VARDHAMAN
COLLEGE OF ENGINEERING

CURRICULUM
For
Bachelor of Technology
Civil Engineering

Under
Choice Based Credit System (CBCS)

B. Tech. - Regular Four-Year Degree Program
(For batches admitted from the Academic Year 2025 - 2026)

&

B. Tech. - Lateral Entry Scheme
(For batches admitted from the Academic Year 2026 - 2027)

August 2025

VARDHAMAN COLLEGE OF ENGINEERING
(Autonomous)
Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade
Kacharam, Shamshabad, Hyderabad- 501 218, Telangana, India
www.vardhaman.org, info@vardhaman.org

Department Vision

To be center of excellence in civil engineering education, research and consultancy to support community directly or indirectly.

Department Mission

M1: To adopt processes enhancing student learning experience and professional skills.

M2: To enhance entrepreneurial skills among the students through Industry Institute Interaction.

M3: To work in-tandem with industry to facilitate advancement of technology for societal needs.

M4: To promote research and continuing education through multi-disciplinary activities.

Program Educational Objectives (PEOs)

PEO1: Graduates will address the technical challenges as a professional by utilizing and enhancing their analytical skills in real world problems in civil engineering.

PEO2: Graduates will adapt to rapidly changing environment in Design and execution of projects and to achieve a high level of technical expertise through lifelong learning.

PEO3: Graduates will communicate their ideas to be effective in collaborating with industry and R & D centers and working as a team member/leader by upholding their responsibilities with excellence.

PEO4: Graduates will explore and apply multidisciplinary open-ended engineering activities considering the societal and economic impacts of engineering decisions, professional and ethical responsibilities of civil engineers.

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

PO3: Design/ Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4: Conduct investigations of complex problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

PSO1: Prepare detailed project reports and execution of industrial projects.

PSO2: Provide solutions for irrigation, drainage and rural water supply.

United Nations Sustainable Development Goals (SDGs)

SDG1: No Poverty – End poverty in all its forms everywhere.

SDG2: Zero Hunger – End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

SDG3: Good Health and Well-Being – Ensure healthy lives and promote well-being for all at all ages.

SDG4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG5: Gender Equality – Achieve gender equality and empower all women and girls.

SDG6: Clean Water and Sanitation – Ensure availability and sustainable management of water and sanitation for all.

SDG7: Affordable and Clean Energy – Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG8: Decent Work and Economic Growth – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG9: Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

SDG10: Reduced Inequalities – Reduce inequality within and among countries.

SDG11: Sustainable Cities and Communities – Make cities and human settlements inclusive, safe, resilient and sustainable.

SDG12: Responsible Consumption and Production – Ensure sustainable consumption and production patterns.

SDG13: Climate Action – Take urgent action to combat climate change and its impacts.

SDG14: Life Below Water – Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

SDG15: Life on Land – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG16: Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG17: Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development.

I B.Tech. I Semester												
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9001	Matrices and Calculus	BS	45	15	-	60	120	4	40	60	100
2	A9009	Engineering Chemistry	BS	45	-	-	45	90	3	40	60	100
3	A9501	Programming for Problem Solving	ES	45	-	-	45	90	3	40	60	100
4	A9011	English for Skills Enhancement	HS	30	-	-	30	60	2	40	60	100
5	A9301	Engineering Drawing	ES	15	-	60	15	90	3	40	60	100
Practical Courses												
6	A9010	Engineering Chemistry Laboratory	BS	-	-	30	-	30	1	40	60	100
7	A9502	Programming for Problem Solving Laboratory	ES	-	-	30	-	30	1	40	60	100
8	A9012	English Language and Communication Skills Laboratory	HS	-	-	30	-	30	1	40	60	100
9	A9302	Engineering Workshop	ES	-	-	30	-	30	1	40	60	100
Community Related Project Work												
10	A9021	Community Centered Design Thinking	PW	-	-	-	45	45	1	40	60	100
Total				180	15	180	240	615	20	400	600	1000

I B.Tech. II Semester												
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9002	Ordinary Differential Equations and Vector Calculus	BS	45	15	-	60	120	4	40	60	100
2	A9007	Engineering Physics	BS	45	-	-	45	90	3	40	60	100
3	A9101	Engineering Geology	ES	45	-	-	45	90	3	40	60	100
4	A9102	Applied Mechanics	ES	45	-	-	45	90	3	40	60	100
5	A9103	Building Materials, Construction and Planning	ES	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9008	Engineering Physics Laboratory	BS	-	-	30	-	30	1	40	60	100
7	A9104	Engineering Geology Laboratory	ES	-	-	30	-	30	1	40	60	100
8	A9304	Computer Aided Engineering Graphics	ES	-	-	30	-	30	1	40	60	100
Community Related Project Work												
9	A9022	Product Design and Development	PW	-	-	-	45	45	1	40	60	100
Total				225	15	90	285	615	20	360	540	900

II B.Tech. I Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9014	Business Economics and Financial Analysis	HS	45	-	-	45	90	3	40	60	100
2	A9105	Concrete Technology	ES	45	-	-	45	90	3	40	60	100
3	A9106	Strength of Materials	PC	45	15	-	60	120	4	40	60	100
4	A9107	Surveying and Geomatics	PC	45	-	-	45	90	3	40	60	100
5	A9108	Fluid Mechanics	PC	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9109	Strength of Materials Laboratory	PC	-	-	30	-	30	1	40	60	100
7	A9110	Surveying and Geomatics Laboratory	PC	-	-	30	-	30	1	40	60	100
8	A9511	Python Programming Laboratory	PC	-	-	30	-	30	1	40	60	100
Skill Development Course												
9	A9111	Computer Aided Building Drafting	PC	-	-	30	-	30	1	40	60	100
Community Related Project Work												
10	A9023	Technology Entrepreneurship	PW	-	-	-	45	45	1	40	60	100
Total				225	15	120	285	645	21	400	600	1000

II B.Tech. II Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9004	Probability Distribution and Statistics	BS	45	-	-	45	90	3	40	60	100
2	A9112	Structural Mechanics	ES	45	-	-	45	90	3	40	60	100
3	A9113	Hydraulics and Hydraulic Machines	PC	45	-	-	45	90	3	40	60	100
4	A9114	Water Resources Engineering	PC	45	-	-	45	90	3	40	60	100
5	A9115	Structural Analysis	PC	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9317	Fluid Mechanics and Hydraulic Machines Laboratory	PC	-	-	30	-	30	1	40	60	100
7	A9116	Building Information Modeling Laboratory	PC	-	-	30	-	30	1	40	60	100
8	A9117	Concrete Technology Laboratory	PC	-	-	30	-	30	1	40	60	100
9	A9006	Computational Mathematics Laboratory	PC	-	-	30	-	30	1	40	60	100
Skill Development Course												
10	A9118	Digital Surveying	PC	-	-	30	-	30	1	40	60	100
Community Related Project Work												
11	A9024	Community Driven Product Evaluation	PW	-	-	-	45	45	1	40	60	100
Total				225	15	150	270	645	21	440	660	1100
12		Exit Optional: Work Based Vocational Course / Internship or Apprenticeship	PW	-	-	-	90	90	2	40	60	100

III B.Tech. I Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9119	Design of Reinforced Concrete Structures	PC	45	-	-	45	90	3	40	60	100
2	A9120	Estimation, Quantity Surveying, and Valuation	PC	45	-	-	45	90	3	40	60	100
3	A9121	Transportation Engineering	PC	45	-	-	45	90	3	40	60	100
4		Professional Elective - I	PE	45	-	-	45	90	3	40	60	100
5		Open Elective - I	OE	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9122	Transportation Engineering Laboratory	PC	-	-	30	-	30	1	40	60	100
7	A9013	English for Employability Skills Laboratory	HS	-	-	30	-	30	1	40	60	100
Skill Development Course												
8	A9123	Structural Analysis and Design	PC	-	-	30	-	30	1	40	60	100
Experiential Learning Course												
9	A9041	Internship/Industrial Training	PW	-	-	-	90	90	2	40	60	100
Value Added Course												
10	A9016	Gender Sensitization, Human Values and Professional Ethics	VA	15	-	-	15	30	1	40	60	100
Total				240	0	90	330	660	21	400	600	1000

III B.Tech. II Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9124	Design of Steel Structures	PC	45	-	-	45	90	3	40	60	100
2	A9125	Environmental Engineering	PC	45	-	-	45	90	3	40	60	100
3	A9126	Soil Mechanics	PC	45	-	-	45	90	3	40	60	100
4		Professional Elective - II	PE	45	-	-	45	90	3	40	60	100
5		Open Elective - II	OE	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9127	Environmental Engineering Laboratory	PC	-	-	30	-	30	1	40	60	100
7	A9128	Soil Mechanics Laboratory	PC	-	-	30	-	30	1	40	60	100
Skill Development Course												
8	A9129	Hydraulic Modeling	PC	-	-	30	-	30	1	40	60	100
Experiential Learning Course												
9	A9042	Mini Project	PW	-	-	-	90	90	2	40	60	100
Value Added Course												
10	A9015	Environmental Science	VA	15	-	-	15	30	1	40	60	100
Total				240	0	90	330	660	21	400	600	1000

IV B.Tech. I Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	A9130	Remote Sensing and GIS	PC	45	-	-	45	90	3	40	60	100
2	A9131	Foundation Engineering	PC	45	-	-	45	90	3	40	60	100
3		Professional Elective - III	PE	45	-	-	45	90	3	40	60	100
4		Professional Elective - IV	PE	45	-	-	45	90	3	40	60	100
5		Open Elective - III	OE	45	-	-	45	90	3	40	60	100
Practical Courses												
6	A9132	Geographical Information Systems Laboratory	PC	-	-	30	-	30	1	40	60	100
7	A9133	Civil Engineering Software Laboratory	PC	-	-	30	-	30	1	40	60	100
Experiential Learning Course												
8	A9043	Major Project – Phase I	PW	-	-	-	90	90	2	100	-	100
Value Added Course												
9	A9017	Indian Knowledge System	VA	15	-	-	15	30	1	40	60	100
Total				240	0	60	330	630	20	420	480	900

IV B.Tech. II Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1		Professional Elective – V	PE	45	-	-	45	90	3	40	60	100
2		Professional Elective – VI	PE	45	-	-	45	90	3	40	60	100
Experiential Learning Course												
3	A9044	Major Project – Phase II	PW	-	-	-	630	630	14	40	60	100
Total				90	0	0	720	810	20	120	180	300

Common Abbreviations Used in the Curriculum

BS – Basic Sciences
HS – Humanities & Social Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Elective
OE – Open Elective
PW – Project Work
VA – Value Added Course
CI – Classroom Instruction
LI – Laboratory Instruction
L – Lecture Hours
T – Tutorial Hours
P – Practical Hours
TW – Team Work
SL – Self Learning
H – Hours
C – Credits
CIE – Continuous Internal Evaluation
SEE – Semester End Examination
SDG – Sustainable Development Goals

List of Professional Electives

Domain: Structural Engineering			
Year & Semester	**Professional Elective #**	**Course Code**	**Title of the Course**
III B.Tech. I Semester	Professional Elective – I	A9151	Advanced Structural Analysis
III B.Tech. II Semester	Professional Elective – II	A9155	Finite Element Method
IV B.Tech. I Semester	Professional Elective – III	A9159	Construction Management
IV B.Tech. I Semester	Professional Elective – IV	A9163	Elements of Earthquake Engineering
IV B.Tech. II Semester	Professional Elective – V	A9167	Prestressed Concrete Structures
IV B.Tech. II Semester	Professional Elective – VI	A9171	Repair and Rehabilitation of Structures

Domain: Transportation Geotechnics			
Year & Semester	**Professional Elective #**	**Course Code**	**Title of the Course**
III B.Tech. I Semester	Professional Elective – I	A9152	Geosynthetics and Ground Engineering
III B.Tech. II Semester	Professional Elective – II	A9156	Pavement Engineering
IV B.Tech. I Semester	Professional Elective – III	A9160	Ground Improvement Techniques
IV B.Tech. I Semester	Professional Elective – IV	A9164	Railway, Airport, Waterway and Harbour Engineering
IV B.Tech. II Semester	Professional Elective – V	A9168	Traffic Engineering
IV B.Tech. II Semester	Professional Elective – VI	A9172	Subsurface Exploration

Domain: Water Resources and Environmental Engineering			
Year & Semester	**Professional Elective #**	**Course Code**	**Title of the Course**
III B.Tech. I Semester	Professional Elective – I	A9153	Air Pollution and Control Technologies
III B.Tech. II Semester	Professional Elective – II	A9157	Watershed Management
IV B.Tech. I Semester	Professional Elective – III	A9161	Ground Water Hydrology
IV B.Tech. I Semester	Professional Elective – IV	A9165	Environmental Impact Assessment
IV B.Tech. II Semester	Professional Elective – V	A9169	Irrigation Engineering
IV B.Tech. II Semester	Professional Elective – VI	A9173	Solid and Hazardous Waste Management

Domain: Emerging / Interdisciplinary			
Year & Semester	**Professional Elective #**	**Course Code**	**Title of the Course**
III B.Tech. I Semester	Professional Elective – I	A9154	Waste-to-Wealth
III B.Tech. II Semester	Professional Elective – II	A9158	Green Building and Sustainability
IV B.Tech. I Semester	Professional Elective – III	A9162	Pre-Engineered Buildings
IV B.Tech. I Semester	Professional Elective – IV	A9166	Smart Cities
IV B.Tech. II Semester	Professional Elective – V	A9170	AI Applications in Civil Engineering
IV B.Tech. II Semester	Professional Elective – VI	A9174	Machine Learning and Data Analytics in Civil Engineering

List of Open Electives

Industry Skills		
#	Course Code	Title of the Course
1	A9505	Computer Organization
2	A9507	Operating Systems
3	A9509	Database Management Systems
4	A9515	Software Engineering
5	A9604	Web Application Engineering
6	A9612	Information Security
7	A9681	Cyber Security
8	A9682	Java Programming
9	A9683	Prompt Engineering
10	A9701	Artificial Intelligence
11	A9702	Machine Learning
12	A9705	Deep Learning
13	A9707	Natural Language Processing
14	A9710	Generative AI
15	A9803	Data Mining
16	A9851	Data Science for Engineers
Emerging Technologies		
#	Course Code	Title of the Course
17	A9381	Fundamentals of Robotics
18	A9382	Introduction to 3D Printing
19	A9383	Hybrid Vehicles
20	A9481	Internet of Things (IoT)
21	A9482	Consumer Electronics
22	A9483	VLSI Design Fundamentals
23	A9484	PCB Design and Fabrication
24	A9656	Blockchain Technology
Sustainability		
#	Course Code	Title of the Course
25	A9166	Smart Cities
26	A9181	Disaster Management
27	A9182	Road Safety Engineering
28	A9183	Building Science and Technology
29	A9281	Renewable Energy Systems
30	A9282	Smart Grid Technologies
31	A9283	Electrical Safety and Sustainable Engineering Practices
32	A9284	Smart Power Systems for Data Centers
33	A9285	E-Waste Management

List of Open Electives (Continued...)

Entrepreneurship		
#	Course Code	Title of the Course
34	A9081	Entrepreneurship Development
35	A9082	Research Methodology and IPR
36	A9083	Principles of Management
37	A9084	Organizational Behavior
38	A9355	Operations Research
39	A9684	E-Commerce
Life Skills and Holistic Development		
#	Course Code	Title of the Course
40	A9085	Emotional Intelligence and Leadership
41	A9086	Yoga and Wellness
42	A9087	National Cadet Corps (NCC)

I B.Tech. I Semester

A9001 – Matrices and Calculus

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	15	0	60	120	4	40	60	100

Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the solution of system of linear equations, eigen values and eigen vectors, functions of several variables, multiple integrals. The course is designed to build conceptual clarity and problem-solving skills, with emphasis on both theoretical understanding and practical applications.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

Course Outcomes

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

A9001.1. Solve system of equations using rank of a matrix.

A9001.2. Construct the canonical form of a quadratic form using orthogonal transformations.

A9001.3. Express a function in series by mean value theorems and evaluate improper integrals using Beta and Gamma functions.

A9001.4. Examine the extremum of a function of several variables.

A9001.5. Apply multiple integrals to find the areas and volumes.

Course Syllabus

Unit-I:

Matrices: Rank of a matrix by Echelon form and Normal form, Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Jacobi and Gauss Seidel Iteration Method.

Unit-II:

Eigen Values and Eigen Vectors: Linear Transformation and Orthogonal transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley- Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley- Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit-III:

Single Variable Calculus: Limit and Continuous of functions and its properties. Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (All the theorems without proof), Definition of Improper Integral, Beta and Gamma functions and their applications.

Unit-IV:

Multivariable Calculus (Partial Differentiation and applications): Definitions of Limit and Continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

Unit-V:

Multivariable Calculus (Integration): Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables for double integrals (Cartesian to polar), Evaluation of Triple Integrals. Applications: Areas by double integrals and volumes by triple integrals.

Books and Materials

Text Books:

1. Grewal, B. S. *Higher Engineering Mathematics*, 43rd ed., Khanna Publications, 2015.
2. Jain, R. K., Iyengar, S. R. K. *Advanced Engineering Mathematics*, 5th ed., Narosa Publishing House, 2016.

Reference Books:

1. Seymour Lipschutz and Marc Lars Lipson *Schaum's Outline of Linear Algebra* , 6th ed., McGraw-Hill Education, 2018.
2. Greenberg Michael D.*Advanced Engineering Mathematics*, 2nd ed., Upper Saddle River, N.J. Prentice Hall, 1998.
3. Kreyszig, E. *Advanced Engineering Mathematics*, 9th ed., John Wiley & Sons, 2006.
4. Ramana, B. V. *Higher Engineering Mathematics*, 32nd reprint, McGraw Hill Education (India), 2018.

A9009 – Engineering Chemistry

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course emphasizes the application of chemical principles to analyse and address engineering problems, including water and its treatment for diverse purposes, the study of engineering materials such as plastics, fibres, elastomers, and composites, as well as non-conventional energy sources, batteries, and fuel cells. The course aims to integrate theoretical knowledge with practical applications, preparing students to evaluate and implement chemical solutions in engineering contexts.

Course Pre/Co-requisites

This course has no specific prerequisites and co requisites.

Relevant Sustainable Development Goals (SDGs)

SDG 6: Clean Water and Sanitation
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action

Course Outcomes

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

A9009.1. Analyse the hardness and other impurities present in the water for industrial and domestic applications.

A9009.2. Apply electrochemical principles to protect the metals from corrosion.

A9009.3. Illustrate the types of energy sources along with their characteristics and applications.

A9009.4. Differentiate the properties of various polymeric materials based on their structure and engineering applications.

A9009.5. Compare the materials to study various physical and chemical properties.

Course Syllabus

Unit-I:

Water and its treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness, numerical problems. Steps involved in the treatment of potable water - disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: sludges, scales and caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – softening of water by ion exchange processes. Desalination of water – Reverse osmosis.

Unit-II:

Electrochemistry and Corrosion: Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - numerical problems. Types of electrodes, reference electrodes - primary reference electrode - standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of an unknown solution using SHE and Calomel electrode.

Corrosion: Introduction- definition, causes and effects of corrosion – theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - nature of the metal, nature of the corroding environment. Corrosion control methods - electroplating, electroless plating and metal cladding.

Unit-III:

Energy Sources:

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Lead acid battery and Lithium ion battery. Fuel Cells – differences between a battery and a fuel cell, construction and applications of Hydrogen-Oxygen fuel cell.

Fuels: Introduction and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulongs formula - Numerical problems. *Fossil fuels:* Introduction, Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and use. *Synthetic Fuels:* Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

Unit-IV:

Polymeric Materials: Terminology, types of polymerization – addition and condensation polymerization with examples. Plastics: Thermoplastic resins & Thermosetting resins. Preparation, properties and engineering applications of Polyvinyl chloride and Teflon. Fibers: Preparation, properties and engineering applications of Nylon-6,6 and Dacron. Elastomers: Natural rubber and its vulcanization, artificial rubbers - Buna-S and Butyl rubber. Conducting Polymers: classification, mechanism of conduction in trans - polyacetylene – applications. Biodegradable polymers: Polylactic acid and its applications.

Unit-V:

Advanced Functional Materials:

Graphene: Isolation, Structure and strength, applications in Computer, Electrical and Electronic Devices.

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications. Biosensor - Definition, Amperometric Glucose monitor sensor.

Portland cement: Chemical constituents, Setting and Hardening and applications of cement.

Books and Materials

Text Books:

1. Rama Devi, B., Aparna, P., and Prasanta Rath. *Engineering Chemistry.* 2nd ed., Cengage Publications, 2025.
2. Jain, Jain. *Engineering Chemistry.* 16th ed., Dhanpat Rai Publication Company, 2015.

Reference Books:

1. Agarwal, Shikha. *Engineering Chemistry.* Cambridge University Press, Delhi, 2015.
2. Chawla, Shashi. *Engineering Chemistry.* Dhanpat Rai and Company (P) Ltd., Delhi, 2011.
3. Thirumala Chary, M., E. Laxminarayana, and K. Shashikala. *A Textbook of Engineering Chemistry.* Pearson Publications, 2021.
4. Singh, Paramvir, Avinash Kumar Agarwal, Anupma Thakur, and R. K. Sinha. *Challenges and Opportunities in Green Hydrogen.* Springer, 2024.
5. Leo, Donald J. *Engineering Analysis of Smart Material Systems.* John Wiley & Sons, 2007.
6. *E-book:* "Engineering Chemistry by Shashi Chawla." Internet Archive, https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2up.

A9501 – Programming for Problem Solving

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the principles of problem-solving and programming through C language. It begins with the basics of algorithms, flowcharts, and structured program design, enabling students to develop logical thinking skills. Core programming concepts such as variables, operators, control statements, arrays, and strings are covered to build a strong foundation. The course further explores modular programming using functions and recursion, along with structures and unions for handling complex data. Advanced concepts like pointers and dynamic memory management are introduced to enhance program efficiency. File handling techniques are discussed for effective data storage and retrieval. Fundamental searching and sorting algorithms are included to improve problem-solving efficiency and performance analysis. By the end of the course, students will be able to design, implement, and evaluate C programs that solve real-world computational problems systematically and efficiently.

Course Pre/Co-requisites

This Course has no specific Pre/Co requisites

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9501.1. Use basic programming constructs and control statements to design solutions for computational problems.

A9501.2. Develop programs using arrays and strings to store and manipulate sequential data.

A9501.3. Implement modular programming using functions, structures, and unions to manage complex problems and data.

A9501.4. Make use of pointers and file handling to effectively manage and process data.

A9501.5. Choose appropriate searching and sorting technique to organize and retrieve data efficiently.

Course Syllabus

Unit-I:

Problem Solving Techniques: Algorithms- Algorithmic approach, characteristics of algorithm and Examples, Flowcharts- Definition, Symbols and examples, Problem solving strategies: Top-down approach and Bottom-up approach.

Introduction to C: Structure of a C Program, Identifiers, Variables, Constants and Data Types. Operators and Expressions. Precedence of operators and Evaluation of Expressions, Type conversions, Formatted input and output. Control Statements: Conditional Statements- if, if else, nested if, else if ladder and switch statements. Iterative or Loop statements- while, do while and for statements. Jump statements- break, continue and goto statements.

Unit-II:

Arrays and Strings: Arrays: Introduction, One Dimensional Arrays - Declaration and initialization, Reading and Writing. Two Dimensional Arrays - Declaration and initialization, Reading and Writing. Manipulating elements of Arrays. Strings: Introduction, Declaration, and initialization, Reading and writing, string handling functions, handling two dimensional strings.

Unit-III:

Functions, Structures and Unions: Functions- Introduction, Function definition and Function call, Categories of functions, Recursion, Limitations of recursive functions, storage classes, Passing Arrays to functions, Common Pre-processor Directives. Structures- Definition, Declaration, and Initialization, accessing structure members, Array of Structures, Arrays within structures, Structures and functions, size of structures, Unions- Definition, Declaration, and Initialization, accessing Union member.

Unit-IV:

Pointers and Files: Pointers-Declaration, Initialization, Pointer to Pointer, Pointer Arithmetic, Parameter Passing Techniques, Pointer to Arrays, Pointers to Structures. Files- Introduction, defining, opening, and closing a File, Input / Output operations on Files, Random Access in files, Command line arguments.

Unit-V:

Searching and Sorting: Time and Space Complexity, Searching- Linear Search and Binary Search, Sorting- Bubble Sort, Selection Sort, Insertion Sort and Quick Sort.

Books and Materials

Text Books:

1. Thareja, Reema. *Programming in C.* AICTE ed., 2nd rev. ed., Oxford University Press, 2018.
2. Forouzan, Behrouz A., and Richard F. Gilberg. *Computer Science: A Structured Programming Approach Using C*, 3rd ed., reprint, Cengage Learning (formerly Course Technology), 2007.

Reference Books:

1. Kanetkar, Yashavant P. *Let Us C: Authentic Guide to C Programming Language.*, 20th ed., reprint, BPB Publications, 2024.
2. Gottfried, Byron S. *Programming with C.*, 4th ed., reprint, McGraw-Hill Education (India), 2018.
3. Padmanabham, P. *C & Data Structures.*, 3rd ed., B.S. Publications, 2016.
4. Hanly, Jeri R., and Elliot B. Koffman. *Problem Solving and Program Design in C.*, 8th ed., reprint, Pearson, 2015.
5. Balagurusamy, E. *Programming in ANSI C.*, 9th ed., reprint, McGraw-Hill Education India, 2024.

A9011 – English for Skill Enhancement

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	30	60	2	40	60	100

Course Description

Course Overview

This course has been designed to develop linguistic and communicative competencies among engineering students. The Reading and Writing skills of the students are honed during the sessions using the prescribed textbook. Additionally, students are trained on effective usage of grammar and vocabulary. Further, they are encouraged to read texts which are aimed at developing their comprehension skills.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 8: Decent Work and Economic Growth
SDG 17: Partnerships for the Goals

Course Outcomes

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

A9011.1. Identify and use appropriate vocabulary to compose and deliver clear oral and written communication
A9011.2. Practice adept usage of grammar for effective communication
A9011.3. Interpret and summarize known and unknown passages
A9011.4. Develop proficiency in writing for academic purposes
A9011.5. Demonstrate basic proficiency in professional correspondence

Course Syllabus

Unit-I:

Theme: Perspectives
Text: Lesson on 'The Generation Gap' by Benjamin M. Spock
Vocabulary: Word Formation - Prefixes and Suffixes; Synonyms and Antonyms
Grammar: Identifying Common Errors in Writing with reference to Articles and Prepositions, Conjunctions
Reading: Reading and its importance - Sub skills of Reading – Skimming and Scanning
Writing: Sentence Structures - Use of Phrases and Clauses in Sentences - Types of Sentences; Punctuation; Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence - Organizing Principles of Paragraphs in Documents

Unit-II:

Theme: Digital Transformation
Text: Lesson on 'Emerging Technologies'
Vocabulary: Homophones, Homonyms and Homographs
Grammar: Identifying Common Errors in Writing with reference to Tenses, Noun-Pronoun Agreement and Subject-Verb Agreement
Reading: Reading Strategies - Guessing Meaning from Context – Identifying Main Ideas - Exercises for Practice
Writing: Essay writing.

Unit-III:
Theme: Attitude and Gratitude
Text: Poems on 'Leisure' by William Henry Davies and 'Be Thankful' – Unknown Author
Vocabulary: Words often Confused; Phrasal Verbs
Grammar: Misplaced Modifiers
Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice
Writing: Letter Writing: Letter of Request, Letter of Inquiry, Letter of Apology, Letter of Complaint, Email writing - Format, Style and Etiquette.

Unit-IV:
Theme: Entrepreneurship
Text: Lesson on 'Why a Start-up Needs to Find its Customers First' by Pranav Jain
Vocabulary: Standard Abbreviations in English, Idioms
Grammar: Redundancies in Oral and Written Communication, Transformation of sentences - Active and Passive Voice
Reading: Prompt Engineering Techniques – Comprehending and Generating Appropriate Prompts - Exercises for Practice
Writing: Precis Writing; Writing a Letter of Application and Resume/CV.

Unit-V:
Theme: Integrity and Professionalism
Text: Lesson on 'Professional Ethics'
Vocabulary: Technical Vocabulary and its Usage, Collocations
Grammar: Transformation of sentences - Reported Speech, Common Errors covering all other aspects of grammar
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text - Exercises for Practice
Writing: Technical Reports - Introduction – Characteristics of a Report - Structure of Report (Manuscript Format)

Books and Materials

Text Books:

1. Board of Editors, *English for the Young in the Digital World.* Orient Black Swan Pvt. Ltd. 2025.

Reference Books:

1. Swan, Michael, *Practical English Usage.* Oxford University Press. New Edition, 2016.
2. Karal, Rajeevan, *English Grammar Just for You.* Oxford University Press. New Delhi, 2023.
3. Cengage India, *Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi, 2024.
4. Sanjay Kumar & Pushp Lata, *Communication Skills – A Workbook.* Oxford University Press. New Delhi, 2022.
5. Wood, F.T., *Remedial English Grammar.* Macmillan, 2007.
6. Vishwamohan, Aysha. *English for Technical Communication for Engineering Students.* McGraw-Hill Education India Pvt. Ltd, 2013.

A9301 – Engineering Drawing

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
15	0	60	15	90	3	40	60	100

Course Description

Course Overview

This course introduces the foundational concepts of Engineering Drawing, emphasizing the importance of visual communication in engineering. It covers engineering curves, orthographic projections of points, lines, planes, and solids, sectional views and lateral surface development of regular solids. The course also includes isometric projections and the interpretation and conversion between orthographic and isometric views. Through systematic drawing methods, students develop the skills to represent three-dimensional objects in two-dimensional form accurately and effectively.

Course Pre/Co-requisites

This course has no specific pre-requisites and co-requisites.

Relevant Sustainable Development Goals (SDG(s))

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

SDG 12: Responsible Consumption and Production

Course Outcomes

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

A9301.1. Construct various types of engineering scales and curves used in technical drawings.

A9301.2. Interpret and create orthographic projections of points, lines, and planes with varying inclinations.

A9301.3. Generate orthographic views of regular solids, inclined to one or both reference planes.

A9301.4. Analyze sectional views of regular solids to construct true shape of the section, and lateral surface development.

A9301.5. Produce isometric views of objects and convert between isometric and orthographic projections.

Course Syllabus

Unit-I:

Introduction to Engineering Drawing: Principles of engineering drawing and its significance; construction of engineering curves – ellipse, parabola, and hyperbola (general method only); cycloidal curves – cycloid, epicycloid, hypocycloid.

Unit-II:

Orthographic Projections – I: Principles of orthographic projection; projections of points located in different quadrants; projections of lines inclined to one reference plane and to both principal reference planes; projections of planes – inclined to one or both reference planes.

Unit-III:

Orthographic Projections – II: Orthographic projections of regular solids – prisms, cylinders, pyramids, and cones; solids inclined to one reference plane and inclined to both principal reference planes; visualization and interpretation of three-dimensional solids through two-dimensional projection views.

Unit-IV:

Sectional Views and Development: Section of Solids – sectional views and true shape of the section. Lateral surface development of regular solids – prisms, cylinders, pyramids, and cones; methods of development; applications in pattern making and sheet metal work.

Unit-V:

Isometric Projections: Concept of isometric projection and isometric scale; isometric projection of lines, regular plane figures, and solids – prism, cylinder, pyramid, and cone; conversion of isometric views to orthographic views and vice versa; enhancement of 3D visualization skills.

Books and Materials

Text Books:

1. Bhatt, N. D. *Engineering Drawing*, 53rd ed., Charotar Publishing House, 2019.
2. Agrawal, Basant, and C. M. Agrawal. *Engineering Graphics*, 3rd ed., Tata McGraw Hill Education, 2010.

Reference Books:

1. Narayana, K. L., and P. Kannaiah. *Textbook on Engineering Drawing*, 3rd ed., SciTech Publishers, 2020.
2. Shah, M. B., and B. C. Rana. *Engineering Drawing and Computer Graphics*, 2nd ed., Pearson Education, 2009.

A9010 – Engineering Chemistry Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

The Engineering Chemistry Laboratory equips students with practical skills essential for understanding the chemical principles behind engineering materials and processes. It bridges theoretical knowledge with real-world applications, fostering analytical thinking and precision. Students learn to handle instruments, analyze data, and interpret results relevant to industrial and environmental contexts. The course emphasizes the role of chemistry in addressing engineering challenges and societal needs. Overall, it builds a strong foundation for innovation and responsible technological development.

Course Pre/Co-requisites

This course has no specific prerequisites and co requisites.

Relevant Sustainable Development Goals (SDGs)

SDG 6: Clean Water and Sanitation
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action

Course Outcomes

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

A9010.1. Apply the instrumental techniques to find out the strength of solutions.

A9010.2. Analyze the impurities present in the water using volumetric analysis.

A9010.3. Make use of different titrimetric methods to measure chemical species.

A9010.4. Analyze the importance of temperature and pressure on physical properties of liquids.

A9010.5. Calculate the yield of synthesized compounds by maintaining appropriate reaction conditions.

Course Syllabus

List of Experiments:

1. Estimation of amount of ferrous ion in the given solution by permanganometry.
2. Estimation of hardness of water by complexometry using EDTA.
3. Estimation of amount of hydrochloric acid in the given solution by conductometry.
4. Estimation of amount of strong and weak acid in the given solution by conductometry.
5. Estimation of amount of hydrochloric acid in the given solution by potentiometry.
6. Estimation of amount of ferrous ion in the given solution using potassium permanganate by potentiometry.
7. Estimation of manganese ion in the given solution by colorimetry.
8. Estimation of Copper ion in the given solution by colorimetry.
9. Determination of viscosity of the given liquid by Ostwald's viscometer.
10. Determination of surface tension of the given liquid by using stalagmometer.

11. Preparation of Bakelite.
12. Preparation of Nylon 6,6.

Laboratory Equipment/Software/Tools Required:

1. Digital Conductometer
2. Digital Potentiometer
3. Digital Colorimeter
4. Electrical Water Heater
5. Wall Mount Distillation Plant
6. Analytical/Digital Weighing Balance
7. Ostwald's Viscometer
8. Stalagmometer
9. Stopwatch
10. Thermometer
11. RB Flask condenser
12. Magnetic Stirrer
13. Pipette
14. Burette
15. Beaker

Books and Materials

Text Books:

1. Rama Devi, B., Aparna, P., and Prasanta Rath. *Engineering Chemistry.* 2nd ed., Cengage Publications, 2025.

Reference Books:

1. Vogel, A. I. *Inorganic Quantitative Analysis.* ELBS Publications.
2. Ahluwalia, V. K. *College Practical Chemistry.* Narosa Publications Ltd., 2007

A9502 – Programming for Problem Solving Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course aims to build practical programming skills using the C language. Students learn to approach problems logically and implement solutions efficiently. Emphasis is given to writing clear and structured programs using control statements and modular design. They gain hands on experience with data handling, including arrays, strings, and user-defined data types. Pointers are introduced to manage memory and work with complex data efficiently. File operations are covered to handle data storage and retrieval. Students practice implementing algorithms for sorting, searching, and numerical computations. The course develops debugging and problem-solving abilities through practical exercises. Focus is placed on optimizing code for better performance and readability. By the end, learners can design and implement robust C programs for a variety of computational problems.

Course Pre/Co-requisites

This course has no specific pre-requisites and co-requisites.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9502.1. Make use of fundamental programming constructs to develop solutions for computational problems.

A9502.2. Perform various operations on arrays and strings to effectively organize, process, and manipulate sequential data in programs.

A9502.3. Develop programs with functions and structures to design modular programs that efficiently handle and process data.

A9502.4. Apply pointers and file handling techniques to implement programs for storing and managing data effectively.

A9502.5. Implement searching and sorting algorithms to efficiently organize and access data.

Course Syllabus

List of Experiments:

1. Variables and Expressions
   a. Write a C program for Swapping of two numbers using a third variable.
   b. Write a C program for the simple and compound interest.
   c. Write a C program to evaluate the expressions (Finding $y = m \cdot x + c$, displacement).
2. Conditional Statements–I
   a. Write a C program for finding the max and min from the three numbers.
   b. Write a C program to check the given year is leap year or not.

c. Write a C program to find the roots of a quadratic equation.

3. Conditional Statements–II
   a. Write a C program to check the given number is power of 2 or not using bitwise operators.
   b. Write a C program to read 3 subject marks. Calculate and display the grade of a student based on the percentages.
   c. Write a C program to perform Arithmetic Operations using switch statement.
4. Iterative Statements–I
   a. Write a C program to find sum of n natural numbers $(1+2+3+\cdots+n)$.
   b. Write a C program to find factorial of a given number.
   c. Write a C program to print Fibonacci numbers.
   d. Write a C program to find reverse of the given number.
   e. Write a C program to check if the binary representation of a positive number is palindrome or not. (Examples: 101, 11, 11011, 1001001 are palindromes. 100, 110, 1011 are not).
5. Iterative Statements–II
   a. Write a C program to read a password until it is correct. For wrong password print "Incorrect password" and for correct password print "Correct password" and quit the program. (The correct password is 1234).
   b. Write a C program to check the given number is prime or not.
   c. Write a C program to find the GCD of given two numbers.
   d. Write a C program to print the output in various triangle patterns using nested `for` loops.
   e. Write a C program to find the sum of the series Geometric Progression.
6. Arrays
   a. Write a C program to find the largest and smallest number among a list of integers.
   b. Write a C program to read an array of n elements and find the mean, variance, and standard deviation.
   c. Write a C program to find addition of two matrices.
   d. Write a C program to find multiplication of two matrices.
7. Strings
   a. Write a C program to demonstrate the string handling functions.
   b. Write a C program to check whether a given string is palindrome or not.
   c. Write a C program to concatenate three strings.
   d. Write a C program to count the lines, words and characters in a given text.
   e. Write a C program that displays the position of a character ch in the string S or -1 if S doesn't contain ch.
8. Functions
   a. Write a C program to find the factorial of a given number using non-recursive and recursive function.
   b. Write a C program to find the nth term of a Fibonacci series using recursive function.
   c. Write a C program to compute x^y.
9. Structures
   a. Write a C program to create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of a student.

b. Write a C program to create a Student structure containing name, rollNo and grade as structure members. Display the name, rollNo and grade of n students by using array of structures concept.

10. Structures and functions
    a. Write a C program to add two complex numbers by passing structure to a function.
    b. Write a C program to add two distances (in inch-feet system) using structures.
11. Pointers
    a. Write a C program to swap two integers using the following methods:
        i. Call by Value
        ii. Call by Reference
    b. Write a C program to demonstrate pointer arithmetic.
    c. Write a program to display values in reverse order from an array using a pointer.
    d. Write a program through a pointer variable to find sum of n elements from an array.
    e. Write a C program to check the given string is palindrome or not using pointer.
    f. Write a C program to print n city names using pointers and strings.
12. Files
    a. Write a C program to merge two files into a third file.
    b. Write a C program to reverse the contents of a file.
    c. Write a C program to use random access functions in files.
    d. Write a C program to count the number of times a character occurs in a text file (file name and character are supplied as command line arguments).
13. Searching
    a. Write a C program that uses a non-recursive function to search for a key value in a list of integers using linear search.
    b. Write a C program that uses a non-recursive function to search for a key value in a sorted list of integers using binary search.
14. Sorting
    a. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
    b. Write a C program that sorts the given array of integers using selection sort in descending order.
    c. Write a C program that sorts the given array of integers using quick sort in ascending order.
    d. Write a C program that sorts the given array of integers using insertion sort in ascending order.
15. Miscellaneous
    1. Write a program that shows the binary equivalent of a given positive number between 0 to 255.
    2. Write a C program to calculate the following, where x is a fractional value:

$$1 - \frac{x}{2} + \frac{x^2}{4} - \frac{x^3}{6}$$

    3. Write a C program to read in two numbers, `x` and `n`, and then compute the sum of this geometric progression:

$$1 + x + x^2 + x^3 + \cdots + x^n$$

    For example: if $n = 3$ and $x = 5$, the program computes $1 + 5 + 25 + 125$.

4. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
5. Write a C program that converts a number ranging from 1 to 50 to its Roman equivalent.
6. Write a C program that uses functions to perform the following operations:
   i. To insert a sub-string into a given main string from a given position.
   ii. To delete n characters from a given position in a given string.
7. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
8. Write a program for display values reverse order from an array using a pointer.
9. Write a program through a pointer variable to sum of n elements from an array.
10. Write a C program that sorts the given array of integers using insertion sort in ascending order

Laboratory Equipment/Software/Tools Required:

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. GCC Compiler (Open source/ Freeware)

Books and Materials

Text Books:

1. Thareja, Reema. *Programming in C.* AICTE ed., 2nd rev. ed., Oxford University Press, 2018.
2. Forouzan, Behrouz A., and Richard F. Gilberg. *Computer Science: A Structured Programming Approach Using C.*, 3rd ed., reprint, Cengage Learning (formerly Course Technology), 2007.

Reference Books:

1. Kanetkar, Yashavant P. *Let Us C: Authentic Guide to C Programming Language*, 20th ed., reprint, BPB Publications, 2024.
2. Gottfried, Byron S. *Programming with C*, 4th ed., reprint, McGraw-Hill Education (India), 2018.
3. Padmanabham, P. *C & Data Structures*, 3rd ed., B.S. Publications, 2016.
4. Hanly, Jeri R., and Elliot B. Koffman. *Problem Solving and Program Design in C*, 8th ed., reprint, Pearson, 2015.
5. Balagurusamy, E. *Programming in ANSI C*, 9th ed., reprint, McGraw-Hill Education India, 2024.

A9012 – English Language and Communication Skills Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course is designed to cater to the needs of students in developing their oral communication skills. It begins with an introduction to Phonetics to make them understand the received pronunciation and to help them speak with a neutral accent. This course incorporates listening skills and draws exercises of listening comprehension from various general and business contexts. The speaking exercises in this course will help the students to present their ideas in different situations, besides helping them to develop team spirit by participating in pair/group activities.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 8: Decent Work and Economic Growth
SDG 17: Partnerships for the Goals

Course Outcomes

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

A9012.1. Acquire the received pronunciation and speak in a neutral accent
A9012.2. Use language effectively in real-life situations
A9012.3. Demonstrate effective use of non verbal communication
A9012.4. Interpret visual data for oral communication
A9012.5. Develop the ability to enhance listening skills

Course Syllabus

List of Experiments:

1. CALL Lab:

Instruction: Speech Sounds - Listening Skills - Listening vs. Hearing - Importance – Purpose - Types
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - Testing Exercises

2. ICS Lab:

Diagnostic Test: Activity titled 'Express Your View'
Instruction: Spoken and Written language - Formal and Informal English - Greetings – Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

3. CALL Lab

Instruction: Barriers to Listening - Active Listening
Practice: Listening for General Information - Multiple Choice Questions - Listening Comprehension - Exercises for practice

4. ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues – Expressions used in Various Situations – Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

5. CALL Lab
Instruction: Minimizing Errors in Pronunciation (MTI)
Practice: Differences between British and American Pronunciation – Listening Comprehension – Exercises for practice

6. ICS Lab:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events

7. CALL Lab:
Instruction: Techniques for Effective Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension – Exercises for practice

8. ICS Lab:
Instruction: Information transfer - oral interpretation of graphical data
Practice: Activity on oral interpretation of graphical data

9. CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension – Exercises for practice

10. ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Dumb Charades Activity
Post-Assessment Test: 'Express Your View'

Laboratory Equipment/Software/Tools Required:

1. Computers with internet
2. K VAN Solutions Software
3. Headphones
4. Audio Visual Equipment
5. Camcorder

Books and Materials

Lab Manual:

1. Laboratory Handbook on English Language and Communication Skills Lab.

Reference Books:

1. Brook-Hart, Guy. *Cambridge English Business Benchmark - Upper Intermediate Business Vantage (with CD)*, 2nd Edition, South Asian Edition, Cambridge University Press, 2019.
2. Shobha, KN & Rayen, J. Lourdes. *Communicative English – A workbook.* Cambridge University Press, 2019.
3. Board of Editors. *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient BlackSwan Pvt. Ltd. , 2016.
4. Mishra, Veerendra et al. *English Language Skills: A Practical Approach.* Cambridge University Press, 2020.
5. *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
6. Ur, Penny and Wright, Andrew. *Five Minute Activities – A Resource Book for Language Teachers.* Cambridge University Press, 2022.
7. *TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).*

A9302 – Engineering Workshop

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

The Engineering Workshop course is designed to introduce students to basic and advanced manufacturing processes, workshop trades, and hands-on practical skills essential for engineering practice. The course provides experiential learning on a variety of trade skills including fitting, carpentry, welding, foundry, plumbing, electrical house wiring, and fabrication techniques such as 3D Printing. Students will gain practical familiarity with common tools, machines, and manufacturing methods, along with safety and quality management practices.

Course Pre/Co-requisites

This course has no specific pre-requisites and co-requisites.

Relevant Sustainable Development Goals (SDG(s))

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 12: Responsible Consumption and Production

Course Outcomes

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

A9302.1. Demonstrate the ability to perform fundamental workshop trades, including fitting, carpentry, welding, and plumbing, by completing a variety of hands-on tasks.

A9302.2. Demonstrate safe and effective usage of fabrication tools and digital equipment.

A9302.3. Identify and operate common workshop machines and tools while strictly adhering to safety protocols and quality management practices.

A9302.4. Recognize the properties of different materials and select appropriate tools and processes for specific manufacturing applications.

A9302.5. Fabricate a complete, functional assembly by integrating multiple skills learned across different workshop trades.

Course Syllabus

Part - A (Practical)

1. Fitting: L - Fit / V - Fit / Square - Fit / Semi Circular - Fit.
2. Carpentry: Lap Joint/ T- Bridle Joint / Mortise & Tenon Joint.
3. House wiring: Series / Parallel / One Bulb by One Switch / Tube Light / One Bulb by Two way Switch.
4. Welding: Butt Joint / Lap Joint / T Joint.
5. Foundry: Single Piece Pattern/ Split Piece Pattern / Multi Piece Pattern.
6. Tin Smithy: Open Scoop / Funnel / Rectangular Tray / Cylindrical.
7. Plumbing: Pipe Threading / Pipe Joints.
8. 3D Printing: Prepare a 3D Printing Model.

Part - B (Demonstration)

1. CNC Machining & Power Tools.
2. Casting & Plastic Moulding.
3. Welding (TIG/MIG, Gas Welding), Brazing.
4. Blacksmithy.

Laboratory Equipment/Software/Tools Required:

1. Fitting: Bench vise, Hacksaw frame, Calipers, Files, Try Square.
2. Carpentry: Carpentry vise, Chisels, Saws, Wooden Hammer, Try Square.
3. House Wiring: Voltage Tester, Wire Cutter, Wire Stripper, Cutting Plier, Nose Plier, Wire Gauge.
4. Welding: Welding M/c, Safeguards, Chipping Hammer, Electrode Holder.
5. Foundry: Wooden patterns, Riddle, Riser, Runner, Gate cutter, Rammers.
6. Tin Smithy: Wire Gauge, Snips, Pliers, Steel rule, Soldering kit, Spot Welding, Nylon Hammers.
7. Plumbing: Pipe Wrench, Pipe Cutter, Pliers, Pipe Die Set.
8. 3D Printing, 3D Modeling & Slicer Software.
9. Furnace, tongs, Swage Block.
10. Additional: Model Joints, Craft Knives and Electric Boards.

Books and Materials

Text Books:

1. Hajra Choudhury, S.K., and Nirjhar Rao. *Elements of Workshop Technology [Vol. 1, Manufacturing Processes]*, Revised and Enlarged 7th ed., Media Prompters & Publishers, 2023.
2. Singh, Devendra, et al. *Workshop Technology: Crafting Innovation for Engineering Students*, 1st ed., Redshine Publication, 2025.
3. Rosenberg, Neil. *Designing 3D Printers: Essential Knowledge*, 3rd ed., Independently published, 2023.

Reference Books:

1. Reddy, K. Venkata. *Workshop Practice Manual*, Reprint, 6th ed., BSP Books Private Ltd, 2025.
2. Gupta, Ram K. *3D Printing: Fundamentals to Emerging Applications*, 1st ed., CRC Press, 2024.
3. Devi, V. Lakshmi, and Kumar K. *Battery Technology Handbook: Classification, Control, and System Integration: Comprehensive Guide to EV Battery Design and Management Systems*, 1st ed., Notation Press, 2024.

A9021 - Community Centered Design Thinking

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	0	45	45	1	40	60	100

Course Description

Course Overview

The "Community-Centered Design Thinking" course aims to enable students to identify and address unique needs and challenges within local communities. Through the application of design thinking principles, students will develop creative problem-solving mindsets and the ability to collaborate effectively in multidisciplinary teams. The course emphasizes integrating moral code, professional standards, and sustainability principles into design solutions.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 3: Good Health and Well-being
SDG 4: Quality Education
SDG 11: Sustainable Cities and Communities
SDG 17: Partnerships for the Goals

Course Outcomes

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

A9021.1. Apply the principles of design thinking, empathy, and sustainability to identify and understand real-world community challenges.

A9021.2. Conduct field research surveys and observation to define community-based problem statements.

A9021.3. Ideate creative solutions using appropriate tools and techniques to meet the identified community needs.

A9021.4. Collaborate with community members, NGOs, and peers to test, refine, and validate design solutions through feedback and co-design processes.

A9021.5. Communicate design outcomes effectively through documentation, storytelling, and ethical reflection considering accessibility, inclusivity, and life-cycle impact.

Course Syllabus

Unit-I:

Community-Centered Design Thinking: Understanding the significance of community-centered approaches, Overview of Design Thinking principles for community engagement.

Unit-II:

Needs and Challenges Assessment: Techniques for identifying and analyzing unique needs within local communities, SDGs Alignment, Case studies illustrating successful community-centered design projects.

Unit-III:

Research and Comparative Analysis for Innovation: Investigating existing solutions to community challenges, comparing their effectiveness, and identifying opportunities to create improved, innovative approaches.

Unit-IV:

Ethical Design and Sustainability: Integrating moral code and professional standards into the design process. Incorporating sustainability principles in design to define socially responsible solutions.

Unit-V:

Refine Problem Statement: study existing solutions, and generate creative, community-focused ideas, with all findings documented for the next stage of development.

Activity Plan

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
1	Unit-I: CCDT	Understand significance of community centered approaches	Concept Briefing + Discussion	Icebreaker: list visible community challenges	Reflection notes: "Why is community engagement critical?"	CO1
2	Unit-I: CCDT	Learn design thinking principles	Concept Briefing + Activity	Mini design thinking cycle for sample issue	Mind-map of 5 stages applied to local issue	CO1
3	Unit-II: Needs Assessment	Acquire techniques for identifying needs	Concept Briefing + Hands on Session	Practice mock interviews, empathy mapping	Conduct mini survey (3–5 people)	CO2
4	Unit-II: Needs Assessment	Connect needs to SDGs	Concept Briefing + Case Study	Group analysis: link issues to SDGs	Case study report (2–3 pages)	CO2
5	Unit-III: Research	Investigate existing solutions	Guided Research	Group research on 2–3 existing interventions	Summary table of solutions	CO3
6	Unit-III: Comparative Analysis	Compare effectiveness of solutions	Presentations	Present comparison of solutions (pros/cons)	Comparative chart submission	CO3
7	Unit-IV: Ethics	Integrate ethics into design	Debate	Debate: "Should cost outweigh ethics?"	Short essay on ethical dilemma	CO4
8	Unit-IV: Sustainability	Apply sustainability principles	Hands on Session	Create sustainability checklist for ideas	Submit checklist + reflection	CO4
9	Unit-V: Refinement	Refine problem statements	Guided Group Work	Rewrite into "How Might We..." questions	Final problem statement submission	CO2, CO5

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
10	Unit-V: Refinement	Study existing solutions deeply	Problem Statement Review	Critique and identify gaps in solutions	Gap Analysis Report	CO3, CO5
11	Unit-V: Ideation	Generate creative ideas	Ideation Hands-on Session	Brainstorming, SCAMPER, Story boarding	Sketches/story boards of top 3 ideas	CO3, CO5
12	Unit-V: Documentation & Presentation	Present and document findings	Final Showcase	Group presentations + reflection sharing	Final report + individual reflection essay	CO5

Books and Materials

Text Books:

1. Pavan Soni. *Design Your Thinking*, Penguin Random House India, New Delhi, 2020.
2. Anuja Agarwal. *Design Thinking: A Framework for Applying Design Thinking in Problem Solving*, Cengage India, 2024.

Reference Books:

1. Srinivasan R., Mohammed Ismail, Arulmozhi Srinivasan. *Design Thinking: Principles, Processes and Applications*, S Chand Publishing, 2025.

I B.Tech. II Semester

A9002 – Ordinary Differential Equations and Vector Calculus

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	15	0	60	120	4	40	60	100

Course Description

Course Overview

This course provides the fundamental mathematical concepts and techniques essential for engineering applications. In this course, the students are acquainted with ordinary differential equations of first and higher order and Laplace transforms, vector calculus. The course is designed to build conceptual clarity and problem-solving skills, with emphasis on both theoretical understanding and practical applications.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9002.1. Make use of first order differential equations to solve real world problems.

A9002.2. Solve ordinary differential equations of higher order.

A9002.3. Apply Laplace transforms to solve ordinary differential equations.

A9002.4. Determine divergence and curl of a vector point function.

A9002.5. Compute line, surface, and volume integrals and convert them into one another using appropriate theorems.

Course Syllabus

Unit-I:

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

Unit-II:

Ordinary Differential Equations of Higher Order: Higher order linear differential equations with constant coefficients: Non-homogeneous terms of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)$ and $xV(x)$, method of variation of parameters.

Unit-III:

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Laplace transforms of functions multiplied by 't' and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

Unit-IV:

Vector Differentiation: Vector point functions and scalar point functions, Gradient, Directional derivatives, Divergence and Curl, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

Unit-V:

Vector Integration: Line integral, Surface integral and Volume Integral. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Books and Materials

Text Books:

1. Grewal, B. S. *Higher Engineering Mathematics*, 43rd ed., Khanna Publications, 2015.
2. Jain, R. K., Iyengar, S. R. K. *Advanced Engineering Mathematics*, 5th ed., Narosa Publishing House, 2016.

Reference Books:

1. Raisinghania M.D. *Ordinary and Partial Differential Equations* , 20th ed., S. Chand Publishing, 2024.
2. Greenberg Michael D.*Advanced Engineering Mathematics*, 2nd ed., Upper Saddle River, N.J. Prentice Hall, 1998.
3. Kreyszig, E. *Advanced Engineering Mathematics*, 9th ed., John Wiley & Sons, 2006.
4. Ramana, B. V. *Higher Engineering Mathematics*, 32nd edition reprint, McGraw Hill Education (India), 2018.

A9007 – Engineering Physics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

The Engineering Physics course introduces the fundamental principles of quantum mechanics, semiconductor physics, quantum computing, magnetic and dielectric materials, as well as lasers and fibre optics. Students will explore theoretical foundations, material properties, and device concepts alongside their practical applications in modern technologies such as electronics, communication, sensing, and computing systems. This course bridges core physics concepts with real-world innovations, preparing learners for advanced studies and research in emerging technologies.

Course Pre/Co-requisites

This course has no specific prerequisites and co requisites.

Relevant Sustainable Development Goals (SDGs)

SDG 7: Affordable and Clean Energy
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9007.1. Apply quantum mechanical principles to understand the particle behavior and formation of energy bands in solids.

A9007.2. Analyze semiconductor properties and explain the operation of P–N junction diode and their applications.

A9007.3. Apply quantum gates to design quantum circuits and implement fundamental quantum algorithms.

A9007.4. Analyze magnetic and dielectric properties relevant to modern technological applications.

A9007.5. Apply laser and fibre optic principles to communication and sensing technologies.

Course Syllabus

Unit-I:

Quantum Mechanics: Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of band gap, classification of solids, concept of discrete energy levels.

Unit-II:

Semiconductor Physics: Intrinsic semiconductors, density of states, Fermi-Dirac distribution function, carrier concentration in intrinsic semiconductors, direct and indirect band gap semiconductors, extrinsic semiconductors, characteristics of P-N junction diode, applications: Light Emitting Diode (LED), solar cell, Hall effect.

Unit-III:

Quantum Computing: Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates (Hadamard, CNOT, Toffoli), challenges and advantages of quantum computing over classical computation, Introduction to quantum algorithms: Deutsch-Jozsa, Shor, Grover (Qualitative).

Unit-IV:

Magnetic and Dielectric Properties: Introduction to magnetic materials, origin of magnetic moment, classification of magnetic materials (dia, para, ferro), Weiss domain theory of ferromagnetism, hysteresis, soft and hard magnetic materials, applications: magnets for EV, Giant Magneto Resistance (GMR) device. Introduction to dielectric materials, types of polarization (qualitative): electronic, ionic & orientational; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

Unit-V:

Lasers and Fibre Optics: Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle. Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibres, applications: optical fibre for communication system, sensor for structural health monitoring.

Books and Materials

Text Books:

1. T. Vijaya Krishna, T. Madhu Mohan, B.K. Pandey, Manoj K. Harbola, and S. Chaturvedi. *Physics for Engineers.* 2nd ed., Cengage, 2024.
2. M. N. Avadhanulu, P. G. Kshirsagar, and T. V. S. Arun Murthy. *A Textbook of Engineering Physics.* 13th ed., S. Chand & Company Pvt. Ltd., 2023.
3. Thomas G. Wong. *Introduction to Classical and Quantum Computing.* Rooted Grove.

Reference Books:

1. Jozef Gruska. *Quantum Computing.* McGraw Hill Education, 1999.
2. Michael A. Nielsen and Isaac L. Chuang. *Quantum Computation and Quantum Information.* Cambridge University Press, 2010.
3. John M. Senior. *Optical Fiber Communications: Principles and Practice.* Pearson Education Limited, 2009.

A9101 – Engineering Geology

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces students to the fundamental principles of geology and their critical applications in construction and infrastructure development. It enables students to understand the significance of geological studies in site selection, material identification, and hazard mitigation. The course covers the classification and identification of minerals and rocks, interpretation of geological structures, analysis of natural hazards such as earthquakes and landslides, and the application of geophysical methods for subsurface exploration. Additionally, it emphasizes the geological considerations essential for the safe and sustainable design of dams, reservoirs, and tunnels, thereby equipping students with the necessary geological insight for effective civil engineering practice.

Course Pre/Co-requisites

The course has no specific pre-requisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 7: Affordable and Clean Energy

SDG 9: Industry, Innovation, and Infrastructure

SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9101.1. Illustrate the significance of geology in civil engineering and identify minerals based on physical properties.

A9101.2. Classify the rocks based on their megascopic properties.

A9101.3. Identify and interpret geological structures such as folds, faults, joints, and unconformities with reference to their impact on construction projects.

A9101.4. Analyze the causes and effects of earthquakes and landslides, and explain the working principles and applications of geophysical methods in civil engineering.

A9101.5. Evaluate geological considerations related to the selection and stability of dam, reservoir, and tunnel sites.

Course Syllabus

Unit-I:

Introduction: Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.

Weathering: Weathering and its types, agents, and engineering significance.

Mineralogy: Importance of study of minerals, Different methods of study of minerals. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of common rock forming minerals and Economic minerals.

Unit-II:

Petrology: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Formation, types, common structures and textures of igneous, Sedimentary and metamorphic rocks and their distinguishing features. Megascopic study of Granite, Dolerite, Basalt, Pegmatite, Charnockite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

Unit-III:

Structural Geology: Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults, unconformities, and joints - parts, types, mechanism and their importance in Civil Engineering.

Unit-IV:

Earthquakes and Landslides: Earthquakes, their causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, their causes and effect, measures to be taken to prevent their occurrence.

Importance of Geophysical Studies: Principles of geophysical study by Gravity methods, Magnetic methods, Electrical methods, Seismic methods, Radio metric methods and geothermal method.

Unit-V:

Geology of Dams, Reservoirs and Tunnels: Types of dams, Geological Considerations in the selection of a dam site. Analysis of past dam failures. Factors contributing in the success of a reservoir. Life of reservoirs. Purposes of tunnelling, Effects of Tunnelling on the ground. Role of Geological Considerations (i.e. Lithological, structural and ground water) in tunnelling.

Books and Materials

Text Books:

1. Chennakesavulu, N. *Engineering Geology.* 3rd ed., Laxmi Publications Pvt. Ltd, 2018.
2. Reddy, D. Venkat. *Engineering Geology.* 2nd ed., revised., Vikas Publishing House, Dec. 2016.

Reference Books:

1. Varghese, P. C. *Engineering Geology for Civil Engineers.* 3rd ed., PHI Learning Pvt. Ltd, 2012.
2. Gokhale, K. V. G. K. *Principles of Engineering Geology.* 3rd ed., B. S. Publications, 2010.

A9102 – Applied Mechanics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course is an introduction to learning and applying the principles of physics to solve engineering problems. It deals with the laws of mechanics to analyze forces, moments, motion of rigid bodies, locate centroid, centre of gravity, compute moment of inertia of standard and composite sections. This course also explains kinetics and kinematics of rigid bodies, impulse, centroidal motion and plane motion of rigid bodies.

Course Pre/Co-requisites

The course has no specific pre-requisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9102.1. Apply the laws of mechanics to evaluate different types of forces and moments acting on a rigid body.

A9102.2. Solve problem of bodies subjected to friction.

A9102.3. Determine centroid and centre of gravity of standard and composite sections.

A9102.4. Evaluate area moment of inertia of standard and composite sections.

A9102.5. Utilise principles of kinematics and kinetics to solve numerical problems.

Course Syllabus

Unit-I:

Introduction to Applied Mechanics: Introduction to Applied Mechanics–Basic Concepts- Principle of Transmissibility of forces- Resultants of Force System: Parallelogram law– Law of Parallelogram of Forces- Forces and components- Resultant of coplanar Concurrent Forces- Lami's theorem– Moment of Force– principle of moments– Coplanar Applications– Couple– characteristics of couple. Equilibrium of Force Systems: Free Body Diagrams, Equations of Equilibrium.

Unit-II:

Friction: Types of Friction - Limiting friction - Laws of friction - Equilibrium of bodies on rough horizontal and inclined planes - Equilibrium of connected bodies on rough horizontal and inclined planes.

Unit-III:

Centroid and Centre of Gravity: Introduction - Centroid - Centroids of lines, areas and volumes – Centroids of composite areas - Centre of gravity of bodies.

Unit-IV:

Area Moment of Inertia: Introduction - Inertia - Inertia of areas - Radius of gyration - Polar moment of inertia - Parallel axis theorem – Perpendicular axis theorem - Moment of inertia of standard sections and composite sections.

Unit-V:

Dynamics of Rigid Bodies: Types of motion, Work Energy Equation- Conservation of energy, Impulse and Momentum principle-Direct Central Collisions-Coefficient of Restitution-D'Alembert's principle.

Books and Materials

Text Books:

1. Tayal, A. K. *Engineering Mechanics: Statics and Dynamics.* 14th ed., Umesh Publications, 2019.
2. Bhavikatti, S. S., and K. G. Rajashekarappa. *Engineering Mechanics.* 9th ed., New Age International, 2024.

Reference Books:

1. Timoshenko, S. P., and D. H. Young. *Engineering Mechanics.* 5th ed., McGraw-Hill International, 1983.
2. Hibbeler, R. C. *Engineering Mechanics.* 12th ed., Prentice Hall, 2009.

A9103 – Building Materials, Construction and Planning

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course helps students understand the fundamentals of building construction with emphasis on materials, components, and standard dimensions of a building. It covers traditional and modern construction materials including timber, steel, aluminium, and sustainable options like fly ash, GGBS, bamboo, and recycled aggregates. It also deals with the various components of the buildings as well as planning of various buildings. It covers building bye laws which plays vital role in planning of a building.

Course Pre/Co-requisites

The course has no specific pre-requisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9103.1. Identify different masonry construction.
A9103.2. Make use of advanced materials for sustainable environment.
A9103.3. Explain the functional requirements of building components and finishing works.
A9103.4. Interpret building bye-laws and regulations.
A9103.5. Plan different types of buildings including their service and safety.

Course Syllabus

Unit-I:

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls: load bearing, partition walls, cavity walls. Manufacturing of clay bricks, Field and laboratory tests on bricks.

Concrete blocks: Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.

Unit-II:

Timber, Steel, Aluminium: Timber-Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, ply wood and its uses. Types of steel-mild steel, high carbon steel, high strength steel properties and uses, light Guage steel, commercial forms of steel and aluminium and their uses.

Sustainable Materials: Introduction to sustainability, importance of sustainable materials, Fly ash, GGBS, Micro Silica, recycled aggregate, Bamboo, Metakaolin, lime stone calcined clay cement, waste plastic.

Unit-III:

Building Components: Lintels, Arches, and stair cases. Coupled Roof, Collar Roofs, King and Queen Post Trusses. Panelled and glazed door, glazed and Panelled windows.

Formwork and Finishings: Form work, Under Pinning and scaffolding. Damp proofing, Plastering, Pointing, White washing, Painting, Constituents of paint, Types of paints, Painting of old Wood and Varnish.

Unit-IV:

Building Byelaws and Regulations: Introduction, Terminology, Principles of Planning, Objectives of building byelaws, Floor area ratio (FAR) and Floor space Index (FSI), Principles underlying building byelaws, Open spaces requirement, built up area limitations, Height of Buildings, Wall thickness, lighting, and ventilation requirement.

Unit-V:

Building Planning: Site selection for residential and commercial building construction, Orientation of building, Classification of buildings, characteristics of various types of residential buildings, Planning and requirements of educational institutions, hospitals, Office buildings, Cinema Hall and hotels.

Service and Safety requirements of Buildings: Damping causes, its effects, and Proofing techniques; Fire hazards, protection, and grading rules; Methods of thermal insulation and materials used.

Books and Materials

Text Books:

1. S.K. Duggal. *Building Materials.* 4th ed., New Age International Publishers., 2012.
2. Kumaraswamy, N., and A. Kameswara Rao. *Building Planning and Drawing.*. 9th ed., revised & enlarged, Charotar Publishing House Pvt. Ltd., 2023.
3. Punmia, B. C., Ashok Kumar Jain, and Arun Kumar Jain. *Building Construction.* 12th ed., Laxmi Publications (P) Ltd., 2023.

Reference Books:

1. SP 7: 2016 *National Building Code of India* 2016.

A9008 – Engineering Physics Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

The Engineering Physics laboratory course provides hands-on experience with fundamental concepts in semiconductors, magnetism, optics, and wave phenomena. Students will conduct practical experiments including the I-V characteristics of LEDs and solar cells, Hall effect measurements, and determination of energy band gaps. The course also covers the analysis of magnetic and dielectric properties, measurement of laser wavelength, characterization of optical fibre parameters, and AC frequency determination using a sonometer. These experiments are designed to enhance conceptual understanding and develop experimental skills relevant to modern physics and engineering applications.

Course Pre/Co-requisites

This course has no specific pre-requisites and co-requisites.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 7: Affordable and Clean Energy
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9008.1. Determine key parameters of LEDs and solar cells from their I–V characteristics.

A9008.2. Apply the Hall Effect to determine the type of semiconductor and estimate the density of majority charge carriers.

A9008.3. Evaluate material properties including energy band gap, magnetic moment, dielectric constant, and magnetic hysteresis behavior.

A9008.4. Apply the principles of lasers and optical fibres to determine laser wavelength and Numerical Aperture.

A9008.5. Apply principles of mechanical waves to determine AC supply frequency.

Course Syllabus

List of Experiments:

1. Determination of threshold voltage of LED from its I-V characteristics.
2. Study the I-V characteristics of Solar cell and find the fill factor.
3. Verification of the type of semiconductor material by estimating the density of majority carriers using the Hall Effect.
4. Determination of the energy band gap of a given semiconductor.
5. Determine the Magnetic moment of a given magnet and Horizontal component of earth's magnetic field.
6. Study of B-H curve of a ferromagnetic material.
7. Determination of dielectric constant of a given material.
8. Determination of the wavelength of a laser source using a plane transmission grating.

9. Evaluation of the numerical aperture (NA) and acceptance angle of a given optical fibre.
10. Determination of the frequency of an AC supply using a sonometer.

Laboratory Equipment/Software/Tools Required:

1. Light Emitting Diode Kit
2. Solar Cell Kit
3. Hall Effect Setup
4. Energy Gap of a Semiconductor Kit
5. Magnetic Moment Setup
6. B-H Curve Kit
7. Dielectric Constant Setup
8. Semiconductor Diode Laser
9. Plane Diffraction Grating
10. Optical Fibre Trainer Kit
11. Sonometer Setup
12. Meters – Ammeter, Voltmeter, Digital Multimeter, Deflecting Magnetometer, Thermometers

Books and Materials

Text Books:

1. Jain, Sushil Kumar, and Manjeet Singh *Applied Physics Experiments*, JBC Press, 2013.

Reference Books:

1. Mal, S. B., and Er. Ashish Jesuja *Practical Physics for Engineering Students of B.Tech*, JBC Press, 2020.

A9104 – Engineering Geology Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course emphasizes on the study of various types of rock formation and its physical properties. Topics such as rocks and minerals, soils, and earthquake activities are discussed with special reference to local geological problems. This lab course also focuses on physical properties of minerals.

Course Pre/Co-requisites

A9101 – Engineering Geology

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 7: Affordable and Clean Energy
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9104.1. Identify and describe common minerals based on their physical properties.

A9104.2. Understand the different types of minerals used in the industries.

A9104.3. Identify and classify rocks through megascopic examination.

A9104.4. Interpret geological maps and draw geological sections.

A9104.5. Solve simple Structural Geology problems.

Course Syllabus

List of Experiments:

1. Study of Physical properties and description of minerals.
2. Study of physical properties and identification of Silicate Minerals – Rock Forming.
3. Study of physical properties and identification of Silicate Minerals – Microcrystalline / Fibrous Varieties.
4. Study of physical properties and identification of Carbonate & Other Non-Metallic Minerals.
5. Study of physical properties and identification of Metallic Ore Minerals.
6. Megascopic description and identification of igneous rocks.
7. Megascopic description and identification of sedimentary rocks.
8. Megascopic description and identification of metamorphic rocks.
9. Study of geological maps.
10. Interpretation and drawing of sections from geological maps showing tilted beds, faults, unconformities etc.
11. Simple Structural Geology problems.
12. Simple strike and Dip problems.

Laboratory Equipment/Software/Tools Required:

1. Minerals
2. Igneous rocks
3. Sedimentary rocks
4. Metamorphic rocks
5. Geological Maps

Books and Materials

Text Books:

1. Chennakesavulu, N. *Engineering Geology.* 3rd ed., Laxmi Publications Pvt. Ltd., 2018.
2. Reddy, D. Venkat. *Engineering Geology.* 2nd ed., revised, Vikas Publishing House, Dec. 2016.

Reference Books:

1. Varghese, P. C. *Engineering Geology for Civil Engineers.* 3rd ed., PHI Learning Pvt. Ltd., 2012.
2. Gokhale, K. V. G. K. *Principles of Engineering Geology.* 3rd ed., B. S. Publications, 2010.

A9304 - Computer Aided Engineering Graphics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course provides students from diverse engineering disciplines with essential skills in computer-aided engineering drawing using AutoCAD. It focuses on the fundamentals of constructing two-dimensional geometric objects, understanding orthographic projections of points, lines, planes, and solids, and applying isometric projections. Students will learn to use AutoCAD tools such as Draw, Modify, Layers, and Dimensioning to create technically accurate drawings aligned with engineering standards. The course emphasizes practical applications relevant to civil, electrical, electronics, and other engineering fields, enabling students to visualize, interpret, and communicate design concepts effectively.

Course Pre/Co-requisites

This course has no specific pre-requisites and co-requisites.

Relevant Sustainable Development Goals (SDG(s))

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

SDG 12: Responsible Consumption and Production

Course Outcomes

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

A9304.1. Analyze the basic drawing and editing tools to create and modify 2D sketches.

A9304.2. Interpret the projection principles to draw points and lines in different quadrants.

A9304.3. Compare the projected views of planes to identify their true shape and inclination.

A9304.4. Apply the orthographic projection principles to construct two-dimensional views of solids.

A9304.5. Construct isometric views by applying principles derived from orthographic drawings.

Course Syllabus

Unit-I:

Introduction to AutoCAD: User Interface and Workspace Customization, Basic Drawing Tools, Modify and Editing Tools, Properties and Object Management, Layer Management, Dimensioning and Annotation, Layouts and Plotting, Geometrical construction of two-dimensional objects.

Unit-II:

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants. Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Unit-III:

Projections of Planes: Regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

Unit-IV:

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Unit-V:

Isometric Projections: Isometric coordinates, Isometric Scale, Isometric Views of Lines, Planes and solids. Conversion of Isometric View to Orthographic View and Vice-versa.

Books and Materials

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., *Engineering Drawing*, 53rd Edition, Charotar Publishing House, 2019.
2. K. Balaveera Reddy et al, *Computer Aided Engineering Drawing*, 2nd Edition, CBS Publications, 2015.

Reference Books:

1. Narayana, K.L. & P Kannaiah, *Text book on Engineering Drawing*, 3rd Edition, Sci-Tech Publishers, 2020.
2. Basant Agrawal B. and Agrawal C. M., *Engineering Graphics*, 3rd Edition, TMH Publication, 2020.
3. Shah, M.B., Rana B.C., *Engineering Drawing and Computer Graphics*, 2nd Edition, Pearson Education, 2009.

A9022 - Product Design and Development

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	0	45	45	1	40	60	100

Course Description

Course Overview

This course equips students with a community-focused approach to product design, taking them from initial concept to a refined, practical solution. They will learn core design principles, understand the product development life cycle, and explore essential hardware and software tools through curated resources. Students will engage in prototyping, testing, and iterative refinement using feedback from community partners, ensuring sustainability and user-centered results. The course also develops their ability to document and communicate designs effectively, including preparing detailed specifications and user manuals.

Course Pre/Co-requisites

A9021 - Community Centered Design Thinking

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production

Course Outcomes

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

A9022.1. Explain the principles of product design and the product development life cycle, with an emphasis on addressing real-world community needs

A9022.2. Generate and evaluate innovative product concepts using relevant Hardware and Software design tools

A9022.3. Develop functional prototypes using appropriate prototyping tools, and perform initial testing and validation

A9022.4. Refine prototypes through iterative feedback loops, integrating sustainability and user-centered design principles

A9022.5. Document and communicate product designs effectively with comprehensive specifications and user manuals tailored for community stakeholders

Course Syllabus

Unit-I:

Introduction to Product Design for Community Need: Understanding the principles and significance of product design, product development life cycle. Communicating design concepts to community partner. Refining designs based on feedback.

Unit-II:

Product Development Skills: Identify & Develop proficiency in using relevant Hardware & Software design tools. Equip with curated resources on tools essential for managing and scaling products effectively.

Unit-III:

Prototype & Testing: Introducing the concepts and purpose of prototyping. Creating functional prototypes to represent product designs using appropriate tools and techniques. Testing prototypes for performance, usability, and alignment with design goals.

Unit-IV:

Iterative Refinement: Refinement of prototypes based on community partner feedback and verification of product sustainability, with integration of user-centered design principles to align with community needs and expectations.

Unit-V:

Documentation and Communication Strategies: Documenting product designs with detailed specifications, Effective communication strategies for conveying designs to community partners, Preparation of user manuals and documentation for community partners.

Activity Plan

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
1	Unit-I: Intro to Product Design	Understand product design principles & life cycle	Concept briefing	Case study analysis of successful community-based product	Short reflection: "Importance of product design for communities"	CO1
2	Unit-I: Intro to Product Design	Identify community needs & build empathy	Concept briefing + Fieldwork preparation	Practice empathy mapping, mock survey in class	Conduct 3–5 interviews/surveys with stakeholders	CO1, CO2
3	Unit-I: Intro to Product Design	Define problem statements	Guided teamwork + Brainstorm session	Develop "How Might We" questions, prioritize opportunities	Submit refined problem statement document	CO1, CO2
4	Unit-II: Product Development Skills	Generate diverse concepts	Creativity Hands-on Session (SCAMPER, Role-storming)	Group ideation, sketching concepts	Sketchbook submission (min. 10 ideas)	CO2
5	Unit-II: Product Development Skills	Apply digital design tools	Hands-on training + Peer support	Practice in Figma / SolidWorks / TinkerCAD	Submit wireframes / 3D sketches	CO2
6	Unit-II: Product Development Skills	Evaluate concepts systematically	Evaluation + User testing demo	Apply Pugh method to concepts, gather peer feedback	Submit evaluation matrix + selected final concept	CO2, CO3

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
7	Unit-III: Prototype & Testing	Build low-fidelity prototype	Practical lab session + Peer feedback	Teams construct basic prototypes from cardboard/foam	Submit prototype photos + reflection	CO3
8	Unit-III: Prototype & Testing	Develop high-fidelity prototype	Prototype building - Hands-on Session	Create working model with core functionality	Submit tested prototype (video evidence optional)	CO3
9	Unit-IV: Iterative Refinement	Collect & apply user/community feedback	User feedback roundtable	Usability testing with peers/partners	Submit iteration log with design changes	CO4
10	Unit-IV: Iterative Refinement	Refine based on sustainability & ergonomics	Fine-tuning activity	Refine materials, safety, visual design, ergonomics	Submit refined prototype design brief	CO4
11	Unit-V: Documentation	Document & communicate design	Documentation + Visual design session	Create instruction guides, packaging design, visuals	Draft user manual (Canva/InDesign optional)	CO5
12	Unit-V: Communication Strategies	Present & reflect on outcomes	Final Showcase	Final presentations: video demos, posters, product showcase	Final report, user manual, and presentation	CO5

Books and Materials

Text Books:

1. Pavan Soni. *Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving*, Penguin Random House India, 2024.
2. Anuja Agarwal. *Design Thinking: A Framework for Applying Design Thinking in Problem Solving*, Cengage India, 2024.

Reference Books:

1. Shalini Rahul Tiwari, Rohit Rajendra Swarup. *Design Thinking: A Comprehensive Textbook*, Wiley India, 2023.
2. Srinivasan R., Mohammed Ismail, Arulmozhi Srinivasan. *A Textbook on Design Thinking: Principles, Processes and Applications*, reprint, S. Chand Publishing, 2025.

II B.Tech. I Semester

A9014 - Business Economics and Financial Analysis

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the fundamentals of Business Economics and Financial Analysis, covering business structures, economic concepts, demand and supply analysis, production and cost, market structures, and pricing. It also focuses on accounting principles, preparation of financial statements, ratio analysis, and capital budgeting methods to support effective financial decision-making.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation, and Infrastructure
SDG 17: Partnerships for the Goals

Course Outcomes

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

A9014.1. Analyze business and economic concepts to assess their impact on the overall economic environment.

A9014.2. Examine the relationship between demand, supply, and elasticity in understanding market behavior.

A9014.3. Apply production, cost, market structure, and pricing concepts to interpret business operations and competitive strategies.

A9014.4. Apply accounting principles and rules for preparing financial statements.

A9014.5. Analyze financial statements and capital budgeting techniques to evaluate the financial health of a business.

Course Syllabus

Unit-I:

Introduction to Business and Economics: Business-Structure of Business Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for company – Conventional and Non-Conventional. Economics-Significance of Economics, Micro and Macro Economic Concepts. Business Economics- Nature and Scope, Role of Business Economist. National Income-Concepts and Importance, Inflation and Money Supply. Business Cycle -Features and Phases.

Unit-II:

Demand and Supply Analysis: Demand-Function, Determinants and types. Law of Demand-Assumption and Exceptions. Elasticity of Demand- Types, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand. Demand Forecasting- Methods of Demand Forecasting. Supply Analysis-Functions, Determinants and Law of Supply.

Unit-III:

Production, Cost, Market Structures & Pricing: Production Analysis- Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale. Cost analysis: Types of Costs, Short run and Long run Costs Break Even Analysis (simple problems). Market Structure: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing-Types of Pricing, Product Life Cycle based Pricing,

Unit-IV:

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

Unit-V:

Ratios Analysis and Capital Budgeting: Concept of Ratio Analysis, Importance and Types of Ratios- Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios– Analysis and Interpretation. Capital Budgeting – Capital, Types of capital, Capital Budgeting Methods (Simple Problems).

Books and Materials

Text Books:

1. D. Chaturvedi, S. L. Gupta. *Business Economics Theory and Applications* 4th ed., Interna tional Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri. *Financial Accounting*, 3rd ed., Tata Mc–Graw Hill, 2011.

Reference Books:

1. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury. *Managerial Economics*, 2nd ed., Tata Mc Graw Hill Education Pvt. Ltd. 2012.
2. A.R. Aryasri, *Managerial Economics and Financial Analysis*, 9th ed., TMH, India, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury. *Managerial Economics*, 2nd ed., Tata Mc Graw Hill Education Pvt. Ltd. 2012.

A9105 – Concrete Technology

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides comprehensive knowledge of concrete technology, including the properties and behaviour of materials used in concrete. Students will learn about cement, aggregates, admixtures, and the characteristics of fresh and hardened concrete. The course covers mix design, testing methods, and the use of special concretes for advanced construction needs, preparing students for quality control and innovation in concrete applications.

Course Pre/Co-requisites

A9103 - Building Materials, Construction and Planning

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9105.1. Identify Quality Control tests on concrete making materials.

A9105.2. Evaluate the workability of fresh concrete through various tests.

A9105.3. Determine the mechanical strength properties of hardened concrete.

A9105.4. Determine the durability properties of concrete.

A9105.5. Design concrete mixes as per IS code and explore special concretes for construction.

Course Syllabus

Unit-I:

Cement: Portland cement- chemical composition- Hydration of cement -Structure of Hydrated cement- test on physical properties- Different grades of cement.

Aggregates: Classification of aggregate- Physical and Mechanical Properties of Aggregates-Deleterious substances in aggregate- Soundness of aggregate- Alkali aggregate reaction- Thermal properties of Aggregates-Grading of Aggregates-Sieve Analysis—Standard Grading Curves.

Admixtures: Types of admixtures- mineral and chemical admixtures- properties-dosages-effects - usage.

Unit-II:

Fresh Concrete: Workability- Factors affecting workability Measurement of workability by different tests-Setting times of concrete- Effect of time and temperature on workability- Segregation & bleeding Mixing and vibration of concrete- steps in manufacture of concrete- Quality of mixing water.

Unit-III:

Hardened Concrete: Water/cement ratio- Gel space ratio- Nature of strength of concrete-Maturity concept-Strength in tension & compression- Factors affecting strength – Relation between compression & tensile strength-Curing of concrete and different curing methods.

Tests on Hardened Concrete: Compression tests- Tension tests - Factors affecting strength of concrete - flexure tests- Split tensile test - Non-destructive testing methods- Codal provisions for NDT.

Unit-IV:

Elasticity, Creep and Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep– Effects of creep – Shrinkage – types of shrinkage.

Durability of Concrete: Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack.

Unit-V:

Mix Design: Factors, the choice of mix proportions- Quality Control of concrete- Statistical Quality Control- Acceptance criteria- Proportioning of concrete mix by normal by using BIS method.

Special Concrete: Introduction to Lightweight concrete-No-fines Concrete- Fiber reinforced concrete Polymer concrete- Self-compacting concrete -Geopolymer Concrete-High Performance Concrete.

Books and Materials

Text Books:

1. Shetty, M.S., and A.K. Jain. *Concrete Technology: Theory and Practice.* 8th ed., S. Chand Publishing, 2019.
2. Neville, A.M., and J.J. Brooks. Rajashekarappa. *Concrete Technology.* 2nd ed., Pearson Education Limited, 2010.

Reference Books:

1. Thomas, Job. *Concrete Technology.* 2nd ed., Cengage Learning India Pvt. Ltd., 2015.
2. Gambhir, M.L. *Concrete Technology: Theory and Practice.* 5th ed., Tata McGraw-Hill Education India Pvt. Ltd., 2017.

A9106 – Strength of Materials

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	15	0	60	120	4	40	60	100

Course Description

Course Overview

This course primarily deals with the internal resistance mechanism of material when it is subjected to external loading. This course begins with simple stresses and strains; and relationship between elastic properties of materials. Then it covers the shear force and bending moment diagrams for different support conditions under different loading conditions. Later, it deals with flexural stress, shear stress, and deflection of the beams; and principal stresses in bars.

Course Pre/Co-requisites

A9102 – Applied Mechanics

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9106.1. Explain concepts and principles related to the strength of materials.

A9106.2. Develop shear force and bending moment diagrams of beams for different support conditions.

A9106.3. Apply theory of simple bending and shear stress concepts on various sections.

A9106.4. Analyse beams for slope and deflections using different methods.

A9106.5. Estimate the principal stresses using analytical and graphical methods.

Course Syllabus

Unit-I:

Simple Stresses and Strains: Concept of stress and strain- St. Venant's Principle-Stress and Strain Diagram– Elasticity and plasticity– Types of stresses and strains- Hooke's law– stress– strain diagram for mild steel– Working stress– Factor of safety– Lateral strain, Poisson's ratio and volumetric strain– Elastic moduli, Elastic constants and the relationship between them– Bars of varying section– composite bars– Temperature stresses. **Strain Energy:** Resilience– Gradual, sudden, and impact loadings– simple applications.

Unit-II:

Shear Force and Bending Moment: Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) for cantilever, simply supported and overhanging beams subjected to point loads, Uniformly distributed loads, uniformly varying loads, Point of contraflexure, Relation between Shear force (S.F), Bending Moment (B.M) and rate of loading at a section of a beam.

Unit-III:

Theory of Simple Bending: Theory of simple bending– Assumptions– Derivation of bending equation– Section Modulus– Determination of flexural/bending stresses of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections– Design of simple beam sections.

Shear Stresses: Derivation of formula for shear stress distribution Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle and channel sections.

Unit-IV:

Slope and Deflection: Slope, deflection and radius of curvature– Differential equation for the elastic line of a beam– Double integration and Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, Uniformly distributed loads, Uniformly varying load– Mohr's theorems– Moment area method– Application to simple cases.

Unit-V:

Principal Stresses: Introduction– Stresses on an oblique plane of a bar under axial loading– Normal and tangential stresses on an inclined plane for biaxial stresses– Two perpendicular normal stresses accompanied by a state of simple shear– Principal stresses– Mohr's circle of stresses– Analytical and graphical solutions.

Books and Materials

Text Books:

1. Bansal, R. K. *A Textbook of Strength of Materials.* 6th ed., Laxmi Publishers, Hyderabad, 2015.
2. Prakash Rao. *Introduction to Strength of Materials.* University Press, New Delhi, 2009.

Reference Books:

1. Beer, F. P., et al. *Mechanics of Materials.* 7th ed., McGraw-Hill, 2014.
2. Shames, Irving H. *Introduction to Solid Mechanics.* 3rd ed., PHI Learning Pvt. Ltd., New Delhi, 2009.
3. Kazimi, S. M. A. *Solid Mechanics.* 1st ed., Tata McGraw-Hill Publishing Company, New Delhi, 2009.

A9107 – Surveying and Geomatics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides fundamental and advanced knowledge of surveying techniques, tools, and methods, covering chain, compass, levelling, theodolite, tacheometry, trigonometric levelling, curves, and modern technologies like Total Station, GPS, Remote Sensing, and GIS.

Course Pre/Co-requisites

A9102 - Applied Mechanics

A9304 - Computer Aided Engineering Graphics

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9107.1. Understand the basics and principles of chain and compass surveying.

A9107.2. Apply levelling techniques to determine elevations and compute earthwork quantities.

A9107.3. Make use of theodolite and tacheometer for angle and distance measurements.

A9107.4. Apply trigonometric methods for height and distance measurements and curve setting.

A9107.5. Utilze advanced tools like Total Station, GPS, Remote Sensing, and GIS in surveying.

Course Syllabus

Unit-I:

Introduction: Introduction to surveying – objectives – classification – principles of surveying. Chain Surveying: Introduction to Chain surveying, Instruments for chaining, obstacles in chaining, errors, corrections in chaining, problems.

Compass Surveying: Introduction to compass surveying, Types of compasses, Designation of bearings, Calculation of included angles from bearings, Traversing, Local attraction, Errors and corrections, problems.

Unit-II:

Levelling: Introduction to Levelling, Types of levelling, Benchmark, Temporary and permanent adjustments, arithmetic checks, Height of instrument method, Rise and fall method, Fly levelling, longitudinal levelling, Cross-sectional levelling, plotting, Errors.

Areas and Volumes: Calculation of areas and volumes, Earthwork, Alignment of Hill roads.

Unit-III:

Theodolite and Tacheometer: Temporary and permanent adjustments of theodolite, Measurement of horizontal angle, Method of repetition and reiteration, Measurement of vertical angle, Principle of tachometry, Determination of stadia constants.

Unit-IV:

Trigonometric Levelling: Heights and distances of accessible and inaccessible objects - Instrument and object are in the same and different vertical planes.

Curves: Types of curves - Elements of simple curves - Methods of setting simple curves, Rankine's method, Two theodolite method.

Unit-V:

Introduction to Advanced Surveying: Total station – introduction – Application –Component parts – Accessories used – Features – characteristics – Electronic Display and data reading – field procedure for coordinate measurement. Remote Sensing, Global Positioning System (GPS), and Geographic Information System (GIS).

Books and Materials

Text Books:

1. Subramanian, R. *Surveying and Levelling.* 2nd ed., Oxford University Press, 2012.
2. Chandra, A. M. *Higher Surveying.* 4th ed., New Age International, 2024.

Reference Books:

1. Gopi, Satheesh, R. Sathikumar, and N. Madhu. *Advanced Surveying: Total Station, GPS, GIS and Remote Sensing.* 2nd ed., McGraw-Hill (Pearson Education in South Asia), 2018.
2. Punmia, B. C., Ashok K. Jain, and Arun K. Jain. *Surveying, Vol. I & II.* 16th ed., reprint, Laxmi Publications Pvt. Ltd., New Delhi, 2018.
3. Arora, K. R. *Surveying, Vol. II.* 15th ed., Standard Book House, Delhi, 2018.

A9108 – Fluid Mechanics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

Fluid mechanics is the fundamental course of Civil Engineering, which deals with fluid's mechanical principles and applications with mathematical descriptions. The course is useful in understanding and providing solutions to many scientific and technological problems including chemical and industrial processes of mechanical systems. The course covers fluid statics (fluids at rest), fluid kinematics (fluids in motion) and fluid dynamics (effect of forces on fluid motion). After completion of the course, the students will understand the principles of Fluid Mechanics and will be able to apply, analyze and evaluate fluid mechanical systems.

Course Pre/Co-requisites

The course has no specific pre-requisite and co-requisite

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9108.1. Outline the properties of fluids and pressures associated with fluids.

A9108.2. Interpret key concepts of fluid kinematics and dynamics to solve problems in a fluid flow.

A9108.3. Apply Bernoulli's equation to study flow measurements in pipes, notches, and weirs.

A9108.4. Examine flows and losses through pipes.

A9108.5. Analyse the boundary layer effect on the laws of fluid.

Course Syllabus

Unit-I:

Properties of Fluids: Introduction to fluids, distinction between a fluid and solid, Properties of fluids-mass density, weight density, specific gravity, specific volume, viscosity, boiling point, compressibility and bulk modulus, surface tension, capillarity, vapour pressure, cavitation, and their influences on fluid motion, Classification of fluids: Newtonian and Non- Newtonian fluids, Newton's law of Viscosity and applications. Fluid Statics: Concept of pressure - atmospheric, gauge and vacuum pressure. Measurement of Pressure-simple Manometers, differential Manometers. Concept of free surface. Fluid pressure at a point, Pascal's law, pressure variation in a fluid at rest, Hydrostatic law. Total pressure and center of pressure, Hydrostatic forces on submerged planes - Horizontal, Vertical, inclined and curved surfaces, Principle of Buoyancy-metacentric height, conditions of Equilibrium.

Unit-II:

Fluid Kinematics: Classification of fluid flows: Steady-Unsteady, Uniform-Non uniform, Laminar-Turbulent, Rotational - Irrotational flows, one, two, and three-dimensional flows. Methods of Describing fluid motion - Eulerian and Lagrangian approach. Streamline, path line, streak lines and stream tube. Equation of continuity for one, two, and three-dimensional flows, velocity and acceleration functions. Basics of Stream function and Velocity Potential Functions.

Fluid Dynamics: Surface and body forces - Euler's and Bernoulli's equations for flow along a stream line. Momentum equation. Correction factors. Bernoulli's equation to real fluid flows.

Unit-III:

Flow Measurement in Pipes: Practical applications of Bernoulli's equation - Pitot tube, Venturi- meter and orifice meter, applications of Momentum equations. Forces exerted by fluid flow on pipe bend, sudden enlargement in pipes. Notches and Weirs: Classification of Notches and Weirs. Discharge over rectangular, triangular, and trapezoidal notches and weirs. Velocity of Approach. Discharge over a Broad crested weir.

Unit-IV:

Flow Through Pipes: Introduction, Reynolds experiment - Characteristics of Laminar & Turbulent flows. Reynolds number. Loss of head through pipes-major, minor losses. Darcy-Weisbach equation. Total Energy Line and Hydraulic Gradient Line. Pipes in series, pipes in parallel. Equivalent pipe concept. Flow through branched pipes. Three reservoir problem. Analysis of pipe networks: Hardy Cross method. Water hammer in pipes and control measures.

Unit-V:

Laminar and Turbulent Flow: Laminar flow through circular pipes and fixed parallel plates. Boundary Layer Theory: Introduction, Definitions. Prandtl contribution, Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum and energy thickness concepts of laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Drag and Lift. Types of drag.

Books and Materials

Text Books:

1. Bansal, R. K. *A Textbook of Fluid Mechanics and Hydraulic Machines.* 10th ed., Laxmi Publications (P) Ltd., 2018.

Reference Books:

1. Modi, P. N., and S. M. Seth. *Hydraulics and Fluid Mechanics Including Hydraulic Machines.* 22nd ed., Standard Book House, 2019.
2. Punmia, B. C., Ashok K. Jain, and Arun K. Jain. *Surveying, Vol. I & II.* 16th ed., reprint, Laxmi Publications Pvt. Ltd., New Delhi, 2018.
3. Subramanya, K. *Fluid Mechanics and Hydraulic Machines.* 2nd ed., McGraw-Hill Education India, 2020.

A9109 – Strength of Materials Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course primarily deals with determination of mechanical properties such as tensile, compressive, impact, shear strength and hardness of the material which is helpful for the design of structures and its applications. Selection of the material for structural application is a difficult task. This course will be helpful to select a proper material for structural applications. This course also supplements the theoretical knowledge gained in strength of materials with practical testing for determining different strengths of materials under various loading conditions.

Course Pre/Co-requisites

A9106 - Strength of Materials

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9109.1. Evaluate properties of the material by tensile test.
A9109.2. Determine compressive and flexural strength of materials.
A9109.3. Analyse properties of material by impact test.
A9109.4. Estimate properties of the material by using hardness test.
A9109.5. Make use of strain gauges and find the strain for a material.

Course Syllabus

List of Experiments:

1. Tension test: Stress-strain curve for mild steel.
2. Tension test: Stress-strain curve for HYSD steel.
3. Compression test on (a) wood (b) concrete/brick.
4. Deflection test on simply supported beam.
5. Deflection test on cantilever beam.
6. Deflection test on continuous beam.
7. Verification of Maxwell's Reciprocal theorem on beams.
8. Determination hardness number by Rockwell hardness test.
9. Determination hardness number by Brinell's hardness test.
10. Impact test on mild steel and cast iron by (a) Izod (b) Charpy.
11. Shear test on mild steel rods.
12. Compression test on close coiled helical spring.

13. Torsion test.
14. Usage of strain gauges.

Laboratory Equipment/Software/Tools Required:

1. Universal testing machine
2. Compression testing machine
3. Brinell hardness testing machine
4. Impact testing machine
5. Shear testing machine
6. Strain gauge apparatus
7. Deflection of beam apparatus (simply supported, cantilever and continuous)
8. Spring testing machine
9. Torsion testing machine

Books and Materials

Text Books:

1. Bansal, R. K. *A Textbook of Strength of Materials*, 6th ed., Laxmi Publishers, Hyderabad, 2015.
2. Prakash Rao. *Introduction to Strength of Materials*, University Press, New Delhi, 2009.

Reference Books:

1. Kazimi, S. M. A. *Solid Mechanics*, 1st ed., Tata McGraw-Hill Publishing Company, New Delhi, 2009.

A9110 – Surveying and Geomatics Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This practical course introduces students to fundamental surveying methods through hands-on experience with various instruments such as chain, compass, plane table, levelling instruments, theodolite. Students will learn to measure distances, angles, and elevations; plot maps and profiles. The course aims to build practical skills essential for site work in civil engineering projects.

Course Pre/Co-requisites

A9107 - Surveying and Geomatics

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9110.1. Conduct chain surveying and handle obstacles during chaining.

A9110.2. Perform compass surveying to determine bearings and distances.

A9110.3. Utilize plane table methods for plotting and mapping.

A9110.4. Perform levelling operations and profile plotting.

A9110.5. Apply theodolite techniques for angle measurement.

Course Syllabus

List of Experiments:

1. Survey of an area by chain survey (closed traverse) and plotting.
2. Chaining across obstacles.
3. Distance between two inaccessible points with a compass.
4. Survey of given area by using a prismatic compass.
5. Survey of given area by radiation method using a plane table.
6. Plot the given traverse by the intersection method using a plane table.
7. Elevation difference between two points using fly levelling.
8. Plot the longitudinal profile of a given stretch.
9. Plot the cross sections of a given stretch.
10. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.
11. Measurement of horizontal angles by the method of repetition.
12. Measurement of horizontal angles by the method of reiteration.
13. Check levelling for error detection.
14. plot the contours of an area by the method of squares.

Laboratory Equipment/Software/Tools Required:

1. 20m/30m chains
2. Arrows
3. Tapes
4. Ranging rods
5. Cross staffs
6. Prismatic compass
7. Plane table apparatus
8. Auto level
9. Levelling staff
10. Theodolite

Books and Materials

Text Books:

1. Subramanian, R. *Surveying and Levelling.* 2nd ed., Oxford University Press, 2012.

Reference Books:

1. Punmia, B. C., Ashok K. Jain, and Arun K. Jain. *Surveying, Vol. I & II.* 16th ed., reprint, Laxmi Publications Pvt. Ltd., New Delhi, 2018.
2. Arora, K. R. *Surveying, Vol. II.* 15th ed., Standard Book House, Delhi, 2018.

A9511 – Python Programming Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This Python programming lab is designed to develop strong problem-solving and coding skills through hands-on practice. It starts with basic concepts like installation, simple output, and input handling to build a clear understanding of the language. Students learn to work with variables, operators, and expressions to perform computations and make logical decisions using conditional statements. Iteration techniques are practiced to solve problems like reversing numbers, factorials, and Fibonacci series. The lab strengthens skills in string handling, including slicing, searching, and transformations. Core Python data structures such as lists, dictionaries, tuples, and sets are explored to manage and process data effectively. Emphasis is placed on writing reusable code through user-defined functions, recursive calls, and lambda expressions. Students work with Python modules to handle tasks like date, time, and calendars. Error handling is introduced to ensure safe and reliable programs. The course concludes with file operations for creating, reading, appending, and summarizing data, preparing students for real-world applications.

Course Pre/Co-requisites

A9501 - Programming for Problem Solving

A9502 - Programming for Problem Solving Laboratory

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 8: Decent Work and Economic Growth

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9511.1. Interpret basic programming constructs and control statements to solve simple computational problems

A9511.2. Apply string operations and regular expressions to process and manipulate text.

A9511.3. Make use of data structures lists, tuples, sets, and dictionaries to store and organize data effectively.

A9511.4 Implement modular programming concepts using functions, modules, and file handling techniques.

A9511.5 Develop applications using exception handling constructs to handle runtime errors in software applications.

Course Syllabus

Theory:

1. **Python Fundamentals and Control Statements:** Introduction to Python, Features of Python, Identifiers, Reserved Words, Data Types, Variables and Constants, Input / Output Statements, Conditional Statements – if, if-else, if-elif-else; Iterative Statements – for, while; Jump / Transfer Statements – break, continue, pass.

2. **Strings and Regular Expressions:** Strings: String Definition, Indexing, Slicing, Multiline Strings, Escape Sequences, String Formatting, Mathematical Operations on Strings, Checking Membership, Comparison, String Manipulation Techniques, String Immutability, Built-in String Functions and Methods. Regular Expressions: Pattern Matching, Search, Replace, Match Objects, Grouping.
3. **Functions, Modules:** Functions: Introduction, Function Definition, Function Call, Types of Arguments, Return Statement, Recursive Functions, Anonymous Functions (Lambda). Modules: Importing, Creating and Using Modules, Standard Libraries.
4. **Exception Handling and File Handling:** Exception Handling – Errors in Python, types of exceptions, try, except, else, finally blocks, raise keyword, custom exception classes. File Handling – Introduction, File Types, Opening and Closing Files, Reading and Writing in Text and Binary Files, File Modes and Methods (read(), readline(), write(), etc.), File Path Operations, Copy and Merge.

List of Experiments:

1. Introduction to Python Lab: Installation and Simple Output Display.
   a. Write a python program to print your Name, Roll Number, and Branch.
   b. Write a python program to read a string "Python Programming" and display it on the screen.
   c. Write a python program to read integer, float & string values and display them on the screen.
2. Programs using Input Output Statements, Variables and Expressions.
   a. Write a python program to read a float value and convert Fahrenheit to Centigrade.
   b. Write a python program to find the area of triangle.
   c. Write a python program to read the marks in 5 subjects and display the average.
3. Programs using various operators in Python.
   a. Write a python program for demonstrating the usage of comparison operators.
   b. Write a python program to swap / interchange two numbers.
   c. Write a python program for demonstrating the usage of unary, shift, logical, membership and identity operators.
4. Programs using Conditional Statements.
   a. Write a python program to check a given number is Even or Odd.
   b. Write a python program to find the greatest of 3 integer numbers.
   c. Write a python program to demonstrate nested if statement.
5. Programs using Iterative Statements.
   a. Write a Python program to reverse the digits of a given number.
   b. Write a Python program to find the factorial of a given number.
   c. Write a python program to display factors of a given integer number.
   d. Write a python program to print Fibonacci numbers.
   e. Write a python program to display all prime numbers between 0 to n.
6. Programs using Strings and its Operations.
   a. Write a program that asks the user to enter a string and perform the following:
      i. Total number of characters in the string.
      ii. Repeat the string 10 times.

iii. The first character of the string.
iv. The first three characters of the string.
v. The last three characters of the string.
vi. The string in backwards.
vii. The seventh character of the string if it exists, otherwise display a message “Not exist”.
viii. The string with its first and last characters removed.
ix. The string into capital case.
x. The string with every letter replaced by a space.

b. Write a python program to demonstrate string concatenation, repetition, and membership testing.
c. Write a python program to demonstrate built-in string functions: upper(), lower(), strip(), find().
d. Write a Python program to count the number of vowels in a given string.

7. Programs using Python Data Structures (Lists).
   i. Print the total number of items in the list.
   ii. Print the last item in the list.
   iii. Print the list in reverse order.
   iv. Print Yes if the list contains a 5 and No otherwise.
   v. Print the number of occurrences of an element in the list.
   vi. Remove the first and last items from the list and sort the remaining items.
   vii. Print how many integers in the list are less than a given value.
   viii. Print the average of the elements in the list.
   ix. Print the largest and smallest value in the list.
   x. Program which applies list comprehensions to generate even numbers.
8. Programs using Python Data Structures (Dictionary).
   a. Write a python program for demonstrating the creation of dictionary, accessing dictionary elements, modifying dictionary elements, finding length and possible operations.
   b. Write a python program to create a dictionary of students with keys as roll numbers and values as names. Perform operations like insert, update and modify student data.
   c. Write a Python program with the following requirements: Create a dictionary that stores 10 usernames as keys and their corresponding passwords as values. Prompt the user to enter a username and a password. Check the entered credentials and:
   (i) If the username does not exist, display: "Not a valid user."
   (ii) If the username exists but the password is incorrect, display: "Invalid password."
   (iii) If both are correct, display: "Welcome".
9. Programs using Python Data Structures (Tuples and Sets).
   a. Write a python program to demonstrate various operations on tuples.
   b. Write a python program to demonstrate various operations on sets.
10. Programs using User Defined Functions.
   a. Define a lambda function to compute square and cube.
   b. Write a python program to find factorial of a given number using function.
   c. Write a python program to find factorial of a given number using recursive function.

11. Programs using Modules.
    a. Write a Python program to display the date and time using the time module.
    b. Write a Python program that prints the calendar of a particular month.
    c. Write a Python program to check whether a given year is a leap year or not using the calendar module.
12. Programs using Exception Handling.
    a. Write a Python program to read two integers from the user and perform division, handling ZeroDivisionError and ValueError using try-except-finally.
    b. Write a Python program that asks for user input and converts it to an integer, with exception handling for invalid data.
13. Programs on File Handling.
    a. Write a Python program to read a text file, handling File Not Found Error.
    b. Write a Python program to count the number of lines, words, and characters, and then write the summary of a file to a new output file with exception handling.
    c. Create a text file named `student_data.txt`.
    d. Accept student details (roll number, name, marks) from the user and write them to the file.
    e. Read and display the contents of the file.
    f. Append new records to the same file and display the updated contents.

Laboratory Equipment/Software/Tools Required:

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Jupyter notebook or Pycharm IDE, Python Run Time System

Books and Materials

Text Books:

1. Reema Thareja. *Python Programming using Problem solving Approach*, 3rd Edition Oxford University Press, New Delhi India, 2017.
2. Gowrishankar S., Veena A.. *Introduction to Python Programming*, 1st Edition, CRC Press, Boca Raton, Florida, USA, 2018..

Reference Books:

1. Charles R. Severance.. *Python for Everybody: Exploring Data Using Python 3*, 1st Edition, , CreateSpace Independent Publishing Platform, United States, 2016.
2. Timothy A Budd. *Exploring Python*, 8th Edition, Tata McGraw Hill, New Delhi, 2019.
3. Allen B. Downey. *Think Python: How to Think Like a Computer Scientist*, 2nd Edition, O'Reilly Media, California, USA, 2016

A9111 – Computer Aided Building Drafting

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course emphasizes on representing the building components using computer aided drafting software. This course helps student to illustrate engineering drawings which are blended with aspects of building planning. The course covers plan, section and elevation views of residential building, office building and their components.

Course Pre/Co-requisites

A9103 - Building Materials, Construction and Planning

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9111.1. Represent building materials and components.

A9111.2. Plan residential building and represent all the building components.

A9111.3. Illustrate elevation and sectional views of residential building.

A9111.4. Construct plan, elevation, and sectional views of public building.

A9111.5. Draft plan, elevation, and sectional views of an overhead water tank

Course Syllabus

List of Experiments:

1. Developing plan of doors and windows
2. Developing plan and section of dog-legged staircase
3. Developing plan of column and footing markings
4. Developing plan of residential building
5. Developing section of residential building
6. Developing elevation of residential building
7. Developing plan of educational building
8. Developing section of educational building
9. Developing elevation of educational building
10. Developing plan of overhead water tank
11. Developing section of an overhead water tank
12. Developing elevation of an overhead water tank

Laboratory Equipment/Software/Tools Required:

1. AutoCAD Software
2. Computer PCs

Books and Materials

Text Books:

1. Kumaraswamy, N., and A. Kameswara Rao. *Building Planning and Drawing.*. 9th ed., revised & enlarged, Charotar Publishing House Pvt. Ltd., 2023.

Reference Books:

1. SP 7: 2016 *National Building Code of India* 2016.

A9023 - Technology Entrepreneurship

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	0	45	45	1	40	60	100

Course Description

Course Overview

This course enables students to transform refined product designs into viable entrepreneurial ventures or patentable innovations. Building on skills from previous courses in design thinking and product development, students will explore opportunity identification, intellectual property protection, market research, sustainable business models, funding strategies, and go-to-market planning. Emphasis is placed on aligning innovations with community needs while preparing for startup creation, patent filing, or both.

Course Pre/Co-requisites

A9022 - Product Design and Development

textbfRelevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 8: Decent Work and Economic Growth

SDG 9: Industry, Innovation, and Infrastructure

SDG 17: Partnerships for the Goals

Course Outcomes

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

A9023.1. Identify and analyze market opportunities for community-driven technological innovations.

A9023.2. Apply intellectual property strategies for protecting product designs and innovations.

A9023.3. Develop sustainable and scalable business models for product commercialization.

A9023.4. Formulate funding, financial, and go-to-market strategies for product launch.

A9023.5. Prepare and deliver investor-ready pitches or patent documentation to relevant stakeholders.

Course Syllabus

Unit-I:

Entrepreneurial Mindset and Opportunity Identification: Understanding technology entrepreneurship in the community context. Startup ecosystem and innovation pathways. Market analysis and opportunity mapping for commercialization of Product.

Unit-II:

Intellectual Property and Innovation Protection: Overview of IP: patents, trademarks, copyrights, and trade secrets; patent search, drafting, filing, and grant procedures; leveraging IP for competitive advantage and innovation scaling.

Unit-III:

Market Research and Business Model Development: Defining target markets, customer segments, and value propositions. Competitive analysis and differentiation strategies. Business Model Canvas and Lean Startup principles.

Unit-IV:

Funding, Financial Planning and Sustainability: Study of funding options including grants, angel investors, venture capital, and crowd funding; budgeting, forecasting, and financial planning for startups; and integration of sustainability into long-term business growth strategies.

Unit-V:

Go-to-Market Strategy, Pitching and Documentation: Branding, marketing, and distribution planning; creating persuasive pitches for investors, partners, and stakeholders; preparing necessary documentation; final presentation of patent draft or startup business plan to an expert panel.

Activity Plan

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
1	Unit-I: Entrepreneurial Mindset	Understand technology entrepreneurship & startup ecosystem	Concept briefing + Open forum	Discussion: examples of community-based startups	Reflection note: "Why entrepreneurship matters for communities"	CO1
2	Unit-I: Opportunity Identification	Identify & map opportunities	Hands on session + Case analysis	Opportunity mapping using local problems	Opportunity mapping chart submission	CO1
3	Unit-II: IP Basics	Learn types of IP (patents, trademarks, copyrights)	Concept briefing + Example-driven discussion	Analyze famous patents & trademarks	Short report: "One innovation and its IP protection strategy"	CO2
4	Unit-II: Patent Process	Apply patent search & filing basics	Demo session + Hands-on exercise	Perform a mock patent search online (guided)	Draft simple patent claim for a product	CO2
5	Unit-III: Market Research	Define target market & customer segments	Concept briefing + Team activity	Build customer personas for chosen product idea	Submit customer persona & value proposition canvas	CO3
6	Unit-III: Business Model Development	Apply BMC & Lean Startup	Business modeling – Hands on session	Teams fill out Business Model Canvas	Submit BMC with initial differentiation strategy	CO3
7	Unit-IV: Funding Sources	Understand startup funding landscape	Concept briefing + Case discussion	Funding source comparison (VC, grants, crowdfunding)	Assignment: Funding strategy document for idea	CO4

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
8	Unit-IV: Financial Planning	Apply budgeting & forecasting	Hands on session	Build basic revenue/cost projection table	Submit 1-year financial projection	CO4
9	Unit-IV: Sustainability	Integrate sustainability in startups	Group reflection	Apply sustainability checklist to business model	Submit revised BMC integrating sustainability	CO4
10	Unit-V: Go-to-Market	Learn branding & marketing strategies	Hands on session + Peer feedback	Draft a marketing plan with target channels	Submit draft marketing & distribution strategy	CO4, CO5
11	Unit-V: Pitching Skills	Develop persuasive pitch	Startup pitch drill	Students deliver 3-min practice pitches with feedback	Submit pitch deck draft	CO5
12	Unit-V: Final Showcase	Present final startup plan/patent draft	Showcase + Expert review	Final presentations to panel (faculty/guests)	Final project submission: startup plan or patent draft	CO5

Books and Materials

Text Books:

1. Deependra Sharma. *Entrepreneurship in India* , Routledge, 2023.
2. Dr. S. Glory Swarupa & Ms. Swapna Vanamala. *Innovation, Incubation and Intellectual Property Rights*, 2023.

Reference Books:

1. Neck, Heidi M., Patricia G. Greene, and Candida G. Brush. *Teaching Entrepreneurship: A Practice-Based Approach*, Edward Elgar Publishing, 2014.
2. Drucker, Peter F. *Innovation and Entrepreneurship: Practice and Principles*, reprint, Harper & Row, 1985.

II B.Tech. II Semester

A9004 – Probability Distributions and Statistics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an undergraduate foundation in both probability distributions and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the field of multidisciplinary engineering applications. The mathematical skills sustained from this course form a suitable base to analytical and theoretical concepts encountered in engineering profession.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

Course Outcomes

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

A9004.1. Identify an appropriate probability distribution for a given discrete or continuous random variable.

A9004.2. Make use of probability distributions to analyze and solve a given problem.

A9004.3. Interpret correlation coefficient and perform regression analysis to fit the best curve.

A9004.4. Inspect scientific hypothesis and estimate confidence intervals at different levels.

A9004.5. Compute P-value of a test statistic using component of hypothesis test.

Course Syllabus

Unit-I:

Random Variables: Discrete and Continuous random variables, Discrete Probability Distributions, Continuous Probability Distributions, Mean and Variance of Random Variables.

Unit-II:

Probability Distributions: Discrete distributions: Binomial distribution, Poisson distribution. Continuous distributions: Uniform distribution, Normal distribution, areas under the Normal Curve, applications of the Normal Distribution.

Unit-III:

Correlation and Regression: Scatter diagram, Positive and Negative correlation, limits for coefficient of Correlation, Karl Pearson's coefficient of correlation, Spearman's Rank correlation, Regression Analysis: Concept, two lines of regression, Properties of regression coefficients. **Curve Fitting:** Method of least squares - Fitting a straight line, second degree parabola and non-linear curves of the form by the method of least squares.

Unit-IV:

Estimation and Testing of Hypothesis for Large samples: Point estimation, Maximum error estimate, Interval Estimation, Introduction to Hypothesis, Level of significance, one tailed and two tailed test, Test concerning one mean and one proportion, Two means and two Proportions.

Unit-V:

Testing of Hypothesis for Small samples: Test for single mean, difference of means and paired t-test, Test for ratio of variances (F-test), Chi-square test for goodness of fit and independence of attributes.

Books and Materials

Text Books:

1. Gupta, S.C. and Kapoor, V. K. *Fundamentals of Mathematical statistics* , 10^{th} ed., S Chand & Sons, New Delhi, 2000.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye *Probability & Statistics for Engineers & Scientists* , 9^{th} ed., Pearson Publishers, 2016.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics* , 43^{rd} ed., Khanna Publications, 2015.
2. T.T. Soong *Fundamentals of Probability and Statistics for Engineers* , John Wiley & Sons, 2004.
3. Miller and Freund's *Probability and Statistics for Engineers* , 8^{th} ed., Pearson Educations, 2011.

A9112 – Structural Mechanics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course is continuation to the Strength of Materials. This course provides an understanding of the behaviour of structural members subjected to different types of loading conditions. It covers torsion in shafts, deformation of springs, stability of columns, combined stresses in beam-columns, and stress analysis in thin and thick cylinders. The course also introduces unsymmetrical bending and the concept of shear centre, which are essential for analysing open thin-walled sections. Students will develop the ability to calculate stresses, strains, deflections, and stability parameters essential for safe structural design.

Course Pre/Co-requisites

A9102 – Applied Mechanics

A9106 - Strength of Materials

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9112.1. Compute torsional stresses in shafts and deflections in helical springs.

A9112.2. Evaluate critical loads and stability of columns using Euler's and Rankine's methods.

A9112.3. Determine stresses in members under combined axial and bending loads.

A9112.4. Assess stress distribution and dimensional changes in thin and thick cylinders.

A9112.5. Apply concepts of unsymmetrical bending in locating shear centres in structural sections.

Course Syllabus

Unit-I:

Torsion of Circular Shafts: Theory of pure torsion– Assumptions made in the theory of pure torsion – Derivation of Torsion equation – Polar section modulus – Power transmitted by shafts – Combined bending and torsion.

Springs: Introduction, Types of springs, deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

Unit-II:

Columns and Struts: Introduction, Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns, assumptions, Derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column, slenderness ratio, Euler's critical stress, Limitations of Euler's theory, Rankine-Gordon formula – Long columns subjected to eccentric loading.

Unit-III:

Beam Columns: Laterally loaded struts – subjected to uniformly distributed and concentrated loads.

Direct and Bending Stresses: Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of chimneys.

Unit-IV:

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction, Derivation of Lame's formulae, distribution of hoop and radial stresses across thickness – compound cylinders, Necessary difference of radii for shrinkage.

Unit-V:

Unsymmetrical Bending: Introduction – Centroidal principal axes of section – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending.

Shear Centre: Introduction – Determination of Shear Centre for Channel section and I-section.

Books and Materials

Text Books:

1. Bansal, R. K. *A Textbook of Strength of Materials.* 7th ed., Laxmi Publications, 2022.
2. Punmia, B. C., Ashok Kumar Jain, and Arun Kumar Jain. *SMTS-I Strength of Materials.* 11th ed., Laxmi Publications, 2025.

Reference Books:

1. Rattan, S. S. *Strength of Materials.* 3rd ed., Tata McGraw-Hill Education, 2017.
2. Subramanian, R. *Strength of Materials.* 3rd, Oxford University Press, 2016.

A9113 – Hydraulics and Hydraulic Machines

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course is intended to introduce open channel hydraulics and the working of hydraulic machinery. It covers knowledge regarding various theories dealing with the flow phenomenon of fluid in open channels. The subject introduces the use of dimensional analysis techniques in solving fluid problems. Major emphasis is given to understand the basics of hydro machinery, its components, function and use of different types of turbines and pumps.

Course Pre/Co-requisites

A9108 - Fluid Mechanics

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 7: Affordable and Clean Energy
SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9113.1. Explain the fundamentals of open channel flows.

A9113.2. Demonstrate an understanding of non-uniform channel flow and hydraulic jump.

A9113.3. Evaluate the model and prototype relations by similarity laws and basics of turbomachinery.

A9113.4. Apply the fundamentals of fluid forces to understand the functioning and technical aspects of hydraulic turbines.

A9113.5. Analyse the possible problems, performance and installation techniques of centrifugal pumps.

Course Syllabus

Unit-I:

Open Channel Flow – I: Introduction to Open channel flow Comparison between open channel flow and pipe flow, Classification of open channel flows, Velocity distribution. Uniform flow – Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient. Most economical sections. Computation of Uniform flow, Normal depth. Critical Flow: Specific energy – critical depth - computation of critical depth – Critical, sub critical and super critical flows.

Unit-II:

Open Channel Flow – II: Non-uniform flow – Gradually Varied Flow - Dynamic equation for G.V.F; Classification of channel bottom slopes – Classification and characteristics of Surface profiles – Computation of water surface profiles by Numerical and Analytical approaches. Direct step method. Rapidly varied flow: Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and other uses – Introduction to Positive and Negative Surges (Theory only).

Unit-III:

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's Method and Buckingham's π Method – Dimensionless groups. Similitude, model studies, types of models. Application of dimensional analysis and model studies to fluid flow problems. Distorted models.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency – Angular.

Unit-IV:

Hydraulic Turbines – I: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine – working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency. Hydraulic Turbines – II: Governing of turbines – Surge tanks – Unit and specific turbines – Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbine.

Unit-V:

Centrifugal Pumps: Pump installation details – classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. Multistage pump– pumps in parallel – performance of pumps – characteristic curves – NPSH – Cavitation. Reciprocating pumps – Working, discharge, slip indicator diagrams.

Books and Materials

Text Books:

1. Bansal, R. K. *A Textbook of Fluid Mechanics and Hydraulic Machines.* 11th ed., Laxmi Publications (P) Ltd., 2024.
2. Chow, V. T. *Open Channel Hydraulics.* 3rd ed., McGraw-Hill Education, 2021.

Reference Books:

1. Modi, P. N., and S. M. Seth. *Hydraulics and Fluid Mechanics Including Hydraulic Machines.* 23rd ed., Standard Book House, 2022.
2. Kumar, D. S. *Fluid Mechanics and Fluid Power Engineering.* 2nd ed., S. K. Kataria & Sons, 2017.
3. Subramanya, K. *Fluid Mechanics and Hydraulic Machines.* 2nd ed., McGraw-Hill Education India, 2020.

A9114 – Water Resources Engineering

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides with technical expertise in engineering hydrology to address the complexities of real-life engineering hydrology problems. In this course, students will learn about the hydrological cycle and its components, initial abstractions and hydrograph analysis, occurrence and movement of groundwater and aquifer parameters. In addition, students can also gain knowledge on floods, irrigation water requirements and design discharge of water course.

Course Pre/Co-requisites

A9108 - Fluid Mechanics

Relevant Sustainable Development Goals (SDGs)

SDG 2: Zero Hunger
SDG 4: Quality Education
SDG 6: Clean Water and Sanitation

Course Outcomes

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

A9114.1. Interpret various components of hydrologic cycle for the management of water resources.
A9114.2. Analyse initial abstractions of precipitation, runoff and hydrographs.
A9114.3. Determine flood discharge, flood routing methods and flood control structure.
A9114.4. Estimate aquifer parameters and flow to wells.
A9114.5. Assess crop water requirement, irrigation techniques and design discharge of a water course.

Course Syllabus

Unit-I:

Components of Hydrologic Cycle: Concept of Hydrologic cycle, Precipitation, Cloud Seeding, measurement of precipitation, types of rain gauges, rain gauge network, optimum number of rain gauges, presentation of rainfall data – hyetograph and mass curve, test for consistency and continuity of rainfall data, maximum intensity/depth-duration-frequency relationship, Mean Precipitation Over an Area by Arithmetic Mean, Thiessen Polygon and Isohyetal Methods, depth area duration relationships, estimation of missing rainfall data, Double Mass Curve, Probable Maximum Precipitation (PMP)

Unit-II:

Initial Abstractions, Runoff and Hydrograph Analysis: Evaporation and Evaporation Process, measurement, estimation and control of evaporation, Evapotranspiration, measurement and estimation of evapotranspiration, Infiltration, factors affecting infiltration, measurement of infiltration, infiltration curve and infiltration indices.

Unit-III:

Runoff: component of runoff, factors affecting runoff, Basin Yield, SCS-CN method of estimating runoff, Rainfall-Runoff relationships, flow duration and flow mass curves. Hydrograph Analysis: Components of Hydrograph, Hydrograph Separation, Unit Hydrograph Components of Hydrograph.

Unit-IV:

Floods and Flood Routing: Definition, Causes of Floods, Flood Discharge Formulae and Envelope Curves, Flood Frequency Analysis, Detention Basins, Levees, Diversion Channels. Flood Routing: Routing Through a Reservoir by I.S.D. Method, Channel Routing by Muskingum Method, Broad Outline on the National Policy on Floods.

Unit-V:

Groundwater Hydrology: Groundwater Occurrence, Types of Aquifers, Aquifer parameters, Porosity, Specific yield, Permeability, Transmissivity and Storage coefficient, Darcy's law, Radial flow to wells in confined and unconfined aquifers, Types of wells. Irrigation: Necessity and Importance of Irrigation, Advantages and ill effects of Irrigation, Types of Irrigation, Methods of application of Irrigation water. Crop Rotation, Soil – water – plant relationship, Consumptive use, Duty and delta, factors affecting duty. Depth and frequency of Irrigation.

Books and Materials

Text Books:

1. Jayarami Reddy, P. *Engineering Hydrology.* 3rd ed., Laxmi Publications Pvt. Ltd., 2019.
2. Punmia, B.C., P.B. Lal, A.K. Jain, and Arun Kumar Jain.*Irrigation and Water Power Engineering.* 16th ed., Laxmi Publications Pvt. Ltd., 2019.
3. Modi, P.N.*Irrigation Water Resources and Water Power Engineering.*, 9th ed., Standard Book House, 2014.

Reference Books:

1. Modi, P. N., and S. M. Seth. *Hydraulics and Fluid Mechanics Including Hydraulic Machines.* 23rd ed., Standard Book House, 2022.
2. Garg, S.K.*Irrigation and Hydraulic Structures.* 5th ed., Khanna Publishers, 2012.
3. Subramanya, K.*Engineering Hydrology.* 4nd ed., Tata McGraw-Hill Education, 2017.

A9115 – Structural Analysis

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course is offered to undergraduate students to deal with determinate and indeterminate structures under various loading conditions. The course introduces the analysis of arches and analysis of indeterminate structures. This course also discusses Slope deflection method and moment distribution methods for continuous beams and frames. Graphical representation of bending moment and shear force in continuous beams also included.

Course Pre/Co-requisites

A9106 - Strength of Materials

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9115.1. Determine the indeterminacy of structures.

A9115.2. Analyse the different types of arches.

A9115.3. Apply energy theorems to beams and trusses.

A9115.4. Evaluate the fixed beams under various loads.

A9115.5. Assess the continuous beams and frames by the displacement method.

Course Syllabus

Unit-I:

Static and Kinematic Indeterminacy: Determinate and Indeterminate structures –Static and Kinematic indeterminacy.

Arches: Introduction to arches and their classification – Analysis of Three and Two hinged parabolic arches

Unit-II:

Energy Theorems: Introduction - Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem - Unit Load Method. Definitions of simple beams and pin-jointed plane trusses. Definitions of statically determinate bent frames.

Unit-III:

Fixed Beams: Analysis of fixed beams with and without varying moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - Shear force and Bending moment diagrams for Fixed Beams - Effect of rotation of a support - Effect of sinking of supports.

Unit-IV:

Slope - Deflection Method: Derivation of slope- deflection equation, Application to continuous beams with and without settlement of supports – Analysis of frames - Shear force and bending moment diagrams.

Unit-V:

Moment Distribution Method: Introduction – Distribution theorem – Carryover theorem - Application to continuous beams with and without settlement of supports – Analysis of frames - Shear force and bending moment diagrams.

Books and Materials

Text Books:

1. Bhavikatti, S.S. *Structural Analysis-I.* 5th ed., Vikas Publishing House, 2021.
2. Bhavikatti, S.S. *Structural Analysis-II.* 5th ed., Vikas Publishing House, 2021.
3. Vazirani, V.N., Ratwani, M.M., and Duggal, S.K. *Analysis of Structures Vol-I: Analysis, Design and Details of Structures.* 17th ed., Khanna Publishers, 1999.

Reference Books:

1. Vazirani, V.N., Ratwani, M.M., and Duggal, S.K. textitAnalysis of Structures Vol-II: Theory, Design and Details of Structures. 16th ed., Khanna Publishers, 1994.
2. Thandavamoorthy, T.S. *Structural Analysis.* 1st ed., Oxford University Press, 2011.
3. Reddy, C.S. *Basic Structural Analysis.* 3rd ed., Tata McGraw-Hill Educan, 2011.
4. Ramamrutham, S., and R. Narayanan. *Theory of Structures.* 11th ed., Dhanpat Rai Publishing Company, 2022.

A9317 - Fluid Mechanics and Hydraulic Machines Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course mainly deals with the behaviour of fluids and hydraulic machines. The objective of this course is to enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

Course Pre/Co-requisites

A9303 - Engineering Mechanics

Relevant Sustainable Development Goals (SDG(s))

SDG 6: Clean Water and Sanitation
SDG 9: Industry, Innovation, and Infrastructure
SDG 13: Climate Action

Course Outcomes

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

A9317.1. Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.
A9317.2. Correlate various flow measuring devices such as Venturimeter and orifice meter.
A9317.3. Discuss the performance characteristics of turbines and pumps.
A9317.4. Estimate energy losses and boundary layer parameters for laminar and turbulent flows.
A9317.5. Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.

Course Syllabus

List of Experiments:

1. Calibration of Venturi meter.
2. Calibration of Orifice meter.
3. Determination of friction factor in a given pipe line.
4. Determination of loss co-efficient due to sudden contraction.
5. Verification of Bernoulli's theorem.
6. Determination of the nature of flow through a pipe (Reynold's experiment).
7. Determination of the efficiency of vane using Impact of jet on Vane Setup.
8. Determination of the operating characteristics of Pelton wheel turbine.
9. Determination of the operating characteristics of Francis Turbine.
10. Determination of the operating characteristics of Kaplan Turbine.
11. Determination of the efficiency of Single Stage Centrifugal Pump.
12. Determination of the efficiency of Multi Stage Centrifugal Pump.
13. Determination of the efficiency of Reciprocating Pump.

Laboratory Equipment/Software/Tools Required:

1. Venturimeter and Orifice meter setup
2. Major and Minor Losses in pipes setup
3. Bernoulli's theorem verification setup
4. Reynolds Apparatus
5. Impact of jet on vane setup
6. Pelton turbine test rig
7. Francis turbine test rig
8. Kaplan Turbine test rig
9. Single Stage Centrifugal Pump test rig
10. Multi Stage Centrifugal Pump test rig
11. Reciprocating Pump test rig

A9116 - Building Information Modeling Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course introduces students to the concepts of Building Information Modeling using Autodesk Revit. It emphasizes on creating, editing, and managing building models elements such as footings, columns, beams, walls, doors, windows, floors, roofs, and furniture. The objective of the course is to develop architectural plans, elevations, structural components, and 3D visualizations while gaining skills in documentation and presentation for professional design projects.

Course Pre/Co-requisites

A9103 - Building Materials, Construction and Planning

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9116.1. Apply the fundamental concepts of Building Information Modeling (BIM).
A9116.2. Utilize various editing tools, ribbons, rendering tools of Revit.
A9116.3. Develop plan and elevation of building.
A9116.4. Model various components of building.
A9116.5. Document project drawings using Revit.

Course Syllabus

List of Experiments:

1. Introduction to BIM
2. Introduction to Autodesk Revit
3. Basic drawing tools
4. Basic editing tools
5. Setting up levels and grids
6. Working with views
7. Working with dimensions and text
8. Develop plan and elevation of a building
9. Modeling of foundation
10. Modeling of columns and beams
11. Modeling of walls, floors, ceiling, and roofs
12. Modeling of stairs, railings, and ramps

13. Rendering and presentation
14. Documenting the project

Laboratory Equipment/Software/Tools Required:

1. Autodesk Revit
2. Computer PCs

Books and Materials

Text Books:

1. Peter B. and Nigel D. *BIM in Principle and in Practice.* 1st ed., ICE Publishing, 2014.
2. Eastman, C.; Teicholz, P.; Sacks, R.; Liston, K. *BIM Handbook: A Guide to Building Information.* 2011.

Reference Books:

1. SP 7: 2016 *National Building Code of India* 2016.

A9117 – Concrete Technology Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course covers a wide range of experiments related to examining the various properties of commonly used construction materials including, concrete and its constituents; cement, coarse and fine aggregate, water and admixture. Additionally, other aspects relevant to fresh and hardened concrete are also explored such as mixing, handling, casting (workability), density and mechanical properties. Other tests such as NDT will help to understand and assess the quality of the concrete construction.

Course Pre/Co-requisites

A9105 – Concrete Technology

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9117.1. Assess different physical properties of cement.

A9117.2. Determine different properties of aggregate.

A9117.3. Evaluate fresh concrete by conducting different workability tests.

A9117.4. Examine mechanical properties of the hardened concrete.

A9117.5. Demonstrate non-destructive testing procedures on concrete.

Course Syllabus

List of Experiments:

1. Determination of fineness and specific gravity of cement.
2. Determination of consistency of standard cement Paste.
3. Determination of initial and final setting times of cement.
4. Determination of soundness of cement.
5. Determination of compressive strength of cement.
6. Determination of fineness modulus of coarse aggregate.
7. Determination of fineness modulus of Fine aggregate.
8. Determination of percentage of voids, and bulk density of coarse aggregate.
9. Determination of percentage of voids, and bulk density of fine aggregate.
10. Determination of workability of fresh concrete by slump cone test.
11. Determination of workability of fresh concrete by compaction factor test.
12. Determination of workability of fresh concrete Vee-Bee consistometer test.

13. Determination of hardened properties of concrete – compressive strength split tensile strength and flexural strength.
14. Demonstration of non-destructive test equipment.

Laboratory Equipment/Software/Tools Required:

1. Vicat's apparatus
2. Specific gravity bottle
3. Le-Chatelier mould
4. Le-Chatelier water bath
5. Sieve sets for fine and coarse aggregates
6. Cylindrical metal measures (1L, 3L and 5L)
7. Slump test apparatus
8. Compaction factor apparatus
9. Vee-bee consistometer
10. Compression testing machine
11. Flexural testing machine
12. Rebound hammer
13. Ultrasonic pulse velocity test setup
14. Moulds (cube, cylindrical and flexural)

Books and Materials

Text Books:

1. Shetty, M.S., and A.K. Jain. *Concrete Technology: Theory and Practice.* 8th ed., S. Chand Publishing, 2019.
2. Neville, A.M., and J.J. Brooks. Rajashekarappa. *Concrete Technology.* 2nd ed., Pearson Education Limited, 2010.

Reference Books:

1. Thomas, Job. *Concrete Technology.* 2nd ed., Cengage Learning India Pvt. Ltd., 2015.
2. Gambhir, M.L. *Concrete Technology: Theory and Practice.* 5th ed., Tata McGraw-Hill Education India Pvt. Ltd., 2017.

A9006 – Computational Mathematics Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course provides hands-on experience in solving mathematical problems using computational tools. This course covers numerical methods and implementation using MATLAB or Python. The course helps to develop skills in algorithm development, data visualization, and scientific computing. In addition, the computational methods for real- world mathematical modeling can be applied.

Course Pre/Co-requisites

A9001 - Matrices and Calculus

A9002 - Ordinary Differential Equations and Vector Calculus

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education

SDG 9: Industry, Innovation, and Infrastructure

Course Outcomes

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

A9006.1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB

A9006.2. Develop the code to find solution of Algebraic and Transcendental using Python/MATLAB

A9006.3. Develop the code to find solution of Linear system of equations using Python/MATLAB

A9006.4. Write the code to solve problems of First-Order linear differential equations with constant coefficients

A9006.5. Write the code to solve problems of Higher order linear differential equations with constant coefficients

Course Syllabus

List of Experiments:

Visualize all solutions graphically using programs.

1. Eigen values and Eigen Vectors
   a. Finding real and complex Eigen values.
   b. Finding Eigen vectors.
2. Solution of Algebraic and Transcendental Equations - Bisection method, Newton Raphson Method
   a. Root of a given equation using Bisection method.
   b. Root of a given equation using Newton Raphson Method.
3. Linear system of equations - Jacobi's iteration method and Gauss-Seidal iteration method
   a. Solution of given system of linear equations using Jacobi's method.
   b. Solution of given system of linear equations using Gauss-Seidal method.

4. First-Order ODEs - Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling
   a. Solving exact and non-exact equations.
   b. Solving exponential growth/decay and Newton's law of cooling problems.
5. Higher order linear differential equations with constant coefficients
   a. Solving homogeneous ODEs.
   b. Solving non-homogeneous ODEs.

Books and Materials

Text Books:

1. Rajkumar Basal, Ashok Kumar Geo, and Manoj Kumar Sharma. *MATLAB and Its Applications in Engineering*. Pearson.
2. Kenneth A. Lambert. *The Fundamentals of Python: First Programs*. Cengage Learning, 2011.
3. Allen B. Downey. *Think Python*. 1st ed., O'Reilly Media.

Reference Books:

1. William Mitchell, Povel Solin, Martin Novak, et al. *Introduction to Python Programming*. NCLab Public Computing, 2012.
2. Jacob Fredslund. *Introduction to Python Programming*. 2007.
3. John C. Lusth. *An Introduction to Python*. University of Alabama, 2011.
4. Dave Kuhlman. *Introduction to Python*. 2008.

A9118 – Digital Surveying

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	30	0	30	1	40	60	100

Course Description

Course Overview

This course gives introduction to advanced instruments like Total station, Electronic theodolite. It includes determination of heights, distances and elevations using trigonometric levelling and principle of tacheometry. This also introduces the assessment of field conditions to select appropriate technique and equipment according to the conditions of a site.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities

Course Outcomes

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

A9118.1. Make use of advanced surveying instruments.
A9118.2. Measure angles and distances.
A9118.3. Interpret field notes and survey data.
A9118.4. Determine elevations/heights of various structures.
A9118.5. Establish setting out works like buildings and highways.

Course Syllabus

List of Experiments:

1. Trigonometric levelling- heights and distance problem.
2. Heights and distances using principles of tachometric surveying.
3. Study of total station and its components - Practice for measurement of horizontal and vertical angles.
4. Measurement of distance and angles using total station.
5. Determination of area using total station.
6. Determination of remote height using total station.
7. Stakeout using total station.
8. Distance and gradient between two inaccessible points using total station.
9. Co-ordinates marking using total station.
10. Curve setting using total station.
11. Setting out works for buildings using total station.
12. Study of UAV (Drone) for surveying applications.

13. GNSS/GPS survey for Georeferencing.
14. Integration of ground survey (total station) and drone survey data in QGIS.

Laboratory Equipment/Software/Tools Required:

1. Tapes
2. Ranging rods
3. Theodolite
4. Total station
5. Electronic distance measuring instrument
6. QGIS

Books and Materials

Text Books:

1. A. M. Chandra. *Higher Surveying.* 3rd ed., New Age International Publishers, 2015.

Reference Books:

1. Satheesh Gopi, R. Sathi Kumar and N. Madhu. *Advanced Surveying: Total station, GPS, GIS and Remote sensing.* 2nd ed., Pearson Education in South Asia, New Delhi, 2017.

A9024 – Community Driven Product Evaluation

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	0	45	45	1	40	60	100

Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with ordinary differential equations of first and higher order and Laplace transforms, vector calculus. In addition, this course can be applied in many areas of engineering such as wireless communication, signal processing, robotics and animation.

Course Pre/Co-requisites

A9023 - Technology Entrepreneurship

Relevant Sustainable Development Goals (SDGs)

SDG 4: Quality Education
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production
SDG 17: Partnerships for the Goals

Course Outcomes

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

A9024.1. Apply structured evaluation frameworks to assess technical, functional, and social impact of products.

A9024.2. Conduct community-centered product testing and collect actionable feedback.

A9024.3. Benchmark products against industry standards and competitor solutions.

A9024.4. Analyze evaluation data to identify strengths, weaknesses, and areas for improvement.

A9024.5. Integrate knowledge from all prior courses to produce a comprehensive commercialization or patent readiness report.

Course Syllabus

Unit-I:

Product Evaluation Fundamentals: Purpose, scope, and importance of product evaluation in community contexts. Key Performance Indicators (KPIs), usability, and sustainability metrics. Ethical considerations in testing with communities.

Unit-II:

Standards, Compliance and Benchmarking: Relevant industry, safety, and environmental standards. Social impact and sustainability assessment frameworks. Competitive benchmarking and market gap analysis.

Unit-III:

Community Centered Testing and Data Collection: Designing and executing real-world product trials. Feedback mechanisms: surveys, interviews, observation, analytics. Collecting and categorizing qualitative and quantitative data.

Unit-IV:

Data Analysis and Product Improvement Planning: Analytical tools for interpreting evaluation results. Identifying design gaps and improvement opportunities. Translating insights into actionable product enhancement plans.

Unit-V:

Integrated Product Documentation: Consolidating insights from design thinking, product development, entrepreneurship, and evaluation. preparing a comprehensive commercialization or patent readiness dossier. and presenting outcomes to a review panel for validation and approval.

Activity Plan

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
1	Unit-I: Evaluation Fundamentals	Understand purpose, scope & importance of product evaluation	Concept briefing	Discussion: "Why evaluation is crucial for community-driven products"	Reflection note on role of evaluation in product lifecycle	CO1
2	Unit-I: KPIs & Metrics	Learn KPIs, usability & sustainability measures	Concept briefing + Case examples	Teams define KPIs for a sample product	Submit KPI framework for selected case	CO1
3	Unit-I: Ethics in Evaluation	Apply ethical considerations in testing	Problem-based learning + Collaborative exchange	Debate: "Ethics vs. Innovation speed in testing"	Short essay on ethical challenge in testing	CO1
4	Unit-II: Standards & Compliance	Learn relevant industry & safety standards	Demo session + Case study	Review product compliance requirements from standards body	Submit compliance checklist for a product	CO2, CO3
5	Unit-II: Benchmarking	Apply benchmarking frameworks	Hands-on session + Benchmarking activity	Benchmark 2 community products against market leaders	Submit benchmarking chart	CO3
6	Unit-II: Market Gap Analysis	Identify market gaps & opportunities	Hands-on session	Teams map competitor strengths vs weaknesses	Submit market gap report	CO3
7	Unit-III: Community-Centered Testing	Design product trials with stakeholders	Hands-on workshop + Role-play	Simulate community feedback session	Submit trial design protocol	CO2

Week	Unit	Objective	Teaching Method	In-Class Activities	Assignments / Assessments	CO Mapping
8	Unit-III: Feedback Mechanisms	Practice data collection methods	Practical session + Peer feedback	Run mock survey/interview for a prototype	Submit collected sample data	CO2
9	Unit-IV: Data Analysis Tools	Analyze evaluation data	Analytical lab + Software demo	Use basic data tools (Excel/SPSS/PowerBI) to interpret results	Submit initial analysis report	CO4
10	Unit-IV: Product Improvement	Translate insights into action	Product improvement exercise	Teams identify weaknesses & propose enhancements	Submit product improvement plan	CO4
11	Unit-V: Integrated Documentation	Consolidate learnings from all prior courses	Documentation	Draft commercialization or patent dossier	Submit draft dossier	CO5
12	Unit-V: Final Showcase	Present integrated evaluation outcomes	Showcase + Expert panel review	Final presentations with reports, feedback loop	Submit final commercialization/patent readiness dossier	CO5

Books and Materials

Text Books:

1. Deependra Sharma *Entrepreneurship in India*, Routledge, 2023.
2. Cooper, Robert G *Winning at New Products: Creating Value Through Innovation*, Basic Books, 2011.

Reference Books:

1. Dr. S. Glory Swarupa, Swapna Vanamala *Innovation, Incubation and Intellectual Property Rights: Experiences of Developing Countries*, 2023.

Vision

To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

Mission

To adopt innovative student centric learning methods.
To enhance professional and entrepreneurial skills through industry institute interaction.
To train the students to meet dynamic needs of the society.
To promote research and continuing education.

Quality Policy

We at Vardhaman College of Engineering, endeavor to uphold excellence in all spheres by adopting the best practices in effort and effect.

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