:** A foundational understanding of agricultural science and environmental science is recommended. Prior coursework in soil science, hydrology, or environmental engineering will be beneficial for grasping the concepts covered in this course.
d. **Rationale:** Soil and Water Conservation Engineering is critical for sustainable land management and agricultural practices. As global agricultural systems face challenges related to soil degradation and water scarcity, effective conservation strategies are essential. This course equips students with the knowledge and skills to assess soil properties, understand erosion mechanisms, and implement conservation practices, promoting sustainable use of natural resources.

e. **Course Learning Objective:**

CLOBJ 1	Understand and classify the physical properties of soil, including texture, structure, bulk density, and porosity.
CLOBJ 2	Analyze the mechanisms of water and wind erosion, and understand the factors influencing erosion rates
CLOBJ 3	Apply various agronomic and structural practices to control erosion by water and wind.
CLOBJ 4	Design and implement water conservation strategies, including farm ponds, bunds, and vegetative measures for soil and water retention.

f. **Course Learning Outcomes:**

CLO 1	Classify soils based on physical properties like texture and structure, and calculate important soil characteristics like bulk density, porosity, and moisture content.
CLO 2	Use the Universal Soil Loss Equation (USLE) to estimate soil loss due to erosion and understand the impact of various environmental factors on erosion.
CLO 3	Design and implement erosion control structures, such as terraces, bunds, and gully control structures, with knowledge of their design parameters and adaptability to different terrains.
CLO 4	Plan and construct water conservation structures like earthen embankments, farm ponds, and vegetated waterways to reduce erosion and improve water retention on agricultural land.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Soil and its properties** An introduction to the soil as a natural body, definitions. Various constituents of soil and their importance. Soil separates; their physical nature and their classifications (I. S. S. S. & U. S. D. A.). Soil texture; definition and textural classification of soil (U. S. D.A.). Soil structure; definition, types and factors affecting soil structure. Bulk density and particle density of soils. Porosity & void ratio. Degree of saturation. Soil moisture content (dry basis & wet basis). Method of soil moisture determination viz. gravimetric method. Infiltration & Infiltration rate.	**25**	**6**
2	**Erosion** Definition, Classification of erosion viz. Geological & accelerated, agents causing erosion. Water Erosion: Its types and Mechanics of Water erosion, Factors affecting erosion by Water. Gully erosion: Principle of gully erosion and Classification of gullies. Wind Erosion: Mechanics of Wind Erosion: Processes of saltation, suspension, surface creep. Factors affecting erosion by wind. Soil loss estimation: Universal soil loss equation (USLE).	**30**	**9**
3	**Erosion Control** Principles of erosion control. Agronomic and field practices to control erosion by wind &water i.e. Contour farming, strip cropping, tillage etc. Terracing to control erosion by water. Types of terraces. Terrace design parameters and planning a terrace system. Bunding to control erosion by water. Types of Bunds. Bund design parameters and planning a Bunding system. Temporary structures for the control of gully erosion, their types and adaptability.	**35**	**12**

	Permanent soil conservation structures viz. Drop spillway, Chute spillway: their principles, adaptability, constructional features and material of construction. Vegetated water ways for the control of erosion.		
4	**Water Conservation** Introduction to the farm ponds. Earthen embankments and water harvesting in relation to soil and water conservation. Soil conservation through tree and grass cultivation.	**10**	**3**

i. Text Book and Reference Book:

1. **Soil and water Conservation Engineering (TextBook)**
   By R Suresh
2. **Land and water management; Principles and Practices**
   By V V N Murthy
3. **Introduction to Soil and Water Conservation Engineering**
   By Mal, B.C | Kalyani Publishers
4. **Principles of Agricultural Engineering Vol-II**
   By A M Michael & T P Ojha

a. **Course Name:** Soil and Water Conservation Engineering Lab
b. **Course Code:** 03601222
c. **Prerequisite:** A foundational understanding of agricultural science and environmental science is recommended. Prior coursework in soil science, hydrology, or environmental engineering will be beneficial for grasping the concepts covered in this course.
d. **Rationale:** Soil and Water Conservation Engineering is critical for sustainable land management and agricultural practices. As global agricultural systems face challenges related to soil degradation and water scarcity, effective conservation strategies are essential. This course equips students with the knowledge and skills to assess soil properties, understand erosion mechanisms, and implement conservation practices, promoting sustainable use of natural resources.

e. **Course Learning Objective:**

CLOBJ 1	Understand and classify the physical properties of soil, including texture, structure, bulk density, and porosity.
CLOBJ 2	Analyze the mechanisms of water and wind erosion, and understand the factors influencing erosion rates
CLOBJ 3	Apply various agronomic and structural practices to control erosion by water and wind.
CLOBJ 4	Design and implement water conservation strategies, including farm ponds, bunds, and vegetative measures for soil and water retention.

f. Course Learning Outcomes:

CLO 1	Classify soils based on physical properties like texture and structure, and calculate important soil characteristics like bulk density, porosity, and moisture content.
CLO 2	Use the Universal Soil Loss Equation (USLE) to estimate soil loss due to erosion and understand the impact of various environmental factors on erosion.
CLO 3	Design and implement erosion control structures, such as terraces, bunds, and gully control structures, with knowledge of their design parameters and adaptability to different terrains.
CLO 4	Plan and construct water conservation structures like earthen embankments, farm ponds, and vegetated waterways to reduce erosion and improve water retention on agricultural land.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. **Soil and water Conservation Engineering (TextBook)**
   By R Suresh
2. **Land and water management; Principles and Practices**
   By V V N Murthy
3. **Introduction to Soil and Water Conservation Engineering**
   By Mal, B.C | Kalyani Publishers
4. **Principles of Agricultural Engineering Vol-II**
   By A M Michael & T P Ojha

i. Experiment List:

Sr. No.	Experiment
1	To determine the bulk density of soil.
2	To determine the texture of soil.
3	To study the various types of soil erosion and their control.
4	Study and Preparation of contour maps.
5	Determination of moisture content by gravimetric method.
6	Exercises on soil loss estimation.
7	To study the bunds for soil erosion control.
8	To study the terracing for soil erosion control.
9	To study the vegetative water ways for the control of erosion and safe disposal of water.
10	Visit to gully ravines.

a. **Course Name:** Farm Power Engineering

j. **Course Code:** 03601223

k. **Prerequisite:** A foundational knowledge of mechanical engineering principles, particularly in dynamics and thermodynamics, is recommended. Prior coursework in agricultural machinery or internal combustion engines will enhance understanding of the concepts covered in this course.

l. **Rationale:** Farm Power Engineering is crucial for understanding the mechanisms that drive agricultural machinery and equipment. As modern agriculture increasingly relies on efficient and powerful machinery, knowledge of farm power sources and engine technology becomes essential. This course equips students with the skills to analyze, operate, and maintain various power systems in agricultural applications, promoting enhanced productivity and sustainability in farming practices.

m. **Course Learning Objective:**

CLOBJ 1	Understand the need for farm power, types of farm tractors, and the classification and working principles of internal combustion engines.
CLOBJ 2	Comprehend the components and functioning of air intake and fuel systems in diesel engines, including air cleaners, fuel pumps, and injectors.
CLOBJ 3	Analyze the necessity and functioning of engine cooling, lubrication systems, and governors, and understand how they contribute to engine efficiency and performance.
CLOBJ 4	Evaluate engine performance through testing methods, calculating parameters such as indicated horsepower (IHP), brake horsepower (BHP), and mechanical and thermal efficiencies.

n. **Course Learning Outcomes:**

CLO 1	Classify various farm power sources and describe the working principles of four-stroke and two-stroke IC engines, along with essential engine parameters like compression ratio and engine displacement.
CLO 2	Identify and describe the components of air intake and fuel systems in diesel engines, and explain their working, including the operation of multi-cylinder fuel injection systems.
CLO 3	Diagnose common defects in cooling and lubrication systems and suggest appropriate rectification measures, while also understanding the role of governors in regulating engine speed.

CLO 4	Conduct engine testing to determine power output and efficiency, analyze exhaust emissions, and implement pollution control measures in line with industry standards.

o. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

p. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Classification of Farm Power Sources** Need of farm power Types of farm tractors	10	2
2	**Principles of l. C. Engines** Introduction and classification of IC engines. Working principle of four stroke and two stroke cycle. Petrol and Diesel engines, their comparison location and function of various parts of IC engines and material used for them. Concept of IC engine terms, bore, stroke, dead centre, crank throw, compression ratio, clearance volume, swept volume/piston displacement, total volume, engine displacement and piston speed. Calculation of IHP, BHP, FHP and engine efficiencies. Working principle of rotary (wankle) engine.	20	9
3	**Air Intake System** Components of air intake system viz. pre-air cleaner, inlet manifold, exhaust manifold. Types of air cleaners: wet, dry.	12	2
4	**Fuel System in Diesel Engine** Components of fuel system, description and working of fuel feed pump. Types working of fuel injection pump, injector, fuel filters, complete detail and working of micro fuel injection system for a multi cylinder engine.	15	3
5	**Engine Governor** Need of Governor : Function and Working Principle. Types of Governor.	13	2

6	**Cooling and Lubrication** Necessity of engine cooling, cooling system, their main features, thermostat, defects in cooling system and their rectification. Functions of lubrication, types and properties of engine lubricants, additives for improving the properties. Lubrication system of IC engine, oil pumps, oil filters, pressure relief valve, positive crank case ventilation.	**15**	**4**
7	**IC Engine Testing** Engine power, indicated and brake power, Efficiency - mechanical, thermal, relative and volumetric efficiencies, Methods of finding indicated and brake horse power, Engine testing procedure, Exhaust smoke analysis and pollution control.	**15**	**8**

q. Text Book and Reference Book:

1. **Tractors & their power untis**
   By J.B. Liljedahl, P.K. Turnquist, D.W. Smith, MakotaHoki,
2. **Automotive Mechanics**
   By William H. Crouse & Donald L. Anglin | Tata McGrawHill Publishing Company Ltd.
3. **A course in Internal Combustion Engines**
   By Mathur. M. L, & Sharma. R. P. | Dhanpat Rai Publications Pvt.Ltd., 1998.
4. **Elements of Agril. Engg**
   By J. Sahay

a. **Course Name:** Farm Power Engineering Lab

r. **Course Code:** 03601224

s. **Prerequisite:** A foundational knowledge of mechanical engineering principles, particularly in dynamics and thermodynamics, is recommended. Prior coursework in agricultural machinery or internal combustion engines will enhance understanding of the concepts covered in this course.

t. **Rationale:** Farm Power Engineering is crucial for understanding the mechanisms that drive agricultural machinery and equipment. As modern agriculture increasingly relies on efficient and powerful machinery, knowledge of farm power sources and engine technology becomes essential. This course equips students with the skills to analyze, operate, and maintain various power systems in agricultural applications, promoting enhanced productivity and sustainability in farming practices.

u. **Course Learning Objective:**

CLOBJ 1	Understand the need for farm power, types of farm tractors, and the classification and working principles of internal combustion engines.
CLOBJ 2	Comprehend the components and functioning of air intake and fuel systems in diesel engines, including air cleaners, fuel pumps, and injectors.
CLOBJ 3	Analyze the necessity and functioning of engine cooling, lubrication systems, and governors, and understand how they contribute to engine efficiency and performance.
CLOBJ 4	Evaluate engine performance through testing methods, calculating parameters such as indicated horsepower (IHP), brake horsepower (BHP), and mechanical and thermal efficiencies.

v. **Course Learning Outcomes:**

CLO 1	Classify various farm power sources and describe the working principles of four-stroke and two-stroke IC engines, along with essential engine parameters like compression ratio and engine displacement.
CLO 2	Identify and describe the components of air intake and fuel systems in diesel engines, and explain their working, including the operation of multi-cylinder fuel injection systems.
CLO 3	Diagnose common defects in cooling and lubrication systems and suggest appropriate rectification measures, while also understanding the role of governors in regulating engine speed.
CLO 4	Conduct engine testing to determine power output and efficiency, analyze exhaust emissions, and implement pollution control measures in line with industry standards.

w. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1. **Tractors & their power untis**
   By J.B. Liljedahl, P.K. Turnquist, D.W. Smith, MakotaHoki,
2. **Automotive Mechanics**
   By William H. Crouse & Donald L. Anglin | Tata McGrawHill Publishing Company Ltd.
3. **A course in Internal Combustion Engines**
   By Mathur. M. L, & Sharma. R. P. | Dhanpat Rai Publications Pvt.Ltd., 1998.
4. **Elements of Agril. Engg**
   By J. Sahay

h. Experiment List:

Sr. No.	Experiment
1	Identification of various types of engines.
2	Identification of various tools used for dismantling and assembling IC engines.
3	Pre-starting checks on engine.
4	Study of air cleaner.
5	Study of fuel injection equipment's of multi cylinder engine, dismantling and reassembling.
6	Study of cooling system, water pump, thermostat.
7	Study of lubrication system, oil pump, oil filter.
8	Determination of indicated power/brake power and specific fuel consumption.
9	Study of Governor.
10	Engine trouble shooting.

a. **Course Name:** Watershed Hydrology
b. **Course Code:** 03601225
c. **Prerequisite:** Zeal to Learn Subject
d. **Rationale:** Watershed hydrology subject knowledge is essential for agricultural engineers
e. **Course Learning Objective:**

CLOBJ 1	Explore the significance of water resources and study the physical and hydrological properties of watersheds and their impact on water movement.
CLOBJ 2	Learn to estimate and measure essential hydrological components such as evaporation, precipitation, and runoff, and analyse their roles within the hydrological cycle.
CLOBJ 3	Gain proficiency in methods such as the Rational Method and SCS-CN for estimating runoff, while interpreting rainfall data using mass curves, hyetographs, and IDF relationships.
CLOBJ 4	Study hydrograph components and base flow separation techniques, using unit hydrograph theory to predict runoff and inform sustainable watershed management strategies.

f. **Course Learning Outcomes:**

CLO 1	Understand the significance of water resources and watershed characteristics.
CLO 2	Describe the hydrological cycle and measure key parameters.
CLO 3	Analyse precipitation and runoff using hydrological techniques.
CLO 4	Study hydrograph analysis and runoff estimation methods.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Water resources and their importance.	**7%**	**1**
2	Watershed and its characteristics.	**10%**	**1**
3	Hydrological cycle and its components.	**10%**	**1**
4	Evaporation - Estimation and measurement.	**8%**	**1**
5	Precipitation and its forms, types and measurement.	**12%**	**2**
6	Frequency analysis of point rainfall.	**10%**	**2**
7	Runoff – Estimation by Rational Method and SCS-CN method. Factors affecting.	**20%**	**4**
8	Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship.	**10%**	**2**
9	Hydrograph - Components, base flow separation, unit hydrograph theory.	**13%**	**2**
		100%	**16**

i. Text Book and Reference Book:

4. Engineering Hydrology (TextBook) K. Subramanya; Tata McGraw Hill Pub. Co. New Delhi
5. Hydrology and Soil Conservation Engineering: Including Watershed Management (TextBook) Ghanshyam Das; Prentice Hall India Learning Private Limited

a. **Course Name:** Watershed Hydrology Lab

j. **Course Code:** 03601226

k. **Prerequisite:** Zeal to Learn Subject

l. **Rationale:** Watershed hydrology subject knowledge is essential for agricultural engineers

m. **Course Learning Objective:**

CLOBJ 1	Explore the significance of water resources and study the physical and hydrological properties of watersheds and their impact on water movement.
CLOBJ 2	Learn to estimate and measure essential hydrological components such as evaporation, precipitation, and runoff, and analyse their roles within the hydrological cycle.
CLOBJ 3	Gain proficiency in methods such as the Rational Method and SCS-CN for estimating runoff, while interpreting rainfall data using mass curves, hyetographs, and IDF relationships.
CLOBJ 4	Study hydrograph components and base flow separation techniques, using unit hydrograph theory to predict runoff and inform sustainable watershed management strategies.

n. **Course Learning Outcomes:**

CLO 1	Understand the significance of water resources and watershed characteristics.
CLO 2	Describe the hydrological cycle and measure key parameters.
CLO 3	Analyse precipitation and runoff using hydrological techniques.
CLO 4	Study hydrograph analysis and runoff estimation methods.

o. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**Theory**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

p. Text Book and Reference Book:

q. Engineering Hydrology (TextBook) K. Subramanya; Tata McGraw Hill Pub. Co. New Delhi

r. Hydrology and Soil Conservation Engineering: Including Watershed Management (TextBook) Ghanshyam Das; Prentice Hall India Learning Private Limited

s. Experiment List:

Sr. No.	Experiment
1	To study different instruments at meteorological observatory station.
2	To study the rainfall measurement system.
3	Analysis of rainfall data i.e. intensity, duration.
4	Exercise on frequency analysis of point rainfall data.
5	To study estimation of runoff using rational method.
6	To study estimation of runoff using SCS-CN method.
7	Exercise on geomorphic parameters of watersheds.
8	Exercise on runoff hydrograph.
9	Exercise on unit hydrograph.
10	Visit to meteorological observatory.

a. **Course Name:** - Food Engineering
t. **Course Code:** 03601227
u. **Prerequisite:** A foundational understanding of basic chemistry, biology, and principles of engineering is recommended. Previous coursework in food science, nutrition, or agricultural engineering will be beneficial for grasping the concepts covered in this course.
v. **Rationale:** Food Engineering is essential for the design and optimization of processes that ensure food safety, quality, and preservation. As the global food industry faces challenges related to sustainability, efficiency, and consumer demand, a solid understanding of food engineering principles is critical. This course provides students with the technical knowledge necessary to innovate and improve food processing methods, ensuring the delivery of safe and high-quality food products.

w. **Course Learning Objective:**

CLOBJ 1	Understand the physical properties of food materials, including shape, density, porosity, friction, and rheological properties.
CLOBJ 2	Learn the fundamentals of food processing techniques such as cleaning, grading, size reduction, and mixing, along with equipment used in these processes.
CLOBJ 3	Understand and apply thermal processing techniques like blanching, canning, freezing, and dehydration in food preservation.
CLOBJ 4	Explore and understand the emerging non-thermal food processing methods like high-pressure processing, pulse electric field, and irradiation for food preservation and safety.

x. **Course Learning Outcomes:**

CLO 1	Measure and analyze the engineering properties of food such as bulk density, porosity, friction coefficients, and rheological behavior, using standard methods like ASTM.
CLO 2	Operate and evaluate food processing systems, such as screening and size reduction equipment, to achieve desired processing outcomes.
CLO 3	Design and implement thermal processing operations like freezing, blanching, and sterilization while understanding the impact on food quality and microbial safety.

CLO 4	Apply non-thermal processing techniques to enhance food safety and quality, while understanding the principles behind high-pressure processing, ultrasound, and ozone treatment.

y. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

z. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Introduction** Introduction and importance of engineering properties of food, shape and size of grains, shape and size of fruits, bulk density of the grains, true density of the grains, porosity, angle of repose, test weight, Coefficient of external friction, co-efficient of internal friction, colour of food materials, aero and hydrodynamic properties, drag coefficient and terminal velocity. Some basic concepts of rheology, rheological equations, ASTM standard.	20	10
2	**Unit Operations** **Primary Processing:** Cleaning, Washing, Methods of washing: Rotary drum washers, brush washers, spray washers, Grading, Screening: Types of screen, Rotary screen, Vibratory screen, shaking screen, revolving screen, perforated metal screens, wire mesh screens, effectiveness of screen, cleaning efficiency, sorting: manual sorting, color sorting, Pre storage treatments for fruits and vegetables: Peeling, slicing, dicing, curing, waxing, pre-cooling **Secondary Processing:** Size reduction- crushing, cutting, impact, shear, Separation, Disintegration, Mixing, Pumping,	35	15
3	**Introduction to Thermal Processing** Cooling, evaporation – various types of evaporators, falling film, rising film evaporators, blanching – methods of blanching, effect of blanching on food, canning – preparation of food, filling, exhausting, sealing, pasteurization, sterilization, Kinetics of microbial death, decimal reduction time and thermal resistance constant, process lethality, freezing – introduction to freezing process, types of freezing, methods of freezing, chilling, drying, dehydration.	35	15
4	**Non-thermal Processing** Basics of novel non-thermal processing – High pressure processing, Pulse electric field, Irradiation, Ultrasound processing, Ohmic heating, Ozone treatment.	10	5

aa. Text Book and Reference Book:

1. **Unit operations of Agricultural Processing**
   By Sahay, K. M. & K.K. Singh
2. **Post Harvest Engineering of horticultural crops.**
   By Sudheer, K P. and Indira, V | New india Publishing House.
3. **Fundamentals of Food Engineering.**
   By Rao, D.G | PHI learning Pvt. Ltd. New Delhi
4. **Introduction to Food Engineering**
   By Singh, R.P. & Heldman, D.R | Academic Press
5. **The Fundamentals of Food Engineering**
   By Charm, S. E.

a. **Course Name:** Introduction to IT Systems Lab
b. **Course Code:** 03606102
c. **Prerequisite:** Basic computer literacy, including knowledge of using a personal computer and navigating file systems. Familiarity with basic software tools such as word processors and spreadsheets.
d. **Rationale:** The Introduction to IT Systems Lab is designed to provide hands-on experience with essential computer components, operating systems, and software applications. In a technology-driven world, proficiency in IT systems is critical for personal and professional success. This course equips students with practical skills in computer operations, web development, and data management, preparing them for future studies or careers in IT.

CLOBJ 1	Identify and describe the functions of various computer hardware components and their roles in the overall system.
CLOBJ 2	Demonstrate the ability to install and configure different operating systems, including Windows and Linux.
CLOBJ 3	Write and execute simple scripts using OS commands and operators to automate tasks and improve efficiency.
CLOBJ 4	Design and implement basic web pages using HTML and CSS, showcasing understanding of web development principles.

e. **Course Learning Outcomes:**

CLO 1	Know about different computer components& different types of memory
CLO 2	Create excel sheet, power point, word, access database etc.
CLO 3	Use internet effectively
CLO 4	Create dynamic webpages including style sheet
CLO 5	Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**100**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. **Basic Computer Course Made Simple**
   By Satish Jain | BPB Publication
2. **Basic Computer Engineering**
   By Sanjay Silakari and Rajesh K Shukla | Wiley India Pvt. Limited, Pub. Year 2011
3. **Computer Fundamentals**
   By P.K. Sinha | BPB Publications
4. **HTML & CSS: The Complete Reference**
   By Thomas A. Powell | McGraw Hill

i. Experiment List:

1.	**Study practical of computer components** Study practical of computer components
2.	**Study practical of different OS installation (Windows, Linux, Ubuntu)** Study practical of different OS installation (Windows, Linux, Ubuntu)
3.	**Write a script for basic OS commands** Write a script for basic OS commands
4.	**Write a script for basic operators in OS** Write a script for basic operators in OS
5.	**Study practical of Internal structure and components of storage devices(Hard disk components)** **Study practical of Internal structure and components of storage devices(Hard disk components)**
6.	**Study practical of input working devices (Keyboard, Mouse, scanner)** **Study practical of input working devices (Keyboard, Mouse, scanner)**
7.	**Study practical of output working devices (Monitor, Printer)** **Study practical of output working devices (Monitor, Printer)**

8.	**Write a HTML code to display “hello world”** **Write a HTML code to display “hello world”**
9.	**Write a HTML code to create a table for student marksheet.** **Write a HTML code to create a table for student marksheet.**
10.	**Write a HTML code to create a simple registration form** **Write a HTML code to create a simple registration form**
11.	**Write a CSS to create user define tag** **Write a CSS to create user define tag**
12.	**Write an HTML code to create static website using CSS** **Write an HTML code to create static website using CSS**
13.	**Study practical of evolution and working of internet** **Study practical of evolution and working of internet**
14.	**Study practical of surfing techniques in internet** **Study practical of surfing techniques in internet**
15.	**Create your Gmail account and use different services provided by Google like Google drive, sharable sheet etc.** **Create your Gmail account and use different services provided by Google like Google drive, sharable sheet etc.**
16.	**Perform various DOS commands** **Perform various DOS commands**
17.	**Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) Fetch the data of the student who has distinction 2) Fetch the data of students with minimum marks in each subject. 3) Sort the data based on percentage**
	Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) **Fetch the data of the student who has distinction** 2) **Fetch the data of students with minimum marks in each subject.**

	3) **Sort the data based on percentage**
18.	**Create a presentation of your favorite movie using animation** **Create a presentation of your favorite movie using animation**
19.	**Create a word file for your resume** **Create a word file for your resume**
20.	**Create library management database in access with minimum 5 tables in it.** **Create library management database in access with minimum 5 tables in it.**

Semester 4

a. **Course Name:** Farm Machinery and Implements
b. **Course Code:** 03601265
c. **Prerequisite:** A basic understanding of mechanical engineering principles and physics is recommended. Prior coursework in agricultural engineering or basic engine mechanics will provide a strong foundation for the concepts covered in this course.
d. **Rationale:** Farm Machinery and Implements play a crucial role in modern agriculture by enhancing productivity and efficiency. As the agricultural sector evolves, understanding the operation, maintenance, and management of farm machinery is essential for improving farm output and sustainability. This course equips students with the technical knowledge required to select and utilize various farm power sources and machinery, ultimately contributing to improved agricultural practices.

e. **Course Learning Objective:**

CLOBJ 1	Understand the need for farm power, the types of tractors used in agriculture, and the basic working principles of IC engines.
CLOBJ 2	Analyze and explain the components and functioning of key IC engine subsystems, including the air intake, fuel injection, cooling, and lubrication systems.
CLOBJ 3	Learn how to calculate engine performance parameters such as Indicated Horse Power (IHP), Brake Horse Power (BHP), and mechanical efficiencies.
CLOBJ 4	Understand the procedures for exhaust smoke analysis and pollution control measures, along with standard engine maintenance practices.

f. **Course Learning Outcomes:**

CLO 1	Identify different types of farm tractors and explain the classification, working principles, and major components of four-stroke and two-stroke IC engines (both petrol and diesel).
CLO 2	Analyze and troubleshoot the air intake system, fuel system, and lubrication system of IC engines, and explain the role of engine governors in speed regulation.
CLO 3	Perform engine tests to calculate indicated and brake horse power, and assess engine performance through thermal, mechanical, and volumetric efficiency.

CLO 4	Conduct exhaust smoke analysis and implement pollution control strategies, and apply proper maintenance techniques for cooling and lubrication systems to ensure engine longevity and efficiency.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Classification of Farm Power Sources** Need of farm power Types of farm tractors	10	3
2	**Principles of l. C. Engines** Introduction and classification of IC engines. Working principle of four stroke and two stroke cycle. Petrol and Diesel engines, their comparison location and function of various parts of IC engines and material used for them. Concept of IC engine terms, bore, stroke, dead centre, crank throw, compression ratio, clearance volume, swept volume/piston displacement, total volume, engine displacement and piston speed. Calculation of IHP, BHP, FHP and engine efficiencies. Working principle of rotary (wankle) engine	15	7
3	**Air Intake System:** Components of air intake system pre-air cleaner, inlet manifold, exhaust manifold Types of air cleaners: wet, dry	15	7
4	**Fuel System in Diesel Engine** Components of fuel system, description and working of fuel feed pump Types working of fuel injection pump, injector, fuel filters, complete detail and working of micro fuel injection system for a multi cylinder engine	15	7
5	**Engine Governor** Need of Governor : Function and Working Principle Types of Governor	15	7

6	**Cooling and Lubrication** Necessity of engine cooling, cooling system, their main features, thermostat, defects in cooling system and their Functions of lubrication, types and properties of engine lubricants, additives for improving the properties Lubrication system of IC engine, oil pumps, oil filters, pressure relief valve, positive crank case ventilation	**15**	**7**
7	**IC Engine Testing:** Engine power, indicated and brake power, Efficiency - mechanical, thermal, relative and volumetric efficiencies, Methods of finding indicated and brake horse power, Engine testing procedure Exhaust smoke analysis and pollution control.	**15**	**7**

i. Text Book and Reference Book:

1. **Tractors & their power untis**
   By J.B. Liljedahl, P.K. Turnquist, D.W. Smith, MakotaHoki,
2. **Automotive Mechanics**
   By William H. Crouse & Donald L. Anglin | Tata McGrawHill Publishing Company Ltd.
3. **A course in Internal Combustion Engines**
   By Mathur. M. L, & Sharma. R. P. | Dhanpat Rai Publications Pvt.Ltd., 1998.

a. **Course Name: :** Farm Machinery and Implements Lab

g. **Course Code:** 03601266

h. **Prerequisite:** A basic understanding of mechanical engineering principles and physics is recommended. Prior coursework in agricultural engineering or basic engine mechanics will provide a strong foundation for the concepts covered in this course.

i. **Rationale:** Farm Machinery and Implements play a crucial role in modern agriculture by enhancing productivity and efficiency. As the agricultural sector evolves, understanding the operation, maintenance, and management of farm machinery is essential for improving farm output and sustainability. This course equips students with the technical knowledge required to select and utilize various farm power sources and machinery, ultimately contributing to improved agricultural practices.

j. **Course Learning Objective:**

CLOBJ 1	Understand the need for farm power, the types of tractors used in agriculture, and the basic working principles of IC engines.
CLOBJ 2	Analyze and explain the components and functioning of key IC engine subsystems, including the air intake, fuel injection, cooling, and lubrication systems.
CLOBJ 3	Learn how to calculate engine performance parameters such as Indicated Horse Power (IHP), Brake Horse Power (BHP), and mechanical efficiencies.
CLOBJ 4	Understand the procedures for exhaust smoke analysis and pollution control measures, along with standard engine maintenance practices.

k. **Course Learning Outcomes:**

CLO 1	Identify different types of farm tractors and explain the classification, working principles, and major components of four-stroke and two-stroke IC engines (both petrol and diesel).
CLO 2	Analyze and troubleshoot the air intake system, fuel system, and lubrication system of IC engines, and explain the role of engine governors in speed regulation.
CLO 3	Perform engine tests to calculate indicated and brake horse power, and assess engine performance through thermal, mechanical, and volumetric efficiency.
CLO 4	Conduct exhaust smoke analysis and implement pollution control strategies, and apply proper maintenance techniques for cooling and lubrication systems to ensure engine longevity and efficiency.

l. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1. **Tractors & their power untis**
   By J.B. Liljedahl, P.K. Turnquist, D.W. Smith, MakotaHoki,
2. **Automotive Mechanics**
   By William H. Crouse & Donald L. Anglin | Tata McGrawHill Publishing Company Ltd.
3. **A course in Internal Combustion Engines**
   By Mathur. M. L, & Sharma. R. P. | Dhanpat Rai Publications Pvt.Ltd., 1998.

h. Experiment List:

Sr. No.	Experiment
1	To study the constructional features and different components of primary tillage implements: Mould board plough /Disc plough.
2	To study the constructional features and different components of secondary tillage implements: Harrow/Cultivators, Rotavators.
3	To study and calibration of Seed Drill.
4	To study the constructional features and different components of sowing Machines: Planter/Transplanter, sugarcane planters, potato-planter.
5	To study the constructional features and different components of interculture equipment/tools: Wheel hand hoe/Cultivators.
6	To study the constructional features and different components of seed treater, different types of sprayers and dusters.
7	To study the constructional features and different components of harvesting machines: Vertical Conveyer Reaper/Mower.
8	To study the constructional features and different components of digging machines: Potato digger/ Groundnut Digger.

9	To study the constructional features and different components of threshing machines: Wheat/paddy thresher, axial flow thresher, High capacity multicrop thresher.

a. **Course Name:** Non-Conventional Energy Sources
j. **Course Code:** 03601267
k. **Prerequisite:** A foundational understanding of basic physics and environmental science is recommended. Previous coursework in energy systems or renewable energy technologies will enhance comprehension of the principles governing non-conventional energy sources.
l. **Rationale:** The study of Non-Conventional Energy Sources is increasingly important in the context of global energy challenges and environmental sustainability. With the depletion of fossil fuels and the need to reduce greenhouse gas emissions, alternative energy sources play a vital role in creating a sustainable energy future. This course equips students with the knowledge and skills to understand, design, and implement non-conventional energy solutions, contributing to energy security and environmental protection

m. **Course Learning Objective:**

CLOBJ 1	Understand the need for and scope of non-conventional energy resources, and compare them with conventional sources.
CLOBJ 2	Analyze the design, operation, and applications of biogas plants, as well as biomass management and briquetting techniques.
CLOBJ 3	Explore the construction and functioning of solar thermal systems, solar photovoltaic systems, and windmills, with a focus on their agricultural and rural applications.
CLOBJ 4	Apply energy conservation principles and practices to various household and industrial contexts, emphasizing improved appliances and cooking technologies.

n. **Course Learning Outcomes:**

CLO 1	Explain the significance of non-conventional energy sources and their role in achieving sustainability, particularly in agricultural and rural areas.
CLO 2	Design and operate biogas plants, including site selection and maintenance, and apply biomass management techniques such as briquetting to enhance energy efficiency.
CLO 3	Evaluate and maintain solar thermal systems (such as solar cookers, water heaters, and crop dryers) and windmills, optimizing their performance based on site and resource availability.

CLO 4	Implement energy conservation strategies by using improved cooking stoves and energy-efficient appliances, while understanding their benefits over traditional systems.

o. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

p. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Introduction** Conventional and Non-conventional sources of energy. Need, importance and scope of non- conventional and alternate energy resources.	10	3
2	**Biogas and Biomass** Biogas, Types of biogas plant. Principles, feedstock, types and design of biogas plants, comparison of designs. Main parts of biogas plants, digester, gas holder, pressure gauge, gas controlling cocks and meter. Site selection of biogas plants. Application of biogas Introduction to biomass and farm residue, management and briquetting	15	7
3	**Solar Energy Technology**Introduction, significance of solar energy, solar spectral and greenhouse effect. Principles of thermal collection and storage. Comparison of flat type collector and concentration or focusing type collectors.	15	7
4	**Solar Thermal Systems**Operation, constructional details and maintenance of solar cooker, solar water heater, solar still, solar water pump, solar crop dryer.	15	7
5	**Solar Photovoltaic System**Introduction of solar photovoltaic system, Working of SPV system, Advantages and disadvantages of SPV system.	15	7
6	**Energy Conservation**Principles of energy conservation. Familiarization with the different energy conservation appliances and practices, improved cooking stoves, benefits of improved cooking stoves over the traditional cooking stoves.	15	7
7	**Wind Energy Technology**Introduction, scope and significance. Type and constructional details of windmill - vertical and horizontal axis. Data required for windmill installation such as meteorological data, agricultural and socio- economic data. Site selection of windmill. Maintenance and performance of windmill.	15	7

q. Text Book and Reference Book:

1. **Non- Conventional Energy Sources**
   By G D Rai | Khanna Publishers
2. **Renewable Energy Sources for Sustainable Development**
   By N. S. Rathore | New India Publishing Agency
3. **Energy Sources**
   By G. D. Rai | Khanna Publications, New Delhi
4. **Post harvest technology of cereals, pulses and oilseeds**
   By Chakraverty, A.
5. **Unit operations of Agricultural Processing**
   By Sahay, K. M. & K.K. Singh
6. **Postharvest Technology of fruits and vegetables (Principles and practices)**
   By Pandey, R.H | Saroj Prakashan, Allahabad

a. **Course Name:** Non-Conventional Energy Sources Lab

m. **Course Code:** 03601268

n. **Prerequisite:** A foundational understanding of basic physics and environmental science is recommended. Previous coursework in energy systems or renewable energy technologies will enhance comprehension of the principles governing non-conventional energy sources.

o. **Rationale: :** The study of Non-Conventional Energy Sources is increasingly important in the context of global energy challenges and environmental sustainability. With the depletion of fossil fuels and the need to reduce greenhouse gas emissions, alternative energy sources play a vital role in creating a sustainable energy future. This course equips students with the knowledge and skills to understand, design, and implement non-conventional energy solutions, contributing to energy security and environmental protection

p. **Course Learning Objective:**

CLOBJ 1	Understand the need for and scope of non-conventional energy resources, and compare them with conventional sources.
CLOBJ 2	Analyze the design, operation, and applications of biogas plants, as well as biomass management and briquetting techniques.
CLOBJ 3	Explore the construction and functioning of solar thermal systems, solar photovoltaic systems, and windmills, with a focus on their agricultural and rural applications.
CLOBJ 4	Apply energy conservation principles and practices to various household and industrial contexts, emphasizing improved appliances and cooking technologies.

q. **Course Learning Outcomes:**

CLO 1	Explain the significance of non-conventional energy sources and their role in achieving sustainability, particularly in agricultural and rural areas.
CLO 2	Design and operate biogas plants, including site selection and maintenance, and apply biomass management techniques such as briquetting to enhance energy efficiency.
CLO 3	Evaluate and maintain solar thermal systems (such as solar cookers, water heaters, and crop dryers) and windmills, optimizing their performance based on site and resource availability.

CLO 4	Implement energy conservation strategies by using improved cooking stoves and energy-efficient appliances, while understanding their benefits over traditional systems.

r. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1. **Non Conventional Energy Sources**
   By G D Rai | Khanna Publishers
2. **Renewable Energy Sources for Sustainable Development**
   By N. S. Rathore | New India Publishing Agency
3. **Energy Sources**
   By G. D. Rai | Khanna Publications, New Delhi
4. **Post harvest technology of cereals, pulses and oilseeds**
   By Chakraverty, A.
5. **Unit operations of Agricultural Processing**
   By Sahay, K. M. & K.K. Singh
6. **Postharvest Technology of fruits and vegetables (Principles and practices)**
   By Pandey, R.H | Saroj Prakashan, Allahabad

h. Experiment List:

Sr. No.	Experiment
1	Demonstration/study of box type solar cooker.
2	Demonstration/study of solar water distillation.
3	Demonstration/study of natural circulation type solar water heater.
4	Demonstration/study of solar photovoltaic lighting system.
5	Demonstration/study of the working of a windmill.
6	Demonstration/study of solar dryer.
7	Study of energy saving appliances and their applications.

8	Visit to biogas plants, for study and demonstration of biogas plants.

a. **Course Name:** Post Harvest Technology

bb. **Course Code:** 03601269

cc. **Prerequisite:** A foundational understanding of agricultural science and food science principles is recommended. Courses in basic biology, chemistry, and agricultural engineering can provide essential knowledge related to plant physiology, moisture dynamics, and material properties.

dd. **Rationale:** Post Harvest Technology (PHT) is crucial for minimizing losses and maximizing the quality and shelf life of agricultural produce. With increasing global demand for food and the significant amount of produce lost post-harvest, understanding the various operations and technologies in PHT is essential. This course equips students with the knowledge to effectively manage post-harvest processes, improve food security, and enhance the economic viability of agricultural enterprises.

ee. Course Learning Objective:

CLOBJ 1	Understand the principles of post-harvest operations, including cleaning, grading, drying, storage, and material handling, and their role in agricultural produce management.
CLOBJ 2	Analyze the theory and principles behind different grain drying methods, including thermal properties, moisture measurement, and drying curves.
CLOBJ 3	Evaluate various storage structures and management practices for cereals and pulses, focusing on the influence of temperature, moisture, and organisms on stored produce.
CLOBJ 4	Develop an understanding of the processing technologies used for fruits and vegetables, such as the production of jams, jellies, and vegetable wafers, and the factors that impact post-harvest quality.

ff. Course Learning Outcomes:

CLO 1	Explain the need and scope of post-harvest processing technologies, including the functional role of operations like drying, sorting, and extraction in agricultural processing.
CLO 2	Apply principles of thermal properties and moisture content to choose appropriate drying methods for cereals and pulses, using techniques like conduction, convection, and mechanical drying.

CLO 3	Design and manage storage solutions for cereals and pulses, addressing issues such as temperature control, moisture regulation, and protection against fungi and insects in both traditional and modern storage systems.
CLO 4	Implement processing technologies for fruits and vegetables, producing products such as jams, marmalades, wafers, and ketchups, while ensuring food safety and minimizing post-harvest losses.

gg. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

hh. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	**Topics**	**W**	**T**
1	**Introduction** Introduction to post harvest technology of agricultural produce, its need, scope and Importance, Brief description and introduction to various post harvest operation such as cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating),washing, their functions and use in the post harvest processing.	**25**	**12**
2	**Drying of Cereals and Pulses:** Thermal properties - Specific heat - Thermal Conductivity - Thermal diffusivity Theory of grain drying - Thin layer drying - Moisture content - Moisture measurement - Direct and indirect methods, Equilibrium moisture content (EMC) - Determination of EMC - EMC models - Hysteresis - Bound, unbound and free moisture, Drying curves - Constant rate period and falling rate period - Deep bed drying, Methods of grain drying - Conduction, Convection, Radiation, Dielectric, Chemical and Sack drying, Methods of drying - Sun drying and mechanical drying iii. Principles of operation of different types of dryers viz. Deep bed dryers, flat bed dryers, continuous flow dryers, L.S.U. dryers, fluidized bed dryers, rotary dryer, spouted beds, tray and tunnel dryers.	**25**	**11**
3	**Storage of Cereals and Pulses:**Introduction, need and importance, general principles of storage, temperature and moisture changes during storage i.e. influence of moisture content, relative humidity, temperature, fungi etc. on stored product. Fungi, insect and other organism associated with stored grains. Familiarization with the various types of storage structures. Deep and shallow bins. Traditional and modem storage structures. Management of storage structures. Losses during storage and their control, space requirement of bag storage structure.	**25**	**11**

4	**Post Harvest Technology of Fruits and Vegetables:**Production and processing scenario of Fruits and vegetables in India and world-scope of fruit and vegetable processing industry in India- present status, constraints and prospective. Processing Technology of Jam, Jelly and Marmalades, Flowcharts of by-products, Processing technology of vegetable wafers- potato wafers- preparation types of peeling, slicing, packaging, Flowcharts of sauces and ketchups.	**25**	**11**

a. Course Name: Post Harvest Technology Lab

ii. Course Code: 03601270

jj. Prerequisite: A foundational understanding of agricultural science and food science principles is recommended. Courses in basic biology, chemistry, and agricultural engineering can provide essential knowledge related to plant physiology, moisture dynamics, and material properties.

kk. Rationale: : Post Harvest Technology (PHT) is crucial for minimizing losses and maximizing the quality and shelf life of agricultural produce. With increasing global demand for food and the significant amount of produce lost post-harvest, understanding the various operations and technologies in PHT is essential. This course equips students with the knowledge to effectively manage post-harvest processes, improve food security, and enhance the economic viability of agricultural enterprises.

ll. Course Learning Objective:

CLOBJ 1	Understand the principles of post-harvest operations, including cleaning, grading, drying, storage, and material handling, and their role in agricultural produce management.
CLOBJ 2	Analyze the theory and principles behind different grain drying methods, including thermal properties, moisture measurement, and drying curves.
CLOBJ 3	Evaluate various storage structures and management practices for cereals and pulses, focusing on the influence of temperature, moisture, and organisms on stored produce.
CLOBJ 4	Develop an understanding of the processing technologies used for fruits and vegetables, such as the production of jams, jellies, and vegetable wafers, and the factors that impact post-harvest quality.

mm. Course Learning Outcomes:

CLO 1	Explain the need and scope of post-harvest processing technologies, including the functional role of operations like drying, sorting, and extraction in agricultural processing.
CLO 2	Apply principles of thermal properties and moisture content to choose appropriate drying methods for cereals and pulses, using techniques like conduction, convection, and mechanical drying.
CLO 3	Design and manage storage solutions for cereals and pulses, addressing issues such as temperature control, moisture regulation, and protection against fungi and insects in both traditional and modern storage systems.

CLO 4	Implement processing technologies for fruits and vegetables, producing products such as jams, marmalades, wafers, and ketchups, while ensuring food safety and minimizing post-harvest losses.

nn. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. No.	**Experiment**
1	Determination of physical properties of agricultural materials e.g. size, shape, density.
2	Determination of density and specific gravity of cereals, pulses and oilseeds.
3	Determination of moisture content of grains.
4	Study of different types of dryers.
5	Study of domestic grain storage structures.
6	Visit to warehouses (bag storage and bulk storage structures).
7	Visit to cold-storage.
8	Study of different packaging materials.
9	Study of material conveying equipments.

a. **Course Name:** Theory of Machines
r. **Course Code:** 03601271
s. **Prerequisite:** A basic understanding of engineering mechanics and fundamental physics principles is recommended. Prior coursework in dynamics and statics, as well as an introduction to mechanical engineering concepts, will provide a solid foundation for the study of machine theory.
t. **Rationale:** The Theory of Machines is essential for understanding the principles of mechanical motion and the functioning of machinery. This course explores the design, analysis, and application of mechanical systems, enabling students to develop skills necessary for engineering design and innovation. Understanding the kinematics and dynamics of machines is vital for optimizing machine performance and ensuring reliability in mechanical applications.

u. **Course Learning Objective:**

CLOBJ 1	Understand the principles behind different types of mechanisms, including links, pairs, and chains, and their practical applications in mechanical systems.
CLOBJ 2	Analyze the kinematic behavior of machine elements, including the calculation of velocity and acceleration in mechanisms through graphical methods.
CLOBJ 3	Explore various types of gears, belt drives, and clutches, and comprehend the principles of motion and power transmission.
CLOBJ 4	Investigate dynamic balancing of rotating masses and understand the construction and operational details of governors used in speed regulation.

v. **Course Learning Outcomes:**

CLO 1	Classify and analyze various types of mechanical pairs, chains, and mechanisms, applying them to solve practical engineering problems.
CLO 2	Apply graphical methods to determine velocity and acceleration in kinematic chains and mechanisms, and use instantaneous centers for solving dynamic problems.
CLO 3	Demonstrate proficiency in analyzing gear trains, belt drives, and friction-based power transmission systems, determining parameters like velocity ratio and power.
CLO 4	Evaluate the balancing of rotating and reciprocating systems, and explain the operational principles of various governors used for speed regulation in engines.

w. **Teaching & Examination Scheme:**

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

x. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Theory**Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions. Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers. Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method. Turning moment diagrams, coefficient of fluctuation of speed and energy, weight of flywheel, flywheel applications. Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, creep and slip on power transmission, Chain drives. Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings. Types of governors. Constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness, stability, hunting, iso-chronism, power and effort of a governor. Static and dynamic balancing. Balancing of rotating masses in one and different planes.	100	30

y. Text Book and Reference Book:

1. **Theory of Machines**
   By R.S.Khurmi | S.Chand.
2. **Theory of Machines**
   By S.S. Rattan | Tata McGraw Hill
3. **Theory of Machines**
   By Dr. Sadhu Singh | Pearson Education.

a. **Course Name:** Strength of Material

z. **Course Code:** 03601273

aa. **Prerequisite:** A foundational knowledge of engineering mechanics and materials science is recommended. Prior coursework in physics and mathematics, particularly in calculus and differential equations, will enhance understanding of the concepts covered in this course.

bb. **Rationale:** Strength of Materials is a crucial subject in engineering that focuses on understanding how materials deform and fail under various loads. With the increasing complexity of structural designs and the necessity for safe, reliable engineering solutions, this course provides essential knowledge for analysing and designing structures. By mastering the principles of stress, strain, and material behaviour, students will be better equipped to solve real-world engineering problems.

cc. **Course Learning Objective:**

CLOBJ 1	Define and explain the concepts of stress, strain, and the different types of modulus of elasticity, and interpret stress-strain diagrams.
CLOBJ 2	Utilize moment area theorems and the conjugate beam method for analyzing deflections in beams.
CLOBJ 3	Evaluate the stability and load-bearing capacity of columns, struts, and masonry dams.
CLOBJ 4	Analyze the vibration characteristics of beams and cantilevers, determining their time periods and understanding resonance phenomena.

dd. **Course Learning Outcomes:**

CLO 1	Students will demonstrate an understanding of the fundamental properties of materials, including stress and strain relationships and elasticity concepts.
CLO 2	Students will effectively apply moment area theorems and other methods to analyze deflections and internal forces in beams and structures.
CLO 3	Students will assess the stability of various structural elements, including columns and masonry dams, using engineering principles.
CLO 4	Students will analyze the dynamic behavior of beams and cantilevers, calculating time periods and understanding the implications of free, forced, and resonant vibrations.

ee. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

ff. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Introduction** Elasticity, definition of stress and strain. Different types of modulus of elasticity. Explanation of stress - strain diagram	15	2
2	**Moment area theorems** Moment area theorems and conjugate beam method	10	2
3	**Columns and Struts.** Columns and Struts	2	1
4	**Riveted and welded connections.** Riveted and welded connections.	20	2
5	**Stability of masonry dams** Stability of masonry dams	5	1
6	**Analysis of statically intermediate beams** Analysis of statically intermediate beams	5	1
7	**Fixed and continuous beam analysis, Propped beams.** Fixed and continuous beam analysis, Propped beams.	5	2
8	**Vibration of cantilever and beam, determination of time period of a cantilever. Free, forced and resonant vibrations with examples** Vibration of cantilever and beam, determination of time period of a cantilever. Free, forced and resonant vibrations with examples	18	2
9	**Three moment equation and moment distribution methods.** Three moment equation and moment distribution methods.	20	2

gg. Text Book and Reference Book:

1. **Design of Steel Structures**
   By N. Subramanian | Oxford University Press (2010)
2. **Irrigation Engineering and Hydraulic Structures**
   By S K Garg
3. **'Strength of Materials'**
   By R.S Khurmi | S. Chand

a. **Course Name :** Strength of Material Lab
s. **Course Code:** 03601274
t. **Prerequisite:** A foundational knowledge of engineering mechanics and materials science is recommended. Prior coursework in physics and mathematics, particularly in calculus and differential equations, will enhance understanding of the concepts covered in this course.
u. **Rationale:** Strength of Materials is a crucial subject in engineering that focuses on understanding how materials deform and fail under various loads. With the increasing complexity of structural designs and the necessity for safe, reliable engineering solutions, this course provides essential knowledge for analyzing and designing structures. By mastering the principles of stress, strain, and material behavior, students will be better equipped to solve real-world engineering problems.

v. **Course Learning Objective:**

CLOBJ 1	Define and explain the concepts of stress, strain, and the different types of modulus of elasticity, and interpret stress-strain diagrams.
CLOBJ 2	Utilize moment area theorems and the conjugate beam method for analyzing deflections in beams.
CLOBJ 3	Evaluate the stability and load-bearing capacity of columns, struts, and masonry dams.
CLOBJ 4	Analyze the vibration characteristics of beams and cantilevers, determining their time periods and understanding resonance phenomena.

w. **Course Learning Outcomes:**

CLO 1	Students will demonstrate an understanding of the fundamental properties of materials, including stress and strain relationships and elasticity concepts.
CLO 2	Students will effectively apply moment area theorems and other methods to analyze deflections and internal forces in beams and structures.
CLO 3	Students will assess the stability of various structural elements, including columns and masonry dams, using engineering principles.
CLO 4	Students will analyze the dynamic behavior of beams and cantilevers, calculating time periods and understanding the implications of free, forced, and resonant vibrations.

x. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1. **Design of Steel Structures**
   By N. Subramanian | Oxford University Press (2010)
2. **Irrigation Engineering and Hydraulic Structures**
   By S K Garg
3. **'Strength of Materials'**
   By R.S Khurmi | S. Chand

h. Experiment List:

Sr. No.	Experiment
1	To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points
2	To perform the Brinell's Hardness tests on the given specimens
3	To study the problems on conjugate beam method
4	To study the problems on riveted connection.
5	To study the problems on welded connection.
6	To study the problems on fixed beam.
7	To study the problems on continuous beam.
8	To study the problems on three moment equations.
9	To study the problems on moment distribution method.

a. **Course Name:** Irrigation Technology

hh. **Course Code:** 03601275

ii. **Prerequisite:** A foundational understanding of agricultural science and environmental engineering is recommended. Prior coursework in soil science, hydrology, or crop production will enhance comprehension of irrigation principles and practices.

jj. **Rationale:** Irrigation Technology plays a critical role in enhancing agricultural productivity and ensuring food security, particularly in regions prone to water scarcity. Understanding irrigation methods, water requirements for crops, and the technologies involved in water management is essential for effective agricultural practices. This course equips students with the knowledge and skills necessary to design and manage efficient irrigation systems, promoting sustainable water use in agriculture.

kk. Course Learning Objective:

CLOBJ 1	Understand the definition, necessity, advantages, and disadvantages of irrigation, as well as different types of irrigation systems and their sources.
CLOBJ 2	Measure and analyze factors affecting water requirements for crops, including evaporation, transpiration, and irrigation scheduling.
CLOBJ 3	Describe and assess various water application methods, including surface, sub-surface, sprinkler, and drip irrigation, along with their adaptability and limitations.
CLOBJ 4	Understand and evaluate different water lifting devices and conveyance systems, including pumps, canals, and open channels, focusing on their design and maintenance.

ll. Course Learning Outcomes:

CLO 1	Students will demonstrate an understanding of various irrigation systems, their functions, and the factors influencing their selection and effectiveness.
CLO 2	Students will accurately calculate and analyze the water requirements of crops based on climatic and soil conditions.
CLO 3	Students will apply appropriate water application methods for specific agricultural scenarios, considering efficiency and sustainability.
CLO 4	Students will assess and recommend effective water lifting and conveyance systems, including their operational aspects and maintenance needs.

mm. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

nn. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Introduction**1A. Definition of Irrigation, Necessity of Irrigation, Advantages and disadvantages of irrigation 1B. Types of irrigation viz. artificial (flow, lift etc.) and natural, Sources of irrigation water, Quality of irrigation water	20	9
2	**Water Requirement of Crops**2A. Evaporation, Measurement of Evaporation, Transpiration, Evapotranspiration, Measurement of Evapotranspiration, Infiltration 2B. Irrigation requirement, Irrigation frequency, Irrigation period, Irrigation scheduling, Duty, Delta, Base period, Irrigation efficiencies, Uniformity of coefficient	20	9
3	**Water Application Methods**3A. Surface methods of irrigation viz. border, check basin and furrow irrigation, their basic details, characteristics, types and their adaptability 3B. Concept of sub-surface irrigation method, its importance and adaptability. Sprinkler and Drip irrigation: their adaptability and limitations	20	9
4	**Water Lifting Devices**4A. Introduction to various water lifting devices viz. manual, animal and power operated 4B. Classification of different types of pumps with its adaptability, limitations, installation, operation and maintenance	45	9
5	**Conveyance of irrigation water**5A. Canals and their classification (brief description only), seepage from canals and field channels, Canal lining - various types, advantages and disadvantages 5B. Introduction to various water conveyance structures and their functions 5C. Open channels - types, layout and design parameters 5D. Subsurface systems of water conveyance - components, hydraulics and layout	20	9

oo. Text Book and Reference Book:

1. **Irrigation Theory and Practice**
   By A M Michael
2. **Principles of Agricultural Engineering**
   By A.M. Michael & T.P. Ojha
3. **Irrigation Engineering and Hydraulic Structures**
   By S K Garg

a. **Course Name: :** Irrigation Technology Lab

y. **Course Code:** 03601276

z. **Prerequisite:** A foundational understanding of agricultural science and environmental engineering is recommended. Prior coursework in soil science, hydrology, or crop production will enhance comprehension of irrigation principles and practices.

aa. **Rationale:** Irrigation Technology plays a critical role in enhancing agricultural productivity and ensuring food security, particularly in regions prone to water scarcity. Understanding irrigation methods, water requirements for crops, and the technologies involved in water management is essential for effective agricultural practices. This course equips students with the knowledge and skills necessary to design and manage efficient irrigation systems, promoting sustainable water use in agriculture.

bb. Course Learning Objective:

CLOBJ 1	Understand the definition, necessity, advantages, and disadvantages of irrigation, as well as different types of irrigation systems and their sources.
CLOBJ 2	Measure and analyze factors affecting water requirements for crops, including evaporation, transpiration, and irrigation scheduling.
CLOBJ 3	Describe and assess various water application methods, including surface, sub-surface, sprinkler, and drip irrigation, along with their adaptability and limitations.
CLOBJ 4	Understand and evaluate different water lifting devices and conveyance systems, including pumps, canals, and open channels, focusing on their design and maintenance.

cc. Course Learning Outcomes:

CLO 1	Students will demonstrate an understanding of various irrigation systems, their functions, and the factors influencing their selection and effectiveness.
CLO 2	Students will accurately calculate and analyze the water requirements of crops based on climatic and soil conditions.
CLO 3	Students will apply appropriate water application methods for specific agricultural scenarios, considering efficiency and sustainability.
CLO 4	Students will assess and recommend effective water lifting and conveyance systems, including their operational aspects and maintenance needs.

dd. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1. **Irrigation Theory and Practice**
   By A M Michael
2. **Principles of Agricultural Engineering**
   By A.M. Michael & T.P. Ojha
3. **Irrigation Engineering and Hydraulic Structures**
   By S K Garg

h. Experiment List:

Sr. No.	Experiment
1	Installation, operation and maintenance of Sprinkler and Drip Irrigation systems
2	Determination of Uniform Coefficient and testing
3	Installation and operation of centrifugal pump
4	Dismantling of centrifugal pump, study of constructional feature of its component and its assembly
5	Installation, operation & maintenance of submersible pump
6	Determination of infiltration rate of soil
7	Problems on water requirement of crops, duty, delta, base period, irrigation scheduling, irrigation efficiency, etc.
8	To survey market and field for the availability, adaptability and selection of various types of pumps and irrigation systems in the region
9	Measurement of irrigation water in the field channels with the use of Parshall flumes and weir.
10	Visit to irrigation and drainage project sites

a. **Course Name:** - Heat and Mass Transfer

pp. **Course Code:** 03601277

qq. **Prerequisite:** A solid foundation in thermodynamics and fluid mechanics is recommended. Prior coursework in physics and mathematics, especially calculus and differential equations, will enhance the understanding of heat and mass transfer principles.

rr. **Rationale:** Heat and Mass Transfer is a fundamental area of study in engineering, vital for the design and optimization of various thermal systems. Understanding the mechanisms of heat transfer—conduction, convection, and radiation—along with mass transfer principles, is essential for applications in energy systems, environmental engineering, and process design. This course provides the analytical and practical skills necessary for tackling real-world engineering problems related to thermal and mass transfer.

ss. **Course Learning Objective:**

CLOBJ 1	Learn the principles and methods of temperature measurement, differentiating between heat and temperature, and assessing various types of thermometers and pyrometers.
CLOBJ 2	Explore the modes of heat transfer—conduction, convection, and radiation—by studying their principles, mathematical formulations, and applications.
CLOBJ 3	Analyze the performance and design of heat exchangers, applying concepts like log mean temperature difference and transfer units.
CLOBJ 4	Understand the principles of mass transfer, including molecular diffusion and mass transfer coefficients, and their relevance in engineering applications.

tt. **Course Learning Outcomes:**

CLO 1	Students will demonstrate an understanding of various temperature measurement techniques and the distinctions between heat and temperature.
CLO 2	Students will apply relevant equations and principles to analyze heat transfer problems involving conduction, convection, and radiation.
CLO 3	Students will evaluate and design heat exchangers, considering performance metrics and operational efficiency.
CLO 4	Students will analyze mass transfer processes in fluids, applying principles such as Flick's law and Reynolds analogy to engineering scenarios.

uu. **Teaching & Examination Scheme:**

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				Theory	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

vv. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Theory**Principles of measurement of temperature and different scales of temperature. Difference between heat and temperature on the basis of K.E. of molecules. Bimetallic and Platinum resistance thermometer: their merits and demerits. Pyrometers- Disappearing filament optical pyrometer. Modes of transfer of heat (conduction, convection and radiation with examples). Coefficient of thermal conductivity, determination of thermal conductivity of good conductor (Searle's method) and bad conductor (Lee's disc method). Properties of heat radiation. Prevost's theory of heat exchange. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation. Electrical analogy. Insulation materials. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers. Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection. Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks. Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy.	100	30

ww. Text Book and Reference Book:

1. **Basics of Heat and Mass transfer Dr. D. S. Kumar; S. K. Kataria and Sons Publishers.**
2. **Fundamentals of Heat and Mass Transfer**
   By Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt | Willey
3. **Heat and Mass Transfer**
   By R. K. Rajput | S. Chand Publication

a. **Course Name:** - Employability Skills

xx. **Course Code:** 03693251

yy. **Prerequisite:** Students should have a basic understanding of communication skills and foundational knowledge in logic and reasoning. Familiarity with general computer applications and presentation tools will be beneficial for tasks like resume building and group discussions.

zz. **Rationale:** The Employability Skills course aims to equip students with essential skills required for the modern workforce. By focusing on critical thinking, problem-solving, and interpersonal skills, this course prepares students to navigate competitive job markets and enhances their ability to contribute effectively in professional environments. Developing these competencies fosters self-sufficiency and adaptability, crucial for entrepreneurial ventures.

aaa. Course Learning Objective:

CLOBJ 1	Students will enhance their ability to analyze problems and develop logical solutions through case studies and critical reasoning exercises.
CLOBJ 2	Students will learn to solve various reasoning questions, including analogies, direction sense, and seating arrangements, to improve their analytical abilities.
CLOBJ 3	Students will refine their verbal and non-verbal communication skills through group discussions and interview preparation.
CLOBJ 4	Students will explore the fundamentals of entrepreneurship, including concept selling and business leadership.

bbb. Course Learning Outcomes:

CLO 1	Improve their critical thinking.
CLO 2	Prepares them for Campus Placement & Competitive Exams.
CLO 3	Builds up their confidence level.

ccc. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**-**	**100**	**-**	**-**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

ddd. Course Content:

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Critical Thinking - Case Studies** Critical thinking is based on pure logical thinking. Solving a critical reasoning question requires nothing but reasoning ability of the candidate. This session deals with the basic logic involved in critical reasoning questions and covers all the type of questions in CT. Worksheets would be provided to students for further practice.	8	2
2	**Coding & Decoding, Alphabetical Series** Understand various types of questions which they can come across in the given topic. Tips and tricks to solve questions on the above mentioned topics.	8	3
3	**Analogy and Odd Man Out** Understand various types of questions which they can come across in the given topic. Tips and tricks to solve questions on the above mentioned topics.	8	3
4	**Direction Sense** Able to solve all the direction sense question in competitive exams and aptitude exams of different Companies.	8	3
5	**Blood Relations**Able to solve all the Blood Relation questions in competitive exams and aptitude exams of different companies.	8	3
6	**Paper Folding** In this section of non verbal reasoning a figure is obtained by folding a piece of paper containing same design along the dotted line.	6	1
7	**Seating Arrangement** Candidates are required to arrange the objects either in a row or circle on the basis of information. Questions are presented in distorted form to create confusion and to taste the candidate's ability to analyze the information step by step in order to answer the question.	8	2
8	**Completion of Figure** In each of the following figure, a part of figure is missing. Find out from the given options, the right figure to fit in the missing figure.	6	2
9	**Completion of Series** In these questions a series of figures is given as problem figure & the candidate are asked to select one of the figurefrom the set of answer figure which will continue the given sequence.	8	3
10	**Entrepreneurship Skills (Selling the Concept)** This topic will help students develop the skills necessary to develop into Self-Sufficient business leaders through Entrepreneurship studies.	8	2
11	**Resume Building** The students will have a proper understanding of the content and how it is to be presented in resume.	8	2
12	**Group Discussion** It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	8	2
13	**Interview Skills**Students are prepared for their interviews, question and answers, how to react on some unique questions, body language & grooming is taken into account.	8	2

eee. Text Book and Reference Book:

1. **Non-Verbal Reasoning**
   By B S Sijwali and Indu Sijwali | Arihant
2. **Develop Your Contributor Personality**
   i-become Publishers, Mumbai

Semester 5

a. **Course Name:** Farm Tractor Systems and Controls
b. **Course Code:** 03601313
c. **Prerequisite:** Farm Tractor Systems and Controls is basic knowledge of mechanical systems, hydraulics, and electrical controls.
d. **Rationale:** This subject is designed to give knowledge about components and their functions of power transmission systems, tractor control systems, hydraulic system, operation control, etc.
e. **Course Learning Objective:**

CLOBJ 1	Understand Tractor System Components
CLOBJ 2	Diagnose and Troubleshoot Issues
CLOBJ 3	Apply Control Systems Knowledge
CLOBJ 4	Implement Maintenance Procedures

f. **Course Learning Outcomes:**

CLO 1	Identify and diagnose the causes of malfunctioning of farm Tractor system.
CLO 2	Rectify tractor troubles based on symptoms and causes
CLO 3	Use the suitable instrument and tools for diagnosis and testing of Tractor systems
CLO 4	Remove engine, transmission and electrical system from tractor, disassemble and rectify faults

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** Sources of farm power and scope of mechanization. Tractor - classification and different type of tractors and systems. Main assemblies of the tractors (Names only)	**6%**	2
2	**Power Transmission System of Tractors:** Functions and various components of power train. Clutch; functions of clutch, type of clutch (single plate, dual plate and multi plate clutch). Gear box; 43 function and working of gear box, types of gear boxes (sliding, constant mesh and synchromesh gears). Differential and differential lock; function and constructional details. Final drive; reduction gear and rear axle. Power take off shaft and drive to the PTO shaft.	**10%**	3
3	**Braking System:** Importance and function of brakes, various types of brakes viz. mechanical and hydraulic and their working.	**10%**	3
4	**Wheels and Tyres:** Types of wheels rim and tyres used in tractors. Function of tyres. Causes of tyre wear. Need for changing the rear wheel, spacing of wheels and arrangement for the change. Wheel ballasting and methods of ballasting.	**4%**	3
5	**Hydraulic System:** Principles and working of hydraulic system	**10%**	4
6	**Steering System:** Functions and components of steering systems.	**16%**	3
7	**Electrical System:** components of electrical systems viz. battery, starter switch, self starter, motor, dynamo: their construction, functions, operation; maintenance and care of the battery.	**10%**	4
8	**Economics:** Selection and Safety of Tractors. Various factors affecting the right selection of a tractor. Safety measures in the operation of tractor, cost analysis of use of tractors	**10%**	4
9	**Maintenance:** Periodical Maintenance Repair and Overhauling of Tractor. Daily, weekly and monthly	**14%**	3

	maintenance, repair and overhauling of tractor.		
10	**Tractor Testing:** Traction, Terms related to traction- Traction efficiency, coefficient of traction, rolling resistance, slip, rim pull. Tractor testing stations, test conditions, general requirements for testing a tractor. Type of tests	**10%**	3
		100%	**32**

i. Text Book and Reference Book:

1.Farm Machines and Equipment, By C.P. Nakra | Dhanpat Rai Publications, New Delhi

2.Farm Tractors Maintenance & repairs By by S.C. Jain & C.R. Rai | Tata McGraw-hill Publishing Co. Ltd., New Delhi.

3.Elements of Agricultural Engineering Part 1 & 2,By Dr. O.P. Singhal and Naresh Chandra Aggarwal | Mumfordganj, Allahabad

4.Basic Farm Machiner,By Shiphen& Ellen | Jain brothers.

a. **Course Name:** Farm Tractor Systems and Controls Lab
b. **Course Code:** 03601314
c. **Prerequisite:** Zeal to learn the subject.
j. **Rationale:** This subject is designed to give knowledge about components and their functions of power transmission systems, tractor control systems, hydraulic system, operation control, etc to students. This subject gives complete knowledge regarding tractor operation, how to maintain and Overhauling. By with these knowledge student can solve many problems. They easily suggest the farmer about different Implements and remedies related to Farm Industries and also give advice to do work with tractor at optimum cost
d. **Course Learning Objective:**

CLOBJ 1	Understand Tractor System Components
CLOBJ 2	Diagnose and Troubleshoot Issues
CLOBJ 3	Apply Control Systems Knowledge
CLOBJ 4	Implement Maintenance Procedures

e. **Course Learning Outcomes:**

CLO 1	Identify and diagnose the causes of malfunctioning of farm Tractor system.
CLO 2	Rectify tractor troubles based on symptoms and causes
CLO 3	Use the suitable instrument and tools for diagnosis and testing of Tractor systems
CLO 4	Remove engine, transmission and electrical system from tractor, disassemble and rectify faults

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1.Farm Machines and Equipment, By C.P. Nakra | Dhanpat Rai Publications, New Delhi

2.Farm Tractors Maintenance & repairs By by S.C. Jain & C.R. Rai | Tata McGraw-hill Publishing Co. Ltd., New Delhi.

3.Elements of Agricultural Engineering Part 1 & 2,By Dr. O.P. Singhal and Naresh Chandra Aggarwal | Mumfordganj, Allahabad

4.Basic Farm Machiner,By Shiphen& Ellen | Jain brothers.

i. Experiment List

Sr. No.	Experiment
1	Familiarization with tractors available in India
2	Familiarization with various tools used for dismantling and assembling of tractors and implements.
3	Study of clutch and its components and assembly.
4	Study of gear box, differential and final drive.
5	Study of Brake and steering.
6	Wheel equipment-care and maintenance, fitting of wheels and adjustment of track width.
7	Operation of hydraulics system, draft position and mix control systems.
8	Periodical maintenance and service of tractors.
9	Repair and overhaul of tractors.
10	To prepare the cost estimate for repair work .

a. **Course Name:** Agricultural Process Engineering
b. **Course Code:** 03601315
c. **Prerequisite:** Agricultural Process Engineering is basic knowledge of engineering concepts, crop science, and processing technologies.
d. **Rationale:** Agro processing could be seen as a set of techno-economic activities carried out for conservation and handling of agricultural produce and to make it usable as food, feed, fiber, fuel or industrial raw material.
e. **Course Learning Objective:**

CLOBJ 1	Understand the Fundamentals of Material Properties and Evaporation
CLOBJ 2	Familiarize with Material Handling and Transportation Equipment
CLOBJ 3	Develop Competence in Grain Milling Techniques
CLOBJ 4	Master the Processes of Pulse and Oilseed Milling

f. **Course Learning Outcomes:**

CLO 1	Understand Agricultural Processing Terminology
CLO 2	Plan and Design Processing Unit Layouts
CLO 3	Master the Unit Operations of Grain and Pulse Milling
CLO 4	Understand Oil Milling Processes and Solvent Extraction Principles

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** Physical states of a material, classical ideal materials, ideal elastic behavior (hookean body), ideal plastic behaviour (st.Venant body), ideal viscous behavior (newtonian liquid), Evaporation, boiling point elevation, types of evaporators, batch type pan evaporator, natural circulation evaporators rising film evaporator, falling film evaporator, rising and falling film evaporator, forced-circulation evaporator plate evaporator. Design of a single effect evaporator, material and energy balances, evaporator efficiency, boiling point elevation, methods of improving evaporator efficiency. Sizing of multiple effect evaporators	**20%**	8
2	**Material handling equipment:** Introduction to material handling and transportation - selection of material handling machines and conveyors, belt conveyor; belt conveyor idlers, idler spacing, belt tension, Bucket elevator: head section, boot section, elevator legs, elevator belts, buckets, drive mechanism, hp requirement, Screw conveyor: screw conveyor details, various shapes of screw conveyor trough, capacity and horse power Pneumatic conveyor, limitations of pneumatic conveying, chain conveyor.	**20%**	8
3	**Wheat milling:** Size reduction: introduction, grinding and cutting, energy used in grinding, kick's law, rittinger's law, bond's law Equipment for size reduction: cutters & grinders, crushers, gyratory crusher, hammer mill, ball mill Breakfast cereal foods - flaked breakfast cereals, puffed breakfast cereals, shredded and granular breakfast cereals and cereals puffed by extrusion Extrusion technology, principle of working, classification of extruders according to process and construction, extruded products and their processing.	**15%**	8
4	**Paddy milling**: Modern rice milling process - cleaning, dehusking, husk separation, paddy separation, polishing and grading operations and their related equipments, parboiling of paddy and its principle, methods of parboiling of paddy	**15%**	8

5	**Pulse milling:** Pulse milling process – Structure of legume seeds, introduction of pulse milling, methods of pulse milling: wet milling and dry milling, cleaning, dehusking, conditioning, splitting, pitting, polishing and grading operations and their related equipments	**15%**	8
6	**Oilseed milling:** Methods of oil milling – Expression, Extraction, Hydraulic press, Screw press, Solvent extraction method, oil refining and clarification and their related equipments	**15%**	8

		100%	**48**

i. Text Book and Reference Book:

1. Unit operations of Agricultural Processing, By Sahay, K. M. & K.K. Singh
2. Principles of Agricultural Engineering, Vol.I Jain Brothers, Karol Bag, New Delhi
3. Principles of Agricultural Engineering Vol-II By A M Michael & T P Ojha

a. **Course Name:** Agricultural Process Engineering Lab
b. **Course Code:** 03601316
c. **Prerequisite:** Zeal to learn the subject
j. **Rationale:** Agro processing could be seen as a set of techno-economic activities carried out for conservation and handling of agricultural produce and to make it usable as food, feed, fiber, fuel or industrial raw material. Hence, the scope of the agro processing industry encompasses all operations from the stage of harvest till the material reaches the end users in the desired form, packaging, quantity, quality and price. Ancient Indian scriptures contain vivid account of the post harvest and processing practices for preservation and processing of agricultural produce for food and medicinal uses. The main objective of agriculture processing is student should be aware of the potential in the agri -culture product.
d. **Course Learning Objective:**

CLOBJ 1	Understand the Fundamentals of Material Properties and Evaporation
CLOBJ 2	Familiarize with Material Handling and Transportation Equipment
CLOBJ 3	Develop Competence in Grain Milling Techniques
CLOBJ 4	Master the Processes of Pulse and Oilseed Milling

e. **Course Learning Outcomes:**

CLO 1	Understand Agricultural Processing Terminology
CLO 2	Plan and Design Processing Unit Layouts
CLO 3	Master the Unit Operations of Grain and Pulse Milling
CLO 4	Understand Oil Milling Processes and Solvent Extraction Principles

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1.Unit operations of Agricultural Processing, By Sahay, K. M. & K.K. Singh
2.Principles of Agricultural Engineering, Vol.I Jain Brothers, Karol Bag, New Delhi
3.Principles of Agricultural Engineering Vol-II By A M Michael & T P Ojha

i. Experiment List

Sr. No.	Experiment
1	Determination of engineering properties of food materials.
2	Determination of internal and external angle of repose of food grains.
3	Determination of static angle of repose of food grains.
4	Study of operation and adjustment different types of grain separators.
5	Study of operation and adjustment of cyclone separator.
6	Study of different materials handling equipments.
7	Visit to rice milling industry for the study of parboiling and rice milling equipment.
8	Visit to a Dal mill and study the operations.
9	Visit to flour mill and study of machinery and processes used in flour milling.
10	Visit to oil-mill and solvent extraction plant.

k. **Course Name:** Entrepreneurship Development and Business Management

l. **Course Code:** 03601317

m. **Prerequisite:** Entrepreneurship Development and Business Management include basic knowledge of economics, accounting, marketing, management principles, business law, finance, and communication skills.

n. **Rationale:** Agriculture sector has lot of potential to develop supporting business along with producing traditional product. This course deals with the key concern areas of entrepreneurship and entrepreneurship development.

o. **Course Learning Objective:**

CLOBJ 1	Understand the Fundamentals of Management and Financial Analysis
CLOBJ 2	Learn Project Evaluation and Appraisal Technique
CLOBJ 3	Familiarize with Global Trade and WTO Agreements
CLOBJ 4	Promote Entrepreneurship and Agribusiness Development

p. **Course Learning Outcomes:**

CLO 1	Develop Managerial Skills and Financial Literacy
CLO 2	Evaluate and Manage Agricultural Projects
CLO 3	Understand the Impact of International Trade Agreements on Agribusiness
CLO 4	Enhance Entrepreneurial Abilities and Knowledge of Agribusiness Policies

q. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

r. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Course Content:** Entrepreneurship, management – Management functions – planning- Organizing - Directing – motivation – ordering – leading – supervision-Communication and control – Capital – Financial management – importance of financial statements – balance sheet – profit and loss statement, Analysis of financial statements – liquidity ratios – leverage ratios, Coverage ratios – turnover ratios – profitability ratios, Agro-based industries – Project – project cycle – Project appraisal and evaluation techniques – undiscounted measures – payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV) – Benefit-Cost Ratio (BCR) – Internal Rate of Return (IRR) – Net benefit investment ratio (N / K ratio) – sensitivity analysis-Importance of agribusiness in Indian economy International trade-WTO agreements – Provisions related to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics-Entrepreneurship development Programmes (EDP)-Generation incubation and commercialization of ideas and innovationsMotivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment-Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs- Economic system and its implications for decision making by individual entrepreneurs- Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis- Government schemes	**100%**	48

	and incentives for promotion of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract farming (CF) and joint ventures (JV), public-private partnerships (PPP)- Overview of agricultural engineering industry, characteristics of Indian farm machinery industry		
		100%	**48**

s. Text Book and Reference Book:

4. FUNDAMENTALS OF ENTREPRENEURSHIP AND SMALL BUSINESS MANAGEMENT
   By Vasant Desai | Himalaya Publishing House
5. ENTREPRENEURSHIP DEVELOPMENT AND PROJECT MANAGEMENT
   By Neeta Baporikar | Himalaya Publishing House | Second
6. Agri-Business Management
   By W. David Downey and Steven P. Erickson

t. **Course Name:** Dairy Engineering
u. **Course Code:** 03601319
v. **Prerequisite:** Dairy Engineering is basic knowledge of dairy science, food technology, and mechanical processes.
w. **Rationale:** Milk & food is an important ingredient for health and therefore it is universally utilized by human being of all age groups. Therefore effective methods of milk & food collection and storage are required to avoid microbiological contamination of milk & food.
x. **Course Learning Objective:**

CLOBJ 1	Understand Dairy Development and Cooperative Movements in India
CLOBJ 2	Comprehend Milk Processing Techniques
CLOBJ 3	Explore Evaporation and Drying Techniques
CLOBJ 4	Learn Cream Separation and Butter Manufacturing Processes

y. **Course Learning Outcomes:**

CLO 1	Gain Insight into India's Dairy Cooperative Movement
CLO 2	Demonstrate Proficiency in Milk Processing Technologies
CLO 3	Apply Knowledge of Evaporation and Drying in Dairy Operations
CLO 4	Master the Techniques of Butter and Cream Processing

z. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

aa. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** Dairy development in India. Rise of Cooperatives in India, achievements of co-operative movement in India, National Dairy Development Board (NDDB), operation flood/ white revolution	**12%**	4
2	**Pasteurization:** Objectives of pasteurization, Pasteurization requirements for milk, Advantages and disadvantages of Batch type and continuous type Pasteurization plants, purpose and special requirement. High temperature short time pasteurizer, utilities, regeneration, holding time.	**14%**	4
3	**Homogenizer:** Purpose of homogenization, working principle of homogenizer, Theory of homogenization, design, material, single stage and two stage homogenizers, efficiency of homogenization.	**14%**	4
4	**Evaporators:** Introduction of evaporators, factors that affect the rate of evaporation, single and multiple operation Evaporators. Forward Feed Multiple effect Evaporator, Backward Feed Multiple effect Evaporator, and Parallel Feed Multiple effect evaporator.	**12%**	4
5	**Drying Equipment:** Objectives of milk drying, Introduction of drum dryer and spray dryer, advantages and Disadvantages of spray drying.	**12%**	4
6	**Butter Manufacture:** Definitions, Principal constituents of butter, butter making process, continuous floatation churn.	**12%**	4
7	**Cream Separations:** Centrifugation, characteristic features of a disc bowl centrifuge, Domestic cream separator, and characteristic features of a tubular bowl centrifuge.	**12%**	4
8	**Plant Layouts and Can Washer:** Introduction, Advantages of good plant layout, Requirements / factors in planning layouts, Types of layouts, Rotary can washer and straight through can washer.	**12%**	4
		100%	**32**

Text Book and Reference Book:

7. Dairy Plant Engineering and Management
   By Ahmed, T | 4th Ed. Kitab Mahal.
8. Dairy technology and engineering
   By Harper, W.J. and Hall, C.W.
9. Engineering for Dairy & A. W.
   By Faral (1980). Rebert E., Kriger Food Products Pub Co. New York.

bb. Course Name: Ground Water and Drainage Engineering

cc. Course Code: 03601321

dd. Prerequisite: Knowledge of irrigation and drainage engineering

ee. Rationale: Ground Water and Drainage Engineering is essential for planning effective methods of land and water utilization

ff. Course Learning Objective:

CLOBJ 1	Understanding Groundwater Hydrology and Well Hydraulics
CLOBJ 2	Principles of Well Design, Construction, and Testing
CLOBJ 3	Reclamation of Salt-Affected Soils
CLOBJ 4	Design and Implementation of Drainage Systems for Waterlogged Soils

gg. Course Learning Outcomes:

CLO 1	Comprehend Groundwater Sources and Aquifer Characteristics
CLO 2	Understand Well Construction Methods and Hydraulic Concepts
CLO 3	Analyse Soil Salinity, Alkalinity, and Reclamation Techniques
CLO 4	Apply Drainage System Design for Waterlogged Soils

hh. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

ii. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Well Hydraulics:** Ground water sources, types of water bearing formations (confined, unconfined aquifer etc.) aquifer characteristics influencing yield of wells. Determination of aquifer constant, specific capacity of wells. Different terms related to well hydraulic such as water tables, isobath, isobar lines, draw down. Recharge of ground water.	**25%**	8
2	**Open Wells and Tube Wells:** Types of wells, open wells, their design parameters and construction of an open well, tube wells, methods of drilling tube wells-rotary drilling, core drilling and percussion drilling. Well installation and well development-objectives and methods. Testing of tube well.	**25%**	8
3	**Salt affected soils and their reclamation:** Saline, alkaline and acid soils, Reasons and factors of their formation. Effect of salinity, alkalinity and acidity on plant growth. Reclamation of these soils and their management	**25%**	8
4	**Waterlogged soils and their drainage:** Water logging, causes of water logging and its effects. Drainage. Types of drainage systems viz. surface and subsurface drainage. Introduction to drainage investigation. Benefits of drainage. Drainage properties of soil. Drainage coefficient. Surface drainage-functional components, types (random drain, parallel field drain, parallel open ditch and bedding system used in flat areas and cross slope ditch system used in sloping areas). Introduction to design criteria and design parameters of open ditches. Benefits of subsurface drainage. Introduction to investigations for subsurface drainage, different method of subsurface drainage viz. tile drains, mole drains, deep open drains and combination of tile and opened drains.	**25%**	8
		100%	**32**

jj. Text Book and Reference Book:

10. Water Well and Pump (Text Book) Michael AM, Khepar SD. and SK Sondhi | Tata Mc-Graw Hill
11. Agricultural Drainage Principles & Practices (Reference Book) US Kadam, RT Thokal, Sunil D Gorantiwar | Westville Publishing House
12. Principles of Agricultural Engineering Vol-II (TextBook) A M Michael & T P Ojha

a. **Course Name:** Ground Water and Drainage Engineering Lab
h. **Course Code:** 03601322
i. **Prerequisite:** Knowledge of irrigation and drainage engineering
j. **Rationale:** Ground Water and Drainage Engineering is essential for planning effective methods of land and water utilization
k. **Course Learning Objective:**

CLOBJ 1	Understanding Groundwater Hydrology and Well Hydraulics
CLOBJ 2	Principles of Well Design, Construction, and Testing
CLOBJ 3	Reclamation of Salt-Affected Soils
CLOBJ 4	Design and Implementation of Drainage Systems for Waterlogged Soils

l. **Course Learning Outcomes:**

CLO 1	Comprehend Groundwater Sources and Aquifer Characteristics
CLO 2	Understand Well Construction Methods and Hydraulic Concepts
CLO 3	Analyse Soil Salinity, Alkalinity, and Reclamation Techniques
CLO 4	Apply Drainage System Design for Waterlogged Soils

m. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

n. Text Book and Reference Book:

1. Water Well and Pump (Text Book) Michael AM, Khepar SD. and SK Sondhi | Tata Mc-Graw Hill
2. Agricultural Drainage Principles & Practices (Reference Book) US Kadam, RT Thokal, Sunil D Gorantiwar | Westville Publishing House
3. Principles of Agricultural Engineering Vol-II (TextBook) A M Michael & T P Ojha

i. Experiment List

Sr. No.	Experiment
1	To study the types of water bearing formations.
2	Study of different types of wells.
3	Different methods of ground water investigation.
4	Study of different types of screen and strainers.
5	Determination of hydraulic conductivity under laboratory and field conditions.
6	Determination of drainable porosity.
7	Determination of drainage requirement.
8	To determine leaching requirement for reclamation saline soils.
9	To determine gypsum requirement for reclamation of sodic soils.
10	Study of different types of filters and strainers used in subsurface drainage system.

a. **Course Name:** Watershed Management
b. **Course Code:** 03601323
c. **Prerequisite:** Basic knowledge of hydrologic processes and watershed
d. **Rationale:** Knowledge about watershed management is important for Agricultural Engineer
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of watershed management and land use planning
CLOBJ 2	Analyse watershed characteristics and techniques for water yield assessment
CLOBJ 3	Explore groundwater recharge, sediment yield management, and rainwater conservation technologies
CLOBJ 4	Examine the impact of cropping systems and land management practices on watershed hydrology

f. **Course Learning Outcomes:**

CLO 1	Understand Watershed Management Principles
CLO 2	Evaluate Watershed Characteristics
CLO 3	Implement Groundwater Recharge and Rainwater Conservation
CLO 4	Analyse Impact of Cropping Systems on Hydrology

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Watershed management:** Watershed management - problems and prospects. Watershed based land use planning.	**16%**	**5**
2	**Watershed characteristics:** Physical and geomorphologic, factors affecting watershed management. Hydrologic data for watershed planning.	**16%**	**5**
3	**Watershed delineation:** Delineation of priority watershed. Water yield assessment and measurement from a watershed. Water budgeting of Watershed	**16%**	**5**
4	**Ground water recharge:** Concept of ground water recharge, watershed management. Sediment yield estimation and measurement from a watershed and sediment yield models. Rainwater conservation technologies - in-situ and ex- situ, storage, design of water harvesting tanks and ponds.	**16%**	**5**
5	**Effect of cropping system:** Effect of cropping system, land management and cultural practices on watershed hydrology.	**16%**	**5**
6	**Watershed programmes:** Evaluation and monitoring of watershed programmes. People's participation in watershed management programmes. Planning and formulation of project proposal; cost benefits analysis of watershed programmes. Introduction and application of remote sensing and GIS in watershed management.	**20%**	**7**
		100%	**32**

i. Text Book and Reference Book:

1. Hydrology and Soil Conservation Engineering: Including Watershed Management (TextBook) Ghanshyam Das; Prentice Hall India Learning Private Limited
2. Field Manual on Watershed Management. (TextBook) Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra.; CRIDA, Hyderabad.
3. Principles of Agricultural Engineering (TextBook) A.M. Michel and T.P. Ojha

a. **Course Name:** Watershed Management Lab
b. **Course Code:** 03601324
c. **Prerequisite:** Basic knowledge of hydrologic processes and watershed
d. **Rationale:** Knowledge about watershed management is important for Agricultural Engineer
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of watershed management and land use planning
CLOBJ 2	Analyse watershed characteristics and techniques for water yield assessment
CLOBJ 3	Explore groundwater recharge, sediment yield management, and rainwater conservation technologies
CLOBJ 4	Examine the impact of cropping systems and land management practices on watershed hydrology

f. **Course Learning Outcomes:**

CLO 1	Understand Watershed Management Principles
CLO 2	Evaluate Watershed Characteristics
CLO 3	Implement Groundwater Recharge and Rainwater Conservation
CLO 4	Analyse Impact of Cropping Systems on Hydrology

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Hydrology and Soil Conservation Engineering: Including Watershed Management (TextBook) Ghanshyam Das; Prentice Hall India Learning Private Limited
2. Field Manual on Watershed Management. (TextBook) Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra.; CRIDA, Hyderabad.
3. Principles of Agricultural Engineering (TextBook) A.M. Michel and T.P. Ojha

i. Experiment List

Sr. No.	Experiment
1	Study of watershed characteristic
2	Analysis of hydrologic data for watershed management
3	Delineation of watershed and measurement of area under different vegetative and topographic conditions
4	Measurement of water and sediment yield from watershed
5	Prioritization of watershed based on sediment yield index
6	Study of different watershed management structures
7	Study of various water budget parameters
8	Study of watershed management technologies
9	Preparation of a techno-economically effective project proposal
10	Visit to watershed development projects

kk. Course Name: Agricultural Structures

ll. Course Code: 03601325

mm. Prerequisite: Agricultural Structures include basic knowledge of agricultural engineering, construction materials, structural design, soil mechanics, and environmental science.

nn. Rationale: Agricultural Structures is to provide essential knowledge and skills required to design, construct, and maintain structures that support agricultural activities. These structures, such as barns, storage facilities, greenhouses, and irrigation systems, are vital for protecting crops, livestock, and equipment.

oo. Course Learning Objective:

CLOBJ 1	Understand Farmstead Planning and Layout
CLOBJ 2	Learn Design and Construction of Livestock and Farm Structures
CLOBJ 3	Explore Sanitation and Waste Management Systems
CLOBJ 4	Estimate Power Requirements and Integrate Renewable Energy

pp. Course Learning Outcomes:

CLO 1	Design Efficient Farmstead Layouts
CLO 2	Apply Knowledge in Constructing Farm Structures
CLO 3	Implement Effective Sanitation and Sewage Systems
CLO 4	Optimize Power Use and Incorporate Alternative Energy

qq. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

rr. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Theory:** 1. Planning and layout of farmstead. 2. Livestock production facilities, BIS. Standards for dairy, piggery, poultry and other farmstructures. 3. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc. 4. Design and construction of rural grain storage system. 5. Site and orientation of building in regard to sanitation, community sanitation system; sewage system its design, cost and maintenance, design of septic tank for smallfamily. 6. Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural housing.	**100%**	32
		100%	**32**

ss. Text Book and Reference Book:

13. Farm Structures in tropical climates
By Bengtsson, L.P.
14. Agricultural buildings and structures. National Food & Energy
By Whitaker, J.H

o. **Course Name:** Agricultural Structures Lab

p. **Course Code:** 03601326

tt. **Prerequisite:** Agricultural Structures include basic knowledge of agricultural engineering, construction materials, structural design, soil mechanics, and environmental science.

uu. **Rationale: Agricultural Structures** is to provide essential knowledge and skills required to design, construct, and maintain structures that support agricultural activities. These structures, such as barns, storage facilities, greenhouses, and irrigation systems, are vital for protecting crops, livestock, and equipment. Properly designed agricultural structures help in improving productivity, reducing post-harvest losses, ensuring food safety, and enhancing the overall efficiency of farming operations.

q. **Course Learning Objective:**

CLOBJ 1	Understand Farmstead Planning and Layout
CLOBJ 2	Learn Design and Construction of Livestock and Farm Structures
CLOBJ 3	Explore Sanitation and Waste Management Systems
CLOBJ 4	Estimate Power Requirements and Integrate Renewable Energy

r. **Course Learning Outcomes:**

CLO 1	Design Efficient Farmstead Layouts
CLO 2	Apply Knowledge in Constructing Farm Structures
CLO 3	Implement Effective Sanitation and Sewage Systems
CLO 4	Optimize Power Use and Incorporate Alternative Energy

s. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

t. Text Book and Reference Book:

1.Farm Structures in tropical climates

By Bengtsson, L.P.

2.Agricultural buildings and structures. National Food & Energy

By Whitaker, J.H

i. Experiment List

Sr. No.	Experiment
1	Design and layout of a dairy farm.
2	Design and layout of a poultry house.
3	Design and layout of a sheep/goat house
4	Design of a biogas plant.
5	Design of ventilation system for dairy and poultry house.
6	Design of a feed/fodder storage structures.
7	Familiarization with local grain storage structures.
8	Moisture condensation in agricultural buildings.
9	Design of grain storage structures.
10	Cost estimation of a farm buildings.

Semester 5

vv. Course Name: Design and Maintenance of Green House

ww. Course Code: 03601327

xx. Prerequisite: Design and Maintenance of Greenhouses is basic understanding of horticulture, climate control, and construction principles.

yy. Rationale: Students with the knowledge and skills necessary to design, construct, and maintain efficient greenhouse structures for optimized agricultural production.

zz. Course Learning Objective:

CLOBJ 1	Understand Greenhouse Types and Technology Development
CLOBJ 2	Learn Design and Construction of Greenhouses
CLOBJ 3	Explore Solar Energy and Environmental Control in Greenhouses

CLOBJ 4	Understand Automation and Instrumentation in Greenhouse Agriculture

aaa. Course Learning Outcomes:

CLO 1	Identify and Analyze Different Greenhouse Types
CLO 2	Design and Construct Efficient Greenhouses
CLO 3	Implement Solar Energy and Environmental Controls
CLO 4	Apply Automation and Pest Management in Greenhouse Operations

bbb. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** History and types of greenhouse, Function and features of greenhouse, Scope and development of greenhouse technology.	**20%**	6
2	**Civil engineering aspects in Green Housing:** Location, planning and various components of greenhouse, Design criteria and calculations, Construction materials and methods of construction, Covering material and characteristics	**20%**	7
3	**Solar Energy in Green Housing:** Greenhouse heating, cooling, shedding and ventilation system, Carbon dioxide generation and monitoring and lighting systems	**20%**	6
4	**Instrumentation in Green Agricultural Activities:** Instrumentation and & computerized environmental control systems, Watering, fertilization, root substrate and pasteurization, Containers and benches, Plant nutrition, Alternative cropping systems, Plant tissue culture.	**20%**	7
5	**Post Handling Activities:** Chemical growth regulation, Disease control, integrated pest management, Post production quality and handling	**20%**	6
		100%	**32**

ccc. Text Book and Reference Book:

15. Solar Engineering Thermal Process
    By Duffie J.A. and Beckman W.A
16. Greenhouse Advanced Technology By Hanan
17. Greenhouse Operation & Management
    By Nelson P.V.

a. **Course Name:** Design and Maintenance of Green House Lab
b. **Course Code:** 03601328
c. **Prerequisite:** Students with the knowledge and skills necessary to design, construct, and maintain efficient greenhouse structures for optimized agricultural production. Greenhouses provide controlled environments that protect crops from adverse weather conditions, pests, and diseases, enabling year-round cultivation and higher yields. This subject focuses on the integration of engineering principles, environmental controls, and automation technologies to create sustainable and cost-effective greenhouse systems.
d. **Course Learning Objective:**

CLOBJ 1	Understand Greenhouse Types and Technology Development
CLOBJ 2	Learn Design and Construction of Greenhouses
CLOBJ 3	Explore Solar Energy and Environmental Control in Greenhouses
CLOBJ 4	Understand Automation and Instrumentation in Greenhouse Agriculture

e. **Course Learning Outcomes:**

CLO 1	Identify and Analyze Different Greenhouse Types
CLO 2	Design and Construct Efficient Greenhouses
CLO 3	Implement Solar Energy and Environmental Controls
CLO 4	Apply Automation and Pest Management in Greenhouse Operations

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				Theory	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**30**	**-**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. Text Book and Reference Book:

1.Solar Engineering Thermal Process
By Duffie J.A. and Beckman W.A
2. Greenhouse Advanced Technology By Hanan
3. Greenhouse Operation & Management
By Nelson P.V.

i. Experiment List

Sr. No.	Experiment
1	Study / visit to a functional green house.
2	Material selection for the construction of green house.
3	Visit to a commercial green house.
4	Measurement of humidity, air velocity & temperature using various methods.
5	Measurement of solar radiations inside the green house.
6	Application of psychometric charts; estimation of cooling requirements in a green house; estimation of ventilation requirements.
7	Thermal performance of green house.
8	Calculations of environment indices inside a green house.
9	Structural analysis of green house.