ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: B.E., Geoinformatics Engineering

Regulations: 2025 (Revised 1, 2026), with effect from the AY 2026 – 27 to all the students of UG Programme.

Abbreviations:

HUM – Humanities (Languages, Management, Heritage, and others)

BS – Basic Science (Mathematics, Physics, Chemistry)

ES– Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

SD – Skill Development

SL – Self Learning

CDP – Capstone Design Project

OE – Open Elective

L – Laboratory Course

T – Theory

LIT – Laboratory Integrated Theory

PW – Project Work

IPW – Internship cum Project Work

DIC – Department Introductory Course

TCP – Total Contact Period(s)

Program Outcomes

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyze complex problems using research and sustainability principles.
3. **Design Solutions**: Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations**: Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools**: Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment**: Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics**: Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork**: Work effectively as an individual and in multidisciplinary teams.
9. **Communication**: Communicate clearly in reports, presentations, and documentation across diverse groups.

10. **Management & Finance**: Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning**: Engage in continuous learning, adapt to new technologies, and think critically.

Program Specific Outcomes (PSOs)

1. Apply principles and techniques for acquiring, processing, analyzing, and interpreting geospatial data using remote sensing, GIS, GPS, and related technologies.
2. Design and implement geoinformatics-based solutions for applications in urban planning, natural resource management, environmental monitoring, and disaster management.
3. Utilize modern software tools, spatial databases, and programming techniques to manage, visualize, and analyze spatial information for decision-making and problem-solving.

Semester – I							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C01	Applied Calculus	T	3-1-0	4	4	BS
2.	CE25C01	Introduction to Civil Engineering	T	3-0-0	3	3	ES (PC) – DIC
3.	PH25C01	Applied Physics – I	LIT	2-0-2	4	3	BS
4.	CY25C01	Applied Chemistry – I	LIT	2-0-2	4	3	BS
5.	ME25C01	Engineering Drawing	LIT	2-0-4	6	4	ES (G)
6.	UC25H01	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	HUM
7.	EN25C01	English Essentials – I	T	2-0-0	2	2	HUM
8.	CS25C02	Computer Programming: Python	LIT	2-0-2	4	3	ES (PC)
9.	ME25C16	Makerspace: Group A – Mechanical Engineering	L	0-0-2	2	1	SD
10.	EE25C11	Makerspace: Group B – EEE & ECE	L	0-0-2	2	1	SD
11.	UC25A01	Life Skills for Engineers – I	---	1-0-2	3	1	HUM
12.	UC25A02	Physical Education – I	---	0-0-4	4	1	HUM
13.		NCC / NSS / NSO / YRC	---	---	---	---	---
				Total Credits	**39**	**27**	

Semester - II							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C02	Linear Algebra	T	3-1-0	4	4	BS
2.	UC25H02	தமிழர்களும் தொழில்நுட்பமும், Tamils and Technology	T	1-0-0	1	1	HUM
3.	PH25C02	Applied Physics (CE) - II	T	2-1-0	3	3	BS
4.	CY25C02	Applied Chemistry (CE) - II	T	2-0-0	2	2	BS
5.	EE25C01	Basic Electrical and Electronics Engineering	T	3-0-0	3	3	ES (G)
6.	GI25201	Geoinformatics Systems	LIT	2-0-2	4	3	ES (PC)
7.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
8.	ME25C05	Re-Engineering for innovation	L	0-0-4	4	2	SD
9.	UC25A03	Life Skills for Engineers – II	--	1-0-2	3	1	HUM
10.	UC25A04	Physical Education – II	--	0-0-4	4	1	HUM
11.		Foreign Language^	LIT	1-0-2	3	1	HUM
				Total Credits	**34**	**23**	

^ Deutsch / Japanese / Korean

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C09	Computational Differential Equations	T	3-1-0	4	4	BS
2.	GI25301	Spatial Database Management System	LIT	3-0-2	5	4	ES(PC)
3.	CE25C03	Surveying and Geomatics	T	3-0-0	3	3	ES(PC)
4.	GI25302	Remote Sensing	T	3-0-0	3	3	ES(PC)
5.	GI25303	Principles of Photogrammetry	T	3-0-0	3	3	ES(PC)
6.	CE25C04	Surveying and Geomatics Laboratory	L	0-0-4	4	2	ES(PC)
7.	GI25304	Remote Sensing and Photogrammetry Laboratory	L	0-0-4	4	2	ES(PC)
8.		Skill Development Course I	LIT	1-0-2	3	2	SD
9.	EN25C03	English Communication Skills Laboratory – I	L	0-0-2	2	1	HUM
				Total Credits	**31**	**24**	

Semester - IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods /Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	GI25401	Cartography and GIS	LIT	3-0-4	7	5	ES(PC)
2.	GI25402	Electronic Surveying	LIT	3-0-4	7	5	ES(PC)
3.	GI25403	Digital Image Processing	LIT	3-0-4	7	5	ES(PC)
4.	GI25404	Geodesy	T	3-0-0	3	3	ES(PC)
5.	GI25405	Hyperspectral and Thermal Remote Sensing	LIT	2-0-2	4	3	ES(PC)
6.		Skill Development Course II	LIT	1-0-2	3	2	SD
7.	EN25C04	English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
				Total Credits	**33**	**24**	

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.		Microwave Remote Sensing	LIT	3-0-2	5	4	ES (PC)
2.		Laser Scanning for Terrain Mapping	LIT	3-0-2	5	4	ES (PC)
3.		Spatial Analytics	LIT	2-0-4	6	4	ES (PC)
4.		Design of Concrete Structures	T	3-0-0	3	3	ES (PC)
5.		Programme Elective I	T	3-0-0	3	3	ES (PE)
6.		Programme Elective II	T	3-0-0	3	3	ES (PE)
7.		Skill Development Course - III	LIT	1-0-2	3	2	SD
8.		Industry Oriented Course - I	L	1-0-2	3	1	SD
				Total Credits	**31**	**24**	
For Honours Degree							
1.		Capstone Design Project – Level I	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – I	T	3-0-0	3	3	
2.		Honours Elective – II	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – I	T	3-0-0	3	3	

Semester – V							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
2.		Minor Elective – II	T	3-0-0	3	3	

Semester – VI							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T-P	TCP		
1.		Geospatial Analysis with Python Programming	LIT	1-0-4	5	3	ES (PC)
2.		Spatial Data Adjustment	LIT	3-0-0	3	3	ES (PC)
3.		Programme Elective – III	T	3-0-0	3	3	ES (PE)
4.		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
5.		Open Elective	T	3-0-0	3	3	--
6.		Project Management	T	2-0-0	2	2	HUM
7.		Survey and Mapping Project with Standards	LIT	1-0-2	3	2	ES (PC)
8.		Industry Oriented Course -II	LIT	1-0-2	3	1	SD
9.		Self-Learning Course	--	--	0	1	--
				Total Credits	**25**	**21**	
For Honours Degree							
1.		Capstone Design Project – Level II	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – III	T	3-0-0	3	3	
2.		Honours Elective – IV	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – III	T	3-0-0	3	3	
2.		Minor Elective – IV	T	3-0-0	3	3	

Semester – VII							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T-P	TCP		
1.		Engineering Entrepreneurship Development	LIT	2-0-2	4	3	HUM
2.		Climate Change and Sustainability	T	2-0-0	2	2	HUM

Semester – VII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
3.		Web and Cloud Based GIS	T	2-1-0	3	3	ES (PC)
4.		Natural Resource Management withGeomatics	T	3-0-0	3	3	ES (PC)
5.		Programme Elective - V	T	3-0-0	3	3	ES (PE)
6.		Programme Elective -VI	T	3-0-0	3	3	ES (PE)
7.		Mini Project	L	0-0-4	4	2	SD
Total Credits					**22**	**19**	
For Honours Degree							
1.		Capstone Design Project –Level III	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – V	T	3-0-0	3	3	
2.		Honours Elective – VI	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – V	T	3-0-0	3	3	
2.		Minor Elective – VI	T	3-0-0	3	3	

Semester - VIII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Project Work / Internship cum Project Work	PW/IPW	0-0-16	16	8	SD
Total Credits					**16**	**8**	

PROGRAMME ELECTIVE COURSES: STREAMS

Surveying & Mapping	Geospatial Data Analytics	Processing and Analysis	Geo Spatial Applications	Geodesy	Geo-Intelligence
Terrestrial and Satellite Photogrammetry	GIS Customization and Scripting	Soft Computing Techniques	Environmental Geoinformatics	Advanced Geodesy	Digital Twins & BIM
GNSS Surveying	Location Based Geospatial Services	Polarimetry and Interferometry	Transportation Geomatics	Satellite Geodesy	Big Data Analytics for Geomatics
Terrestrial and Bathymetric Laser Scanning	Space Syntax	Pattern Recognition	Geomatics for Hydrology and Water Resources	Physical Geodesy	IoT Applications in Geomatics
Unmanned Aerial System (UAS) for Large Scale mapping	GIS based Utility and Asset Management	Raster Data Modelling	Geomatics for Disaster and Risk Mitigation	Geodetic Interferometry	Decision Support Systems for Geomatics
Underground and Hydrographic Surveying	Geo Spatial Modeling& Simulation	Agriculture and Forest Management using Geomatics	Satellite Meteorology	Geodetic Control Survey and Adjustment	Location Intelligence& Surveillance
Cadastral Surveying	Sustainable Development Goalsand Geomatics	Spatial Statistics	Geomatics for ocean and Coastal Applications	Geodetic Astronomy	Geomatics for SmartCities

Semester I

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4

Course Objectives:

- To provide technical competence of modelling engineering problems using calculus.
- To apply the calculus concepts in solving engineering problems using analytical methods and computational tools.

Differential Calculus: Functions, graph of functions, New functions from old functions, Limit of a function, Continuity, Limits at infinity, Derivative as a function, Maxima and Minima of functions of single variable, Mean value theorem, Effect of derivatives on the shape of a graph.

Activities: Visualization of the functions, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Functions of Several Variables: Partial derivatives, Chain rule, Total derivative, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers, Application problems in engineering.

Activities: Partial Derivatives with two or three variables, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Integral Calculus: Fundamental theorem of Calculus, Indefinite integrals and the Net Change Theorem, Improper integrals, Arc Length, Area of Region, Area of surface of revolution.

Activities: Definite and Indefinite Integrals, Determination of Area, Solving of Competitive Examination questions (Ex. GATE).

Multiple Integrals: Iterated integrals and Fubini's theorem, Evaluation of double integrals, change of order of integration, change of variables between Cartesian and polar co-ordinates, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates.

Activities: Double integrals and triple integrals using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Methodology for Continuous Assessment : Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).

References:

1. Anton, H., Bivens, I. C., & Davis, S. (2021). Calculus: Early transcendentals. John Wiley & Sons.
2. Ron Larson and David C. Falvo,(2013), Calculus: an Applied Approach. Cengage Learning.
3. Stewart, J., Clegg, D., & Watson, S. (2019). Calculus: Early transcendentals.

4. Thomas, G. B., Jr., Weir, M. D., Hass, J., & Heil, C. (2018). Thomas' calculus: Early transcendentals. Pearson.
5. Singh, K. (2019). Engineering Mathematics through applications, Bloomsbury Publishing.
6. Grewal, B. S. (2012). Higher Engineering Mathematics, Khanna Publishers.

E-resources:

1. https://math.libretexts.org/Bookshelves/Calculus/Map%3A_Calculus__Early_Transcendentals_(Stewart)/
2. https://openstax.org/books/calculus-volume-1/
3. https://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
4. SCILAB, https://www.scilab.org/

	Description of CO	**PO**	**PSO**
CO1	Explain the meaning of derivative, integral, and their geometric and physical interpretations.	---	---
CO2	Apply differentiation and integration techniques to compute maxima, minima, and area.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyze the behavior of single and multivariable functions using derivatives and partial derivatives.	PO2(3)	PSO1(2) PSO3(1)
CO4	Utilize modern computational software and online platforms to deepen understanding, perform complex calculations, and visualize mathematical concepts.	PO5(2) PO11(1)	PSO2(3) PSO3(1)

CE25C01	Introduction to Civil Engineering	L	T	P	C
		3	0	0	3

Course Objective:

- To impart the significance of the Civil Engineering and provide insight to the essentials of components of infrastructure.

Overview of Civil Engineering: Role of civil engineers in society, Ethics in Civil Engineering Practice, outstanding accomplishments of the profession, future trends- Types of projects, stages of projects, specification and scope.

Fields of Civil Engineering: Overview of Structural, Construction, Geotechnical, Environmental, Transportation, Water Resources and Environmental Engineering – Introduction to Engineering Geology and seismology.

Civil Engineering Materials: Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel – Timber, Glass - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building components.

Building Components: Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering- NBC.

Infrastructure:

Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management system- Introduction to Highways and Railways - Introduction to Green Buildings.

Activities:

An Industrial visit to a nearby Civil Engineering Projects.

Seminar / assignment on Emerging Civil Engineering fields.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (10%), Assignments (40%) and Internal Examinations (50%)

References:

1. Ramamrutham, S. (2013). Basic civil engineering. Dhanpat Rai Publishing Co. (P) Ltd.
2. Seetharaman, S. (2005). Basic civil engineering. Anuradha Agencies.
3. Kumar, S. (2001). Building construction. Standard Publishers.
4. Rangwala, S. C. (2009). Building materials (27th ed.). Charotar Publishing House Pvt. Ltd.
5. Palanichamy, M. S. (2000). Basic Civil Engineering. Tata McGraw Hill.

	Description of CO	PO	PSO
CO1	Explain core Civil engineering concepts.	---	---
CO2	Apply basic engineering calculations in Civil Engineering systems.	PO1(3)	PSO1(3) PSO2(1)
CO3	Identify practices followed in infrastructure construction.	PO2(2)	PSO2(2) PSO3(1)

PH25C01	Applied Physics – I	L	T	P	C
		2	0	2	3

Course Objective(s):

- To impart knowledge and expose the essentials of physics in various engineering applications.

Properties of Matter: Elasticity, Cantilever, Young's modulus (non-uniform bending), Girders: Bridges and buildings, Viscosity: Stokes method, Surface tension: drop weight method, Thermal expansion, Thermal stress, Bimetallic strips, Expansion joints

Practical: Non-Uniform bending, Young's modulus of the material, Torsional pendulum, Rigidity modulus of the wire and moment of inertia of the disc.

Activities: Virtual demonstration of thermal stress.

Oscillations: Simple Harmonic motion, Torsional pendulum, Couple per unit twist, Damped and Forced Oscillation

Waves: Waves on a stretched string, Energy and Power, standing waves, Ultrasonics, piezo, electric method, Acoustic grating, Electromagnetic waves: Maxwell equation, Production of EM waves by dipole antenna, Propagation of EM waves in free space, wave equation, Cell phone reception

Practical: Melde's string experiment – Frequency of an electrically vibrating metal tip.

Activities: Virtual demonstration of propagation of EM waves

Quantum Mechanics: Black body radiation, Photoelectric effect, de Broglie hypothesis, Schrodinger Wave equation, Particle in a box (infinite potential well - three-dimensional box), Barrier penetration and quantum tunnelling.

Practical: Photo-electric effect, Determination of Planck's constant.

Activities: Virtual demonstration of Scanning Transmission Electron Microscope

Applied Optics: Interference: Air wedge, Michelson's Interferometer, Fiber optics: Structure of a fiber, Fiber Optic Communication System, Fiber Sensors (Virtual demo), Displacement, pressure sensor and Temperature sensor, Einstein Co-efficient, Nd: YAG laser, CO_2 laser (construction, functioning and applications), dye laser

Practical: Ruling width of Compact disc using Laser, Thickness of a thin sheet/wire using Air wedge Method.

Activities: Demonstration of sensors and applications of Lasers

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Young, H. D., & Freedman, R. A. (2020). University physics with modern physics. Pearson.
2. Gaur, R. K., & Gupta, S. L. (2022). Engineering physics. Dhanpat Rai Publications.
3. Mathur, D. S. (2010). Elements of properties of matter. S. Chand Publishing.
4. Griffiths, D. J. (2018). Introduction to quantum mechanics. Cambridge University Press.
5. Silfvast, W. T. (2008). Laser fundamentals. Cambridge University Press.

E-Resources:

1. Barrier penetration problem and Quantum tunnelling: https://archive.nptel.ac.in/courses/115/104/115104096/
2. EM waves and wireless channelling: https://onlinecourses.nptel.ac.in/noc24_ee31/preview
3. CO2 Laser: https://onlinecourses.nptel.ac.in/noc25_ph03/preview
4. Bimetallic Strips _ https://www.youtube.com/watch?v=WZQ8lvxdzDk
5. Cell phone Reception_ https://www.youtube.com/watch?v=1JZG9x_VOwA
6. Dipole Antenna_ https://www.youtube.com/watch?v=4xF1Fq2wB1I
7. Optical Sensors_ https://auece.digimat.in/nptel/courses/video/108106173/L02.html
8. Scanning Tunnelling Electron Microscope_ https://www.youtube.com/watch?v=XNYZYbXNWQA

	Description of CO	PO	PSO
CO1	Explain the physics concepts in various applications.	---	---
CO2	Apply the principles of wave optics and laser physics in practical systems.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the behaviour of materials under different conditions.	PO2(2)	PSO1(2) PSO3(1)
CO4	Conduct experiments in groups and interpret the data.	PO4(3) PO8(1)	PSO1(2) PSO2(2)

CY25C01	Applied Chemistry – I	L	T	P	C
		2	0	2	3

Course Objectives:

- To provide students with a solid understanding of the chemical principles for engineering applications.
- To introduce the chemical properties of materials and how these properties influence the selection and use of materials in engineering systems.
- To impart practical applications of chemistry in commonly used engineering devices

Water Technology: Water quality parameters and standards. Industrial feed water, Remediation. Municipal water treatment. Desalination.

Practical: Analysis of alkalinity, hardness and dissolved oxygen.

Activity: Coagulation of water sample using Alum

Nano-chemistry: Classification, Size, dependent properties. Preparation of nanomaterials, Top-down and Bottom-Up approaches, Applications (Flipped classroom).

Practical: Preparation of nanoparticles by Sol-Gel method.

Electrochemistry: Electrochemical cell, Electrode potential., Redox reaction. Conductivity of electrolytes, Factors.

Practical: Conductometric titrations

Activity: Electrochemical cell demonstration

Corrosion & Control: Chemical and electrochemical corrosions, galvanic series, factors influencing corrosion, Electrochemical protection. Organic and Inorganic coating.

Practical:

- Corrosion study by weight loss and salt spray method.
- Potentiometry/UV-visible spectrophotometer.

Activities: Case Study on Corrosion in Pipelines and Electronics, Control measures for a corroded metal

Batteries

Conventional, Contemporary and Emerging battery storage technologies, Primary & Secondary Batteries, Battery Pack, Battery Materials, Performance Parameters, Testing, Safety aspects.

Practical: Measurement of EMF, Internal Resistance, Charge and Discharge Characteristics.

Activities: Demonstration of battery pack in e-vehicles.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Jain, P. C., & Jain, M. (2015). Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd.
2. Dara, S. S. (2004). A Textbook of Engineering Chemistry. Chand Publications.
3. Sachdeva, M. V. (2011). Basics of Nano Chemistry. Anmol Publications Pvt Ltd.
4. Friedrich, E. (2014). Engineering Chemistry. Medtech.

E-Resources:

1. Water and Wastewater Engineering (Prof. Ligy Philip, IIT Madras) – https://nptel.ac.in/courses/105106202.
2. Electrochemical Energy Systems (Prof. S. Mitra, IIT Madras) – https://nptel.ac.in/courses/113106028.
3. Corrosion (Prof. Kallol Mondal, IIT Kanpur) – https://nptel.ac.in/courses/112104088
4. Chemistry of Battery Systems (Prof. V. R. Marathe, IIT Madras) – https://nptel.ac.in/courses/115106130
5. Resource on all battery types, testing, and safety – https://batteryuniversity.com/articles

	Description of CO	PO	PSO
CO1	Understand the importance of chemistry applications with underlying mechanisms.	---	
CO2	Apply the chemistry concepts in widely used devices.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the effect of various chemical parameters on performance of engineering systems.	PO2(2)	PSO1(2) PSO2(1)
CO4	Perform experimentations as a group and interpret the results.	PO4(3) PO8(1)	PSO2(2) PSO3(2)
CO5	Communicate findings through case studies and reports	PO9(1)	PSO2(2) PSO3(3)

ME25C01	Engineering Drawing	L	T	P	C
		2	0	4	4

Course Objectives:

- To impart knowledge on dimensions and drawing standards.
- To explore the orthographic projection of lines and solids.
- To provide the understanding of orthographic, isometric and perspective views.

Fundamentals: Drawing instruments, Drawing standards (BIS), Lettering in engineering, Sheet layout, elements of dimensioning, Systems of dimensioning. Free hand sketching of 2D & 3D objects, Conics – Ellipse, Parabola and Hyperbola.

Activities: Virtual Demonstration of Conics and Cycloids.

Orthographic Projection: First angle projection, Projection of points, straight lines and planes.

Projection of Solids: Simple Solids, Section of Solids, Development of Surfaces

Activities: Development of models of various solids and virtual demonstration of sectioning, CAD modelling of 2D objects.

Isometric Projection: Isometric Scale, Projection of Simple solids.

Activities: Conversion of 3D into 2D orthographic views, CAD modelling of 3D objects.

Perspective Projection: Simple solids projection

Activities: Virtual demonstration of perspective views.

Project: Development of 2D objects and 3D objects using CAD tools.

Weightage:
Continuous Assessment: 50%
End Semester Examinations: 50%

Methodology for Continuous Assessment :
Project – 10%, Models - 5%, Assignments - 35% and Internal Examinations - 50%

References:

1. Natarajan, K. V. (2025). A Text Book of Engineering Graphics. Dhanalakshmi Publisher.
2. Venugopal, K., & Prabhu Raja, V. (2022). Engineering Drawing + AutoCAD. New Age International Publishers.

E-resources:

1. CAD Software – https://www.freecadweb.org/
2. Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – https://onlinecourses.nptel.ac.in/noc22_me105/preview
3. MIT Design Handbook: Engineering Drawing and Sketching – https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

	CO Description	PO	PSO1
CO1	Explain the advantages of engineering drawing in engineering applications	---	
CO2	Apply the concepts of projections in formulating various solid parts in engineering systems.	PO1(3)	PSO1(2)
CO3	Analyse the various view and interpret the engineering drawings.	PO2(3)	PSO1(2)
CO4	Use CAD tools for creation of various models.	PO3(1)	PSO2(2)
CO5	Critically think and develop innovative models.	PO11(1)	PSO3(1)

UC25H01	தமிழர் மரபு	L	T	P	C
		1	0	0	1

மொழி மற்றும் இலக்கியம்: இந்திய மொழிக் குடும்பங்கள், திராவிட மொழிகள், தமிழ் ஒரு செம்மொழி, தமிழ் செவ்விலக்கியங்கள், சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை, சங்க இலக்கியத்தில் பகிர்தல் அறம், திருக்குறளில் மேலாண்மைக் கருத்துக்கள், தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம், பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள், சிற்றிலக்கியங்கள், தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி, தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை:நடுகல் முதல் நவீன சிற்பங்கள் வரை, ஐம்பொன் சிலைகள், பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் , தேர் செய்யும் கலை, சுடுமண் சிற்பங்கள், நாட்டுப்புறத் தெய்வங்கள், குமரிமுனையில் திருவள்ளுவர் சிலை, இசைக் கருவிகள், மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

தமிழர்களின் திணைக் கோட்பாடுகள்: தமிழகத்தின் தாவரங்களும், விலங்குகளும், தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள், தமிழர்கள் போற்றிய அறக்கோட்பாடு, சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும், சங்ககால நகரங்களும் துறை முகங்களும், சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி, கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு, இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் , சுயமரியாதை இயக்கம் இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள், தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

UC25H01	Heritage of Tamils	L	T	P	C
		1	0	0	1

Language and Literature: Language Families in India, Dravidian Languages, Tamil as a Classical Language, Classical Literature in Tamil, Secular Nature of Sangam Literature, Distributive Justice in Sangam Literature, Management Principles in Thirukural, Tamil Epics and Impact of Buddhism & Jainism in Tamil Land, Bakthi Literature Azhwars and Nayanmars, Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Heritage - Rock Art Paintings to Modern Art – Sculpture: Hero stone to modern sculpture, Bronze icons, Tribes and their handicrafts, Art of temple car making, Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments, Mridhangam, Parai, Veenai, Yazh and Nadhaswaram, Role of Temples in Social and Economic Life of Tamils.

Folk and Martial Arts: Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance, Sports and Games of Tamils.

Thinai Concept of Tamils: Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature, Aram Concept of Tamils, Education and Literacy during Sangam Age, Ancient Cities and Ports of Sangam Age, Export and Import during Sangam Age, Overseas Conquest of Cholas.

Contribution of Tamils to Indian National Movement and Indian Culture:
Contribution of Tamils to Indian Freedom Struggle, The Cultural Influence of Tamils over the other parts of India, Self-Respect Movement, Role of Siddha Medicine in Indigenous Systems of Medicine, Inscriptions & Manuscripts, Print History of Tamil Books

References:

1. தமிழகவரலாறு, மக்களும்பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ், முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி, வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை, ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils, The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi, 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL), Reference Book.

EN25C01	English Essentials – I	L	T	P	C
		2	0	0	2

Course Objectives:

- Enhance learners' listening and speaking skills to understand and deliver speeches effectively
- Equip students with the skills to write clear, coherent, and grammatically correct texts for various purposes.
- Strengthen the ability to comprehend, interpret, and analyse written English across diverse contexts.

Speaking Skills: Self-Introduction (Tenses, Adjectives) Expressing opinions (Subject-Verb Agreement), Participating in Conversations (Speech Acts - agreeing & disagreeing – synonyms and antonyms**)**

Suggested Activities: Self-Introduction, Just a Minute (JAM) Video recording, Situational role plays, Spell Bee, Word Substitution, Usage of Apps.

Listening Skills: Listening to Simple Conversations (Understanding tone and intent), Short Speeches / Stories, Extracting information, Pronunciation, Listening to Various Accents.

Suggested Activities: Listening and Repeating, Gap fill exercises, Note-taking

Reading Skills: Reading Strategies – (Skimming, scanning, predicting) intensive reading - short passages and long passages on suggested themes (Sentence Patterns, Prefixes and suffixes, idioms and phrases).

Activities: Reading - newspaper and digital articles, Cloze, Reading comprehension, note making and summarising,

Writing Skills: Word Substitution, Sentence Formation, Hints Development (Guided Writing), Writing Different Types of Paragraphs - (Sentence Structure) – Letter Writing / Emails (Informal)

Activities: Error Detection, Picture and poster description, Descriptive, Narrative and Comparative paragraphs, Brainstorming and Mind Mapping - Informal letters/ Emails

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (10%), Assignments (20%), Speaking Task (10%), Reading Task (10%), Writing Task (10%), Internal Examinations (40%).

References:

1. Miller, K. Q., & Wahl, S. T. (2023). Business and Professional Communication: KEYS for Workplace Excellence (5th ed.). SAGE Publications.

2. Kumar, Sanjay & Pushpalatha. (2018). English Language and Communication Skills for Engineers. India: Oxford University Press.
3. Sharma, S., & Mishra, B. (2024). Communication Skills for Engineers and Scientists. PHI Learning.

E-resources:

1. Cambridge English – https://www.cambridgeenglish.org/learning-english/grammar-and-vocabulary/
2. Perfect English Grammar – https://www.perfect-english-grammar.com/
3. British Council – Learn English - https://learnenglish.britishcouncil.org/grammar
4. Speechling – https://speechling.com/
5. mePro by Pearson – https://mepro.pearson.com/
6. TED Talks – https://www.ted.com/

	Description of CO	**PO**	**PSO1**
CO1	Listen and comprehend spoken English, take and draft notes.	---	---
CO2	Apply vocabulary and grammar appropriately to communicate in written and spoken forms.	PO1(3)	PSO1(2) PSO3(3)
CO3	Analyze texts in different contexts using appropriate reading strategies.	PO2(2)	PSO2(1)
CO4	Communicate thoughts and ideas in real life situations.	PO9(2)	PSO3(2)
CO5	Develop communication skills relevant to engineering and technology.	PO11(1)	PSO3(3)

CS25C02	Computer Programming: Python	L	T	P	C
		2	0	2	3

Course Objectives:

- To equip engineering students with the foundational knowledge and practical skills in Python programming to analyse and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

Introduction to Python: Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, Interactive and Script Mode, Indentation, Comments, Error messages, Variables, Reserved Words, Data Types, Arithmetic operators and expressions, Built-in Functions, Importing from Packages.

Practical: Problem Analysis Chart, Flowchart and Pseudocode Practices. (Minimum three)

Control Structures: if, if-else, nested if, multi-way if-elif statements, while loop, for loop, nested loops, pass statements.

Practical: Usage of conditional logics in programs. (Minimum three)

Functions: Hiding redundancy, complexity; Parameters, arguments and return values; formal vs actual arguments, named arguments, Recursive & Lambda Functions.

Practical: Usage of functions in programs. (Minimum three)

Strings & Collections: String Comparison, Formatting, Slicing, Splitting, Stripping, Lists, tuples, and dictionaries, basic list operators, searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values.

Practical: String manipulations and operations on lists, tuples, sets, and dictionaries. (Minimum three)

File Operations: Create, Open, Read, Write, Append and Close files. Manipulating directories, OS and Sys modules, reading/writing text and numbers, from/to a file; creating and reading a formatted file (csv, tab-separated, etc.).

Practical: Opening, closing, reading and writing in formatted file format and sort data. (Minimum three)

Packages: Built-in modules, User-Defined modules, Numpy, SciPy, Pandas, Scikit-learn**.**

Practical: Usage of modules and packages to solve problems. (Minimum three), Project (Minimum Two)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Matthes, E. (2019). Python crash course: A hands-on, project-based introduction to programming. No Starch Press.
2. Brown, M. C. (2018). Python: The complete reference. McGraw Hill Publishers.
3. Guttag, J. V. (2016). Introduction to computation and programming using Python: With applications to understanding data. MIT Press.
4. McKinney, W. (2017). Python for data analysis: Data wrangling with pandas, NumPy, and IPython. Shroff/O'Reilly.

E-resources:

1. Official Python Documentation – https://docs.python.org/3/
2. Python Tutorials – https://www.w3schools.com/python/
3. NumPy – https://numpy.org/doc/
4. SciPy – https://scipy.org/
5. Google's Python class – https://developers.google.com/edu/python/

	Description of CO	**PO**	**PSO**
CO1	Explain the potential usage of Python in engineering applications	---	---
CO2	To apply the concepts of Python in solving engineering problems and formulate new projects.	PO1 (2) PO5 (2)	PSO2(2) PSO3(1)
CO3	To interpret the data and effectively communicate in groups.	PO2 (3) PO8 (1) PO9 (1)	PSO3(1) PSO3(2)
CO4	Adapt new programming concepts and technologies in the profession.	PO11 (1)	PSO2(2)

ME25C16	Makerspace : Group A– Mechanical Engineering	L	T	P	C
		0	0	2	1

Course Objectives:

1. To develop practical skills in the **selection, handling and safe use of hand tools and power tools** for assembly, disassembly and basic fabrication activities.
2. To provide hands-on experience in **welding processes, joint preparation and fabrication of simple components** using appropriate materials and welding techniques.
3. To introduce students to **contemporary digital manufacturing practices**, including solid modelling, assembly modelling, 3D printing and laser cutting.

List of Activities:

(A). Dis-assembly & Assembly Practices

i. Tools and its handling techniques.
ii. Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.
iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.
iv. Dis-assembly and assembly of a Bicycle.

(B). Welding Practices

i. Welding Procedure, Selection & Safety Measures.
ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.
iii. Hands-on session of preparing base material & Joint groove for welding.
iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Stell plates / pipes, for fabrication of a simple part.

(C). Contemporary Digital Manufacturing Practices

i. Demonstration of Solid Modelling of components.
ii. Demonstration of Assembly Modelling of components.
iii. Fabrication of simple components / parts using 3D Printers.
iv. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

References:

1. Stephen Christena, Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics, Crestline Books, 2014.
2. H. Lipson, Fabricated - The New World of 3D Printing, Wiley, 1st edition, 2013.
3. Refrigeration and Air Conditioning C. P. Arora 3rd McGraw Hill Education 2014
4. Welding: Principles and Applications Larry Jeffus 9th Cengage Learning 2020/2021.
5. Computer Aided Design and Manufacturing M. M. M. Sarcar, K. Mallikarjuna Rao & K. Lalit Narayan 2nd PHI Learning 2012
6. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing Ian Gibson, David Rosen, Brent Stucker & Mahyar Khorasani 3rd Springer 2021.

	Description of CO	PO	PSO
CO1	Demonstrate the proper selection, use and handling of basic hand tools and power tools for assembly and disassembly activities.	PO (3)	---
CO2	Apply appropriate welding processes and safety practices to prepare joints and fabricate simple mechanical components.	PO1(3)	PSO2(1)
CO3	Develop three-dimensional solid and assembly models of simple mechanical components using appropriate CAD software.	PO5(3)	PSO2(2)
CO4	Fabricate simple components using contemporary manufacturing processes such as 3D printing and laser cutting while adhering to applicable safety practices.	PO8(2)	PSO3(2)

EE25C11	Makerspace : Group B – EEE & ECE	L	T	P	C
		0	0	2	1

Course Objectives:

1. To develop practical skills in the selection, handling, assembly and disassembly of electrical and electronic components using appropriate tools and techniques.
2. To provide hands-on experience in electrical wiring, soldering, electronic circuits, and the integration of sensors, actuators and microcontrollers for basic applications.

List of Activities:

(A) Electrical Wiring Practices

i. Electrical Installation tools, equipment & safety measures.
ii. Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box.
iii. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.
iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(B) Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.
ii. Dis-assembly and assembly of Computers.
iii. Hands-on session of Soldering Practices in a Printed Circuit Board.
iv. Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.
v. Hands-on session of integration of sensors and actuators with a Microcontroller.
vi. Demonstration of Programmable Logic Control Circuit.

References:

1. Code of Practice for Electrical Wiring Installations (IS 732:2019)
2. Electrical Wiring, Estimating & Costing — S. L. Uppal, Sixth Edition, Khanna Publishers,1987.
3. Electronic Devices and Circuit Theory — Boylestad & Nashelsky,11th Edition, Pearson Education India, 2015.
4. Practical Electronics for Inventors — Scherz & Monk, 4th Edition, MGH, 2016.
5. Programmable Logic Controllers — Frank D. Petruzella,6th Edition, MGH, 2023.

	Description of CO	PO	PSO
CO1	Demonstrate the proper selection, use and handling of electrical installation tools and equipment for basic electrical wiring practices.	---	---
CO2	Carry out basic electrical wiring connections for domestic and low-power applications, applying appropriate safety and protection measures.	PO1(3)	PSO2(1)
CO3	Assemble, disassemble and test basic electronic components and circuits using appropriate soldering and testing techniques.	PO5(2)	PSO2(2)
CO3	Integrate sensors and actuators with a microcontroller and demonstrate basic programmable control applications.	PO11(2)	PSO3(2)

UC25A01	Life Skills for Engineers – I	L	T	P	C
		1	0	2	1

Course Objectives

- To equip engineering students with essential life skills encompassing personal and emotional development, effective management of time and stress, financial literacy, digital safety, and civic responsibility.
- To enhance self-awareness, interpersonal skills, and resilience to prepare students for the professional and personal challenges of engineering careers and life beyond academics**.**

Personal and Emotional Development: Self-Awareness & Personality, Emotional Intelligence & Empathy, Positive thinking, Right attitude, Stress & Anger Management, Goal-Setting & Time Management, Growth Mindset & Resilience.

Activities: Personality tests (MBTI, DISC), reflection journals, Empathy circle, role-playing difficult conversations, Guided mindfulness sessions, stress relief toolkit creation, Vision board creation, weekly time audit and planner, Group challenge scenarios, resilience journal.

Management Skills: Financial Literacy: Budgeting & Saving, Nutrition, Health, and Hygiene, Digital Literacy & Online Safety, Civic Responsibility & Ethics

Activities: Create a monthly budget, financial simulation game, Meal planning workshop, physical wellness challenge, Social media audit, privacy and safety scenarios, Community service, values debate.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. Khera, S. (2003). You can win. Macmillan.
2. Levesque, H. (n.d.). Life skills 101: A practical guide to leaving home and living on your own. (Publication year not specified)
3. Mitra, B. K. (2017). Personality development & soft skills (3rd impression). Oxford University Press.
4. ICT Academy of Kerala. (2016). Life skills for engineers. McGraw Hill Education (India) Private Ltd.

	Description of CO	PO	PSO1
CO1	Understand personality traits and emotional intelligence, in interpersonal interactions.	---	---
CO2	To work and execute as a team through successful implementation of set goals.	PO7 (1) PO8 (2) PO9 (2)	PSO3(2)
CO3	Develop and implement best practices in day-to-day life, in terms of planning and execution.	PO11 (3)	PSO3(2)

UC25A02	Physical Education - I	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart the fundamentals of physical education for development of students' physical, mental, and social well-being.
- To instill a lifelong appreciation for physical activity towards the development of positive attitude and fostering values of team work and sportsmanship.

Introduction to physical education: Exercise for Good Posture – Conditioning and Calisthenics for Before start, Jogging, Bending, Twisting, Standing, Sitting and Relaxation, Training on First Aid Practices.

Participation of athletic events: Rules and regulations of important athletic events, Sprint, Jumps, Throws and Hurdles.

Skill development in any one of the following outdoor games: Basket Ball, Volley Ball, Ball Badminton, Football, Hockey, Kho-Kho, Kabaddi, Cricket, Hand ball and Tennis.

Skill development in any one of the following indoor games: Shuttle Badminton, Chess and Table Tennis.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	---
CO2	Apply basic principles of exercise science in the routine life.	PO1(3)	PSO1(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8(3)	PSO3(2)
CO4	Demonstrate independent learning in health, nutrition, and fitness-related topics.	PO11(2)	PSO3(2)

Semester II

MA25C02	Linear Algebra	L	T	P	C
		3	1	0	4

Course Objectives:

- To impart foundational knowledge in linear algebra essential for analysing and solving problems in engineering applications.
- To provide the knowledge on computation using software and interpret key linear algebra concepts using software.

Vector Spaces Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension, Dimension of Subspaces.

Activities: Open-Source software, exercises to test linear dependence and independence using rank, compute span and basis of a set of vectors, determine the dimension of subspaces, and illustrate the concept of subspace and basis in $\boldsymbol{R^2}/\boldsymbol{R^3}$ with visualization.

Linear Transformations and Diagonalization: Null space, Range, Dimension Theorem (statement only), Matrix representation of a linear transformation, Eigenvalues & Eigenvectors, Diagonalizability.

Activities: Open-Source software, exercises to compute the matrix representation of a linear transformation, find the null space and range of a matrix, and compute eigenvalues and eigenvectors of a matrix.

Inner Product Spaces: Inner product, Norms, Cauchy, Schwarz inequality, Gram, Schmidt orthogonalization, Simple problems (up to $\boldsymbol{R^3}$).

Activities: Open-Source software, exercises to compute inner products and vector norms.

Matrix Decomposition: Orthogonal transformation of a symmetric matrix to diagonal form - Positive definite matrices, QR decomposition, Singular Value Decomposition (SVD), Least squares solutions- simple problems (up to $3 \times 3\ matrices$).

Activities: Open-Source software, exercises to check if a matrix is positive definite, perform QR decomposition and SVD using built-in functions.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Methodology for Continuous Assessment : Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). Linear algebra. Pearson.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). Linear algebra and its applications with MATLAB. Pearson.
3. Bronson, R. (2011). Schaum's outline of matrix operations. McGraw-Hill Education.
4. Strang, G., & Thomson, R. (2005). Linear algebra and its applications. Brooks/Cole.

5. Lipschutz, S., & Lipson, M. (2009). Schaum's outline of linear algebra. McGraw-Hill.
6. Kreyszig, E. (2018). Advanced engineering mathematics. Wiley India.

	Description of CO	PO	PSO
CO1	Explain the fundamental concepts of Linear Algebra.	---	
CO2	Compute and interpret eigenvalues and eigenvectors.	PO1(3)	PSO1(2)
CO3	Apply inner product concepts and perform orthogonalization.	PO1 (3)	PSO1(1)
CO4	Compute least squares solutions of linear system of equations.	PO1 (2) PO2 (2)	PSO3(1)
CO5	Use MATLAB to implement and validate key linear algebra concepts	PO5 (1) PO11 (1)	PSO2(2)

UC25H02	தமிழர்களும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில், பானைத் தொழில்நுட்பம், கருப்பு சிவப்பு பாண்டங்கள், பாண்டங்களில் கீறல் குறியீடுகள்.

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு, சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள், மாமல்லபுரச் சிற்பங்களும், கோவில்களும், சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள், மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ, சாரோசெனிக் கட்டிடக் கலை.

உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை, உலோகவியல், இரும்புத் தொழிற்சாலை, இரும்பை உருக்குதல், எஃகு, வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள், நாணயங்கள் அச்சடித்தல், மணி உருவாக்கும் தொழிற்சாலைகள், கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள், எலும்புத்துண்டுகள், தொல்லியல் சான்றுகள், சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு, சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம், கால்நடை பராமரிப்பு, கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள், வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள், கடல்சார் அறிவு, மீன்வளம், முத்து மற்றும் முத்துக்குளித்தல், பெருங்கடல் குறித்த பண்டைய அறிவு, அறிவுசார் சமூகம்.

அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழ் வளர்ச்சி, தமிழ் நூல்களை மின்பதிப்பு செய்தல், தமிழ் மென்பொருட்கள் உருவாக்கம், தமிழ் இணையக் கல்விக்கழகம், தமிழ் மின் நூலகம், இணையத்தில் தமிழ் அகராதிகள், சொற்குவைத் திட்டம்.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (20%), Assignments (30%), Internal Examinations (50%)

References

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

UC25H02	Tamils and Technology	L	T	P	C
		1	0	0	1

Weaving and Ceramic Technology: Weaving Industry during Sangam Age, Ceramic technology, Black and Red Ware Potteries (BRW), Graffiti on Potteries.

Design and Construction Technology: Designing and Structural construction House & Designs in household materials during Sangam Age, Building materials and Hero stones of Sangam age, Details of Stage Constructions in Silappathikaram, Sculptures and Temples of Mamallapuram, Great Temples of Cholas and other worship places,Temples of Nayaka Period, Type study (Madurai Meenakshi Temple), Thirumalai Nayaka rMahal, Chetti Nadu Houses, Indo, Saracenic architecture at Madras during British Period.

Manufacturing Technology: Art of Ship Building, Metallurgical studies, Iron industry, Iron smelting, steel, Copper and gold Coins as source of history - Minting of Coins, Beads making, industries Stonebeads, Glass beads, Terracotta beads, Shell beads / bone beats, Archeological evidences, Gem stone types described in Silappathikaram.

Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompuof Chola Period, Animal Husbandry - Wells designed for cattle use , Agriculture and Agro Processing -Knowledge of Sea -Fisheries, Pearl, Conche diving, Ancient Knowledge of Ocean -Knowledge Specific Society.

Scientific Tamil & Tamil Computing: Development of Scientific Tamil, Tamil computing, Digitalization of Tamil Books, Development of Tamil Software, Tamil Virtual Academy, Tamil Digital Library, Online Tamil Dictionaries, Sorkuvai Project.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (20%), Assignments (30%), Internal Examinations (50%)

References

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils, The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi , 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

PH25C02	Applied Physics (CE) – II	L	T	P	C
		2	1	0	3

Course Objectives:

- To provide a comprehensive understanding of physics concepts in Civil engineering applications.

Mechanic: Elasticity – Types of supports and loads – free body diagrams - Equilibrium of rigid bodies – Types of structures: Beams, frames, trusses – Analysis of trusses – internal forces in members – Moment of inertia and bending- cantilever

Activities: Virtual Demonstration of deflection of beams and moment of inertia.

Acoustics: Reverberation – Loudness – Focusing – Echelon – Noise – Echo - Resonance – Interference – Sabine's formula (Derivation) – Absorption coefficient – Sonometer - Sound insulation.

Activities: Virtual Demonstration of sound insulation and resonance.

Lighting: Visual field glare, colour – day light calculations – day light design of windows, measurement of day light and use of models and artificial skies - artificial lighting – LED characteristics.

Activities: Virtual Demonstration of heat infiltration in glass, glass as building material, LED Characteristics.

Engineering Materials: Composites – Fibre Reinforced Plastics (FRP) – Fiber Reinforced Metals (FRM) – Fiber Reinforced Bricks (FRB) - Shape memory alloys – Ceramics – Thermal, Mechanical, Electrical and Chemical properties –3D printed construction materials - Nano materials.

Activities: Demonstration of 3D printing of materials, Composite fabrication.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)

References:

1. Balasubramaniam, R. (2014). Callister's materials science and engineering. Wiley India Pvt. Ltd.
2. Hibbeler, R. C. (2017). Engineering mechanics. Pearson.
3. Hibbeler, R. C. (2023). Structural analysis. Pearson.
4. Medved, S. (2021). Building physics. Springer.

E-resources:

1. Moment of Inertia: https://youtu.be/fDJeVR0o__w
2. Ceramics: https://www.youtube.com/watch?v=oeDANQrsnZ0

3. Sound Insulation: https://youtu.be/nhE2a4GEOtA
4. Shape memory alloys: https://nescacademy.nasa.gov/video/00a31561480547248033a1c2df6f87831d
5. White LED: https://archive.nptel.ac.in/courses/108/108/108108122/
6. Daylighting and lighting design: https://youtu.be/vZO09qL-vZs
7. 3D Printed construction materials_ https://www.youtube.com/watch?v=UntRnpuWBtU

	Description of CO	**PO**	**PSO**
CO1	Explain the concepts of physics in civil engineering stream.	---	
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)	PSO1(3)
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in civil engineering.	PO2(2)	PSO1(2)

CY25C02	Applied Chemistry (CE) – II	L	T	P	C
		2	0	0	2

Course Objectives

- To provide comprehensive understanding of chemistry concepts in building materials.

Building Materials: Introduction, Bricks, Glass, Cement, Special Cement, Concrete, Reinforcement.

Activities: Virtual demonstration of properties of building materials.

Composites: Types, Matrix materials, Hybrids, Fiber Reinforcement, Characteristics, PMC, MMC, CM Applications.

Activities: Virtual demonstration of fabrication of composite materials.

Sustainable Materials: Bio-based materials, Product & Technology development, Admixtures, Environmental aspects, energy efficiency.

Activities: Calculation of carbon footprint in buildings.

Analytical Methods: Thermal conductivity, porosity, absorption and emission characteristics of building materials.

Activities: Analytical methods with virtual experiments, Hands-on demonstration of any one of the methods.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (5%), Assignments (20%), Flipped Class (5%), Virtual Practice (20%), Internal Examinations (50%)

References:

1. Jain, P. C., & Jain, M. (2022). Engineering chemistry. Dhanpat Rai Publishing Company (P) Ltd.
2. Eckold, G. (1994). Design and manufacture of composite structures. Woodhead Publishing Ltd.
3. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2022). Fundamentals of analytical chemistry (10th ed.). Cengage Learning India Pvt. Ltd.
4. Spitzer, W. G., & Simonson, K. (2011). Green building materials: A guide to product selection and specification. Wiley.

E- resources:

1. https://archive.nptel.ac.in/courses/112/104/112104229/
2. https://nptel.ac.in/courses/103108100

	Description of CO	PO	PSO
CO1	Explain the applications of chemistry in civil engineering stream.	---	
CO2	Apply chemistry concepts to select appropriate materials.	PO1(3)	PSO1(2)
CO3	Analyse the systems and interpret data from the virtual studies in the field of civil engineering.	PO2(2)	PSO2(2) PSO3(1)

EE25C01	Basic Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart foundational knowledge in principles and applications of electrical and electronics engineering.

DC Fundamentals: Current and Voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Series parallel combination of R, L and C components, Voltage Divider and Current Divider Rules.

Activities: Virtual Demonstration of electrical laws & circuits, Hands-on Breadboarding, Solving GATE questions.

AC Fundamentals: Faraday's Laws of Electro-magnetic Induction, Definition of Self and Mutual Inductances, Generation of sinusoidal voltage, Instantaneous & RMS values of sinusoidal signals, Introduction to 3-phase systems, Electrical Safety, Fuses and Earthing.

Activities: Virtual Demonstration of electromagnetic induction, Measurement of instantaneous and RMS values of AC signals, Solving GATE questions.

Electric Machines: DC Machines, Transformers, Star and delta Connections, Three phase Induction motors, Synchronous Generators, Single Phase Induction Motors, Stepper Motor, Universal Motor and BLDC motor.

Activities: Virtual demonstration of step-up and step-down transformers, Virtual working models of Universal and BLDC motors, Solving GATE questions.

Semiconductor Devices: PN junction diodes, Zener Diode, Voltage regulator, BJT & FET Transistors, Timers, Operational Amplifiers.

Activities: Virtual demonstration of V-I characteristics of PN junction and Zener diodes using simulation, inverting/non-inverting amplifiers, Solving GATE questions.

Digital Electronics: Boolean algebra, Basic and Universal Gates, adders, multiplexers, demultiplexers and flip-flops.

Activity: Online logic gate simulators, Solving GATE questions.

Microcontrollers: Introduction, Architecture, Potential Applications.

Activities: Physical demonstration of a microcontroller and online simulation of microcontroller.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz (5%), Assignments (25%), GATE Questions (20%), Internal Examinations (50%)

References:

1. Del Toro, V. (2022). Electrical engineering fundamentals. Pearson Education.
2. Hambley, A. R. (Year). Electrical engineering: Principles and applications (Edition if known). Publisher.(Note: Please provide the year and edition for complete citation)
3. Mehta, V. K., & Mehta, R. (2006). Principles of electrical engineering and electronics. S. Chand Publishing.

E-resources:

1. https://archive.nptel.ac.in/courses/108/106/108106172/
2. Circuit Simulator – https://www.falstad.com/circuit/

	Description of CO	PO	PSO
CO1	Understand and explain basic electrical and electronic concepts.	---	
CO2	Apply and analyse electrical circuits in real-time applications.	PO1 (3) PO2 (1)	PSO1(2)
CO3	Identify and utilise key electronic devices used in engineering applications	PO2 (2)	PSO1(2)

GI25201	Geoinformatics Systems	L	T	P	C
		2	0	2	3

Course Objectives:

- To provide the Fundamental Knowledge of Geospatial Systems.
- To Enhance the understanding of Geospatial Data.
- To develop Networking and Geoportal Proficiency.
- To strengthen the skills in Satellite data analysis and GIS Applications.
- To Encourage Practical Application of Geospatial Tools

Introduction to Geospatial Systems

Topics Covered:

1. Fundamentals of electromagnetic radiation
2. Overview of Remote Sensing, GIS, GPS
3. Components of GIS: Hardware, Software, Data, People, and Methods
4. File operations and system basics

Practicals:

1. Introduction to Remote Sensing Sensors and resolution

Mandatory Activity:

1. Seminar

Geospatial Data Services

Topics Covered:

1. Geospatial data sources and formats
2. Open data policies and data acquisition
3. Land use/land cover datasets and Digital Elevation Models (DEMs)

Practicals:

1. Exploring geospatial data sources

Mandatory Activity:

1. Quiz

Geoportals and Web GIS

Topics Covered:

1. Network concepts, layers, and protocols
2. Geospatial and Web GIS protocols
3. Interactive mapping and data sharing

Practicals:

1. Exploring open data portals

Mandatory Activity:

1. Flipped Classroom - Students explore geoportals before class and discuss mapping solutions in groups.

Satellite Applications

Topics Covered:

1. Image processing techniques
2. Satellite image interpretation
3. Applications: Agriculture, disaster, water resource, urban planning

Practicals:

1. Creating GeoPDF with geotagged photographs

Mandatory Activity:

1. Poster Presentation

GIS Applications Using Open Data

Topics Covered:

1. Open data integration with GIS
2. Applications in health, environment, disaster, and urban planning

Practicals:

1. Creating story maps using Google Earth

Mandatory Activity:

1. Project-Based Learning – Story Maps

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Shellito, B. A. (2015). Introduction to geospatial technology (3rd ed.). W.H. Freeman.
2. McInerney, D., & Kempeneers, P. (2015). Open source geospatial tools: Applications in Earth observation. Springer.
3. Mitchell, T. (2005). Web mapping illustrated: Using open source GIS toolkits. O'Reilly.
4. Lo, C. P., & Yeung, A. K. W. (2006). Concepts and techniques of geographic information systems (2nd ed.). Pearson Prentice Hall.
5. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic information systems and science. Wiley.
6. Heywood, I., Cornelius, S., & Carver, S. (2011). An introduction to geographical information systems. Pearson Education.
7. Saraf, A. K. (n.d.). Geographic information systems [Online course]. NPTEL, IIT Roorkee. https://onlinecourses.nptel.ac.in/noc22_ce26/preview
8. Copernicus Data Space Ecosystem. (n.d.). Sentinel-1 (SAR), Sentinel-2 (Optical), Sentinel-3 (Ocean, Land, and Atmosphere), Sentinel-5p. [Data set]. Retrieved from [URL]
9. NASA Earthdata. (n.d.). MODIS, Landsat, ASTER, VIIRS, SRTM [Data set]. Retrieved from [URL]

10. USGS Earth Explorer. (n.d.). Landsat (Optical), MODIS, ASTER, SRTM [Data set]. Retrieved from [URL]
11. PlanetScope. (n.d.). High resolution optical data with university access [Data set]. Retrieved from [URL]
12. NASA POWER. (n.d.). Atmospheric, meteorological, and solar energy data [Data set]. Retrieved from [URL]
13. ESA Climate Change Initiative. (n.d.). Sea level, sea surface temperature, soil moisture, carbon, glaciers, and other climate variables [Data set]. Retrieved from [URL]
14. Survey of India (SOI). (n.d.). Toposheets, administrative boundaries [Data set]. Retrieved from [URL]
15. NRSC Bhoonidhi. (n.d.). CartoSAT, CartoDEM, RISAT (SAR), OceanSat, ResourceSat, LISS1, LISS2, LISS3, LISS4 [Data set]. Retrieved from [URL]
16. NRSC Bhuvan. (n.d.). Thematic maps (Geomorphology, Land Degradation, LULC, Glacial Lakes, Satellite Data) [Data set]. Retrieved from [URL]

	Description of CO	**PO**	**PSO**
CO1	Explain the fundamental concepts of geospatial systems and data.	--	--
CO2	Apply techniques for handling, processing, and managing geospatial data.	PO1 (2) PO2 (2)	PSO1(3)
CO3	Analyze satellite data, networking tools, and geoportals for effective geospatial applications (Analyze).	PO2(2) PO3(1) PO5(2)	PSO2(2)
CO4	Communicate findings through case studies and reports.	PO7(1) PO11(3)	PSO3(3)

EN25C02	English Essentials – II	L	T	P	C
		1	0	2	2

Course Objectives

- Enable learners to improve fluency and accuracy in spoken and written communication.
- Develop learners' ability to articulate ideas clearly and effectively in formal and informal spoken interactions.
- Help learners construct well-organised written documents relevant to academic and workplace contexts.

Oral Communication: Types (Verbal and Nonverbal), Interpersonal and group communication, Telephonic conversation.

Suggested Activities: Short presentations, Debates, Formal Speeches (Welcome, Vote of Thanks and introducing guests), Listen and respond to short podcasts.

Business Correspondence: Email Communication, Formal Letters (Types), Business Meeting.

Suggested Activities: Email and letter writing (Complaint, request, permission), Agenda, minutes of the meeting.

Academic Writing: Paraphrasing, Summarizing, Essay Writing, Instructions and Recommendations.

Suggested Activities: Essay writing (Cause and effect, argumentative, persuasive), User guides/ manuals, policy document.

Team Work: Leadership Skills (Team building, Team Leader, Team player), Negotiation and Problem solving skills

Suggested Activities: SWOT Analysis, Brainstorming and Group discussions.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Worksheets (10%), Group Activity (20%), Report Writing (20%), Internal Examinations (50%)

References:

1. Koneru Aruna. (2020). English Language Skills for Engineers. McGraw Hill Education.
2. Taylor, Shirley & Chandra .V. (2010). Communication for Business A Practical Approach. India: Pearson Longman.
3. Ian Badger, et al., (2014). Listening: B2 (Collins English for Life: Skills), Collins.
4. Raymond Murphy (2019), Grammar in Use, Cambridge University Press.

E-resources:

1. Communication for Business Success - https://open.umn.edu/opentextbooks/textbooks/8
2. TED Talks – https://www.ted.com/

	Description of CO	PO	PSO
CO1	Understand the importance of communication and drafting skills in engineering and technology.	---	
CO2	Apply listening strategies to comprehend spoken English in various contexts.	PO1(3)	PSO3(2)
CO3	Participate actively in group discussions by analysing critically from different views.	PO2(2) PO8(1)	PSO3(3)
CO4	Create written reports coherently for various purposes.	PO9(2)	PSO3(2)
CO5	Adapt communication styles to global, multicultural environments.	PO11(1)	PSO2(2)

ME25C05	Re-Engineering for innovation	L	T	P	C
		0	0	4	2

Course Objectives:

- To cultivate foundational skills in prototyping, and automation for development of prototypes with real-world applications.
- To provide a comprehensive, hands-on exposure to product development through reverse engineering concepts.

Bootcamp 1: Introduction to Product Development, Reverse Engineering, Overview of the product lifecycle, Hands-on disassembly of simple products, Practice of basic measurements and sketching, Introduction to CAD modeling of disassembled parts, Virtual assembly of parts.

Bootcamp 2: Embedded System Programming (Open-source platforms), Practice of interfacing sensors, reading data, automation in home, healthcare and agriculture.

Reverse Engineering: Sketch and prototype alternative designs, Group brainstorming sessions, Manufacture prototype parts using 3D printing and / or workshop tools, Assemble prototype product.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Methodology for Continuous Assessment : Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)

References:

1. Wang, W. (2010). Reverse engineering: Mechanisms, structures, systems & materials. CRC Press.
2. Margolis, M. (2020). Arduino cookbook: Recipes to begin, expand, and enhance your projects. O'Reilly Media.

E-resources:

1. GrabCAD – https://grabcad.com/
2. GitHub – https://github.com/

	Description of CO	PO	PSO
CO1	Understand the product development lifecycle, including stages such as concept generation, design, prototyping, and testing.	---	
CO2	Apply reverse engineering techniques to analyze and document existing products.	PO1 (3) PO2 (2)	PSO1(2)
CO3	Collaborate in teams to fabricate prototypes using appropriate tools.	PO5 (2) PO8 (1) PO9 (1)	PSO3(3)
CO4	Engage in independent learning and continuously adapt to emerging technologies in product design	PO11(2)	PSO2(2) PSO3(2)

UC25A03	Life Skills for Engineers – II	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart and cultivate analytical reasoning, innovative thinking, effective collaboration, and ethical leadership to prepare students for complex challenges in professional and personal environments.

Critical Thinking: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Activities: Two-Brainstorm Method, “30 Circles” Challenge, “Desert Survival” Simulation, Lateral thinking riddles and puzzles, "What If?" Scenario Writing, Fast vs. Slow Thinking Game, Creativity Myth Busters

Problem Solving: Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Activities: Case study analysis, Escape Room challenge.

Leadership: Leadership Styles & Self-Assessment, Communication & Active Listening, Decision-Making & Responsibility, Teamwork & Delegation, Empathy, Integrity & Conflict Management, Vision, Motivation & Goal-Setting.

Activities: Crisis Leadership Simulation, Tower Challenge, Leadership Dilemmas Role-Play, Team Vision Board

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. De Bono, E. (2017). *Six thinking hats*, Little, Brown Book Group.
2. Facione, P. A. (2015). *Critical thinking: What it is and why it counts*. Insight Assessment.
3. Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
4. Whetten, D. A., & Cameron, K. S. (2016). *Developing management skills*. Pearson.

	Description of CO	PO	PSO
CO1	Explain the importance of leadership and management skills in life.	---	
CO2	Apply and demonstrate creative thinking techniques to generate innovative solutions.	PO7 (3)	PSO1(1) PSO2(1)
CO3	Exhibit effective collaboration and communication skills through teamwork, active listening, and conflict resolution strategies.	PO8 (2)	PSO3(3)
CO4	Integrate scientific temperament and logical reasoning into c problem solving in engineering and real-world contexts.	PO11 (2)	PSO2(1) PSO3(2)

UC25A04	Physical Education - II	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart knowledge on gymnastic exercises and pressing needs for upskilling in a particular game.

Basic gymnastics exercises: Warming up, Suitable exercise, Lead up games, Safety education, Movement education, Balanced Walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

Upskilling in any one of the athletics: Broad Jump, High Jump, Triple Jump, Relay Sprints, Javelin Throw, Discuss Throw, Shot Put, Short and Long-distance Running.

Advance skills in any one of the indoor/outdoor games, which has been opted by the student in the I semester.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.
4. Kandappan, K. (2004). *Foundations of physical education*. Friends Publications.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	
CO2	Apply safety principles and methods during sports activities.	PO1(3)	PSO3(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8 (3)	PSO3(2)
CO4	Demonstrate the advanced technical skills and strategic understanding in the game of their interest.	PO11(1)	PSO3(2)

Foreign Language^

UC25F01	Deutsch – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Deutsch language, including reading, writing systems, pronunciation, and speaking.

Basics & Introduction: German alphabet and pronunciation, Basic greetings and farewells, Introducing yourself and others (Ich heiße…, Wer bist du?), Numbers 1–100 and days of the week, Personal pronouns (ich, du, er, sie…), Sentence structure (SVO word order).

Activities: Alphabet spelling game, short skits, Use color-coded cards for SVO sentences.

Grammar Essentials & Everyday Vocabulary: Present tense of regular verbs (spielen, arbeiten, machen…), Common irregular verbs: sein (to be), haben (to have), gehen, kommen, Articles and gender (der, die, das; ein, eine), Simple questions and negation (nicht, kein), Describing people and things: adjectives and colors, Family, school, food, and common objects vocabulary.

Activities: Conjugate regular and irregular verbs, “Question Chain” game, Create a simple family tree.

Everyday Communication in German: Asking for and giving directions, Telling the time and talking about schedules, Ordering food and drinks at a café or restaurant, Talking about hobbies, weather, and daily routines, Listening to short conversations and responding appropriately, Introduction to German culture and formal/informal language use (du vs Sie).

Activities: Ordering food and drinks, Give directions, Formal / Informal greetings, Do’s and Don’ts.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. Funk, H., Kuhn, C., & Demme, S. (2015). Menschen A1: Deutsch als Fremdsprache Kursbuch. Hueber Verlag.

	CO Description	PO	PSO
CO1	Understand simple spoken Deutsch in everyday contexts.	---	
CO2	Communicate with widely used Deutsch words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Deutsch language.	PO11 (1)	PSO3(2)

UC25F02	Japanese – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Japanese language, including reading, writing systems, pronunciation, and speaking.

Writing Systems & Basic Communication: Introduction to Hiragana: vowels, basic characters, reading & writing, Introduction to Katakana: basic characters and usage, Basic greetings and farewells (こんにちは, おはようございます, さようなら), Introducing yourself (名前、出身、年齢), Basic sentence structure: Subject–Object–Verb, Numbers 1–100, days of the week, classroom expressions.

Activities: Flashcard games and writing drills, Self-introduction, Numbers & date-matching, Greeting expressions, Listening to audio.

Grammar & Everyday Vocabulary: Particles: は (wa), を (wo), の (no), へ (e), に (ni), Present tense verbs: です, ます-form conjugation (たべます、のみます), Negative forms: ではありません, ません, Describing people and objects using adjectives (い and な), Question formation: なに、どこ、だれ、いつ, Vocabulary for family, food, colors, and basic actions.

Activities: Verb conjugation drills, Guessing game, Picture description, “Shopping” with food vocab and counters

Conversation & Cultural Etiquette: Talking about routines and schedules (daily verbs, time expressions), Asking and giving simple directions (〜はどこですか？), Ordering food and making polite requests (〜をください、〜をおねがいします), Expressing likes and dislikes (すき・きらい), Listening to short conversations and identifying key phrases, Introduction to formal/informal speech and Japanese etiquette.

Activities: Skits and role-plays, daily schedule, beginner-level dialogue, Group discussion on etiquette.

Activities: Practice worksheets and flashcards for hiragana, Writing drills and reading simple katakana words, Dialogue practice for greetings and self-introduction, Sentence construction exercises with basic SOV structure, Particle usage exercises and short dialogues, Role-play scheduling, shopping, and telling time, Verb conjugation drills for common verbs, Descriptive sentence exercises using adjectives, Practice Q&A dialogues forming questions and negations, Kanji writing practice and quizzes for basic characters, Vocabulary tests and conversational practice on daily topics, Oral presentations and listening comprehension quizzes.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, C., & Tokashiki, K. (2011). Genki I: An integrated course in elementary Japanese. The Japan Times.
2. The Japan Foundation. (2017). Marugoto Japanese language and culture starter (A1) course book for communicative language activities. Goyal Publishers.

	CO Description	PO	PSO
CO1	Understand simple spoken Japanese in everyday contexts.	---	
CO2	Communicate with widely used Japanese words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.	PO11 (1)	PSO3(2)

UC25F03	Korean – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Korean language, including reading, writing systems, pronunciation, and speaking.

Fundamentals of Korean: Introduction to Hangul: consonants and vowels, Basic pronunciation and syllable formation, Common greetings and self-introductions, Numbers (Sino-Korean and Native Korean basics), Basic sentence structure (Subject-Object-Verb), Simple expressions (e.g., 감사합니다, 안녕하세요).

Activities: Writing and reading Hangul practice sheets, Pronunciation drills and audio repetition, Dialogue practice for greetings and self-introduction, Counting and number exercises.

Essential Grammar and Vocabulary: Particles (은/는, 이/가, 을/를) and usage, Basic verbs and present tense conjugation, Sentence patterns: affirmative, negative, interrogative, Common adjectives and descriptive sentences, Expressing possession and location, Asking simple questions (어디, 뭐, 누구).

Activities: Verb conjugation and sentence formation drills, Role-play conversations for shopping and daily routines, Descriptive writing and speaking exercises, Question and answer practice.

Everyday Korean Communication: Polite speech levels and honorifics introduction, Talking about time, dates, and schedules, Ordering food, shopping phrases, counting objects, Simple directions and transportation vocabulary, Listening practice with short dialogues, Cultural notes on etiquette and communication.

Activities: Role-play ordering at a restaurant or buying items, Listening comprehension exercises, Giving and asking for directions practice, Group conversations and presentations.

Weightage: Continuous Assessment: 100%

Methodology for Continuous Assessment : Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. King, R., Yeon, J., & Brown, A. (2015). Elementary Korean. Tuttle Publishing.
2. Cho, Y., Lee, H., Schulz, C., Sohn, H.-M., & Sohn, S.-O. (2001). Integrated Korean: Beginning 1. University of Hawai‘i Press.

	CO Description	PO	PSO
CO1	Understand simple spoken Korean in everyday contexts.	---	
CO2	Communicate with widely used Korean words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.	PO11 (1)	PSO3(2)

Semester III

MA25C09	Computational Differential Equations	L	T	P	C
		3	1	0	4

Course Objectives:

- The Objectives of the course are to equip students with the ability to formulate and solve various types of Ordinary and Partial Differential Equations (ODEs & PDEs) and to develop proficiency in applying numerical methods and computational tools for solving differential equations encountered in engineering problems.

First Order Ordinary Differential Equations: Basic concepts of ordinary differential equations–Formation of first order differential equations from physical problems–First order and first-degree ODE: Variables separable–Exact equations–Leibnitz's equation – Bernoulli's equation – Numerical Methods: Solving first order ODE by Euler's formula, Taylor series and Runge Kutta method of 4^{th} order.

Activities: Application and Visualization of the first order ODE using open-source software and solving Competitive Examination questions

Higher Order Ordinary Differential Equations: Formation of second order differential equations from physical problems–Linear equations of second and higher order with constant coefficients – Euler's linear equations – Method of variation of parameters–Numerical Methods: Solving second order ODE by Runge-Kutta method of 4th order and finite difference method.

Activities: solving ordinary differential equations using open-source software and solving of Competitive Examination questions

First Order Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Numerical Methods for first order PDE by Method of lines with Runge-Kutta method of order fourth.

Activities: Application and Visualization of the Partial Differential Equations using open-source software and solving Competitive Examination questions

Higher Order Partial Differential Equations: Linear homogeneous partial differential equations of second and higher order with constant coefficients. Numerical Methods: Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain—Solution of one-dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes—Solution of one-dimensional wave equation by explicit scheme.

Activities: Application of the second order PDE using open-source software of 1-D wave, 1-D heat equations, Laplace and Poisson equations and Solving Competitive Examination questions

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving Competitive Examination questions (20%), Internal Examinations (40%).

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, (11th ed.), John Wiley & Sons, USA,2025.
2. Joe D. Hoffman, Numerical *Methods for Engineers and Scientists* (3rd ed.). CRC Press (Taylor & Francis Group), 2001.
3. Steven C. Chapra and Raymond P. Canale. *Numerical Methods for Engineers* (8th ed.). McGraw-Hill Education, 2021.
4. William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations and Boundary Value Problems,* (11thed.). John Wiley & Sons, USA,2017.
5. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2026.
6. Randall J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, SIAM,2007.

E-resources:

1. https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
2. https://archive.nptel.ac.in/content/syllabus_pdf/111107063.pdf
3. https://github.com/patrickwalls/mathematicalpython

	Description of CO	PO	PSO
CO1	Explain first and higher-order ODEs using appropriate analytical and numerical techniques.	-	-
CO2	Solve higher-order PDEs using classical and finite difference methods.	PO1(3) PO5(3)	PSO1(2)
CO3	Apply various solution methods to differential equations arising in engineering contexts.	PO1 (3) PO5(3)	PSO2(1)
CO4	Interpretation of numerical solutions for partial differential equations and using open-source software.	PO2(3) PO5(3) PO11(2)	PSO2(1)

GI25301	Spatial Database Management System	L	T	P	C
		3	0	2	4

Course Objective

To develop skills in designing and managing databases with emphasis on spatial data structures and models.

Fundamentals of DBMS, SDBMS: DBMS concepts, architecture, users, and comparison with file systems; Introduction to SDBMS, spatial data types, GIS integration, and client–server architecture.

Practical:

1. Creation of database tables, relationships, and establishing client–server connectivity

Spatial Data Models, Database Design: Field-based and object-based models – Spatial data types and operations – Entity–Relationship (ER) model for spatial data – Relational data model – Constraints and normalization – Mapping ER model to relational model – Object-oriented data modeling – UML diagrams for spatial systems.

Practical:

1. ER modeling for spatial datasets and mapping to relational schema.
2. Object-oriented modeling using UML for spatial databases.

SQL, Spatial Query Processing: SQL (DDL, DML), queries, views, triggers, and constraints - Spatial SQL, OGC standards, and execution of spatial queries (buffer, overlay, topology).

Practical:

1. Implementation of SQL operations and execution of spatial queries on GIS datasets.

Spatial Storage, Indexing, Applications: Disk geometry and file organization – Buffer management – Clustering techniques – Indexing concepts – Spatial indexing methods (Grid files, R-tree) – Spatial join index – Query optimization – Concurrency control – Database recovery techniques – Security mechanisms in SDBMS – Spatial data organization in commercial and open-source SDBMS – Application programs and user interface design.

Practical:

1. Creation of spatial indexes and optimization of spatial queries
2. Implementation of database security, triggers, and recovery mechanisms

Tasks:

1. Design and implement a complete spatial database for a real-world application (e.g., watershed, land use, or agricultural planning) including ER modeling, schema design, data creation, and client–server setup.
2. Develop and execute complex SQL and spatial queries (buffer, overlay, intersection, spatial joins) on a given dataset, including indexing and query optimization, and interpret the results.

3. Create a simple spatial database application (using GIS interface or frontend) incorporating indexing, security, and recovery features; evaluate system performance and present findings.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References

1. Nikos Mamoulis, Spatial Data Management, Springer Nature, 2022, ISBN: 978-3-03101884-8.
2. Shashi Shekhar, Sanjay Chawla, Spatial Databases: A Tour, Prentice Hall, 1st edition, 2003.
3. Philippe Rigaux, Michel Scholl, Agnès Voisard, Spatial Databases: With Application to GIS, The Morgan Kaufmann Series in Data Management Systems, Elsevier, 2001.
4. Avi Silberschatz, Henry F Korth, Sudarshan S, Database System Concepts, 7th edition, McGraw Hill, 2020.
5. Ravikanth V Kothuri, Albert Godfrind, Euro Beinat, Pro Oracle Spatial for Oracle Database 11g, Apress, 2019.
6. Regina LeoHsu, PostGIS in Action, O'Reilly & Associates Inc., 3rd edition, 2021.

E Resources

1. NPTEL – Database Management Systems
   https://nptel.ac.in
2. NPTEL – Geographic Information Systems

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the architecture, components, and functionalities of DBMS and Spatial DBMS.	-	-	-	-
CO2	Design spatial databases using ER, relational, and object-oriented data models.	PO1 (3) PO2 (3) PO5 (2)	3	2	3
CO3	Apply SQL and spatial SQL for querying, manipulating, and managing spatial data.	PO1 (2) PO2 (3) PO5 (3)	3	2	3
CO4	Implement spatial indexing, recovery, security mechanisms, and perform spatial analysis using geometrical and topological operations.	PO1 (2) PO2 (3) PO5 (3)	3	2	3

CE25C03	Surveying and Geomatics	L	T	P	C
		3	0	0	3

Course objective:

To study the various methods of surveying and understand the concept of control, control and modern surveying and also to use various survey instruments

Levelling: Chain Surveying, Datum, benchmarks, levelling methods (fly and check), booking and reduction, contouring

Theodolite Surveying: Horizontal and vertical angle measurements - Temporary and permanent adjustments - Trigonometric levelling - Single and double plane methods – Stadia tacheometry - Subtense method - Tangential tacheometry.

Activity: Review of Competitive Exam Questions related to levelling and theodolite surveying.

Modern Surveying: Total station - components, working, errors, applications; Bathymetry, GPS - components, data acquisition, errors, applications; Introduction to drone surveying and LiDAR.

Activity: Case study report on GPS applications.

Control Surveying, Adjustment: Horizontal and vertical control, triangulation, traversing, trilateration, coordinate computation; errors, weights, and adjustment of observations.

Activity: Seminar on control surveying.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment: Quiz - 10%, Case study report – 20%; Seminar report – 20%, Internal Examinations – 50%

References

1. Kanetkar.T. P and Kulkarni.S. V, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2010
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2016.
3. Subramanian.R., Surveying and Levelling, Second Edition, Oxford University Press, 2012.
4. Bannister and Raymond.S, Surveying, Seventh Edition, Longman 2004
5. Roy.S. K, Fundamentals of Surveying, Second Edition, Prentice' Hall of India, 2011
6. Arora.K. R, Surveying Vol I & II, Standard Book house, Twelfth Edition, 2013.
7. IS 12843:1989: Specification for electronic total stations for surveying
8. IS 12762:1994: Specification for global positioning system (GPS) receivers for surveying
9. IS 4880 (Part 1-4):1975: Code of practice for design of control surveys for civil engineering projects

E-Resources:

1. https://nptel.ac.in/courses/105/104/105104101/
2. https://www.britannica.com/technology/surveying
3. http://egyankosh.ac.in/handle/123456789/39480
4. https://www.isro.gov.in/spacecraft/satellite-navigation

CO – PO Mapping

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain principles of levelling, theodolite surveying, and contouring.	-	-	-	-
CO2	Apply surveying techniques to determine heights, distances, and field measurements.	PO1 (3) PO2 (2) PO4 (3)	3	2	1
CO3	Analyze modern surveying methods such as Total Station, GPS, and remote sensing tools.	PO1 (2) PO2 (3) PO5 (3)	2	3	-
CO4	Apply control surveying methods and adjust observations for accurate surveying results.	PO1 (3) PO2 (2)	3	2	-

GI25302	Remote Sensing	L	T	P	C
		3	0	0	3

Course Objectives:

To provide comprehensive knowledge on the principles of remote sensing, electromagnetic radiation, and sensor systems.

Fundamentals of Remote Sensing, EMR

Principles of remote sensing, electromagnetic spectrum, radiation laws, and energy interactions.
Atmospheric effects, spectral signatures, and reflectance characteristics of earth features.

Activity: Poster Presentation on reflectance characteristics

Satellite Orbits, Platforms and Sensors

Satellite motion, Kepler's laws, orbital types, and remote sensing platforms. Sensor types, resolution concepts, and characteristics of earth observation satellites.

Activity: Flipped Classroom discussion on satellite platforms and sensors.

Remote Sensing Data Products and Image Processing

Types of remote sensing data, preprocessing, corrections, and image enhancement techniques.
Histogram analysis, band combinations, filtering, and data management.

Activity: Seminar on histogram stretching and image enhancement.

Image Interpretation and Applications

Visual and digital image interpretation techniques, LULC mapping, and image statistics; Applications in agriculture, water resources, disaster management, and urban planning.

Activity: Case study on Land use/land cover mapping using satellite imagery

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz - 10%, Case study report – 20%; Seminar report – 20%, Internal Examinations – 50%

References:

1. GIS Modelling in Raster. By Michael N. DeMers, Wiley, 2002. ISBN: 9780471319658.
2. Mathematical Modelling in Geographical Information System, Global Positioning System and Digital Cartography. By Hari Shanker Sharma, Rama Prasad, P.R. Binda, Concept Publishing, 2006. ISBN: 9788180693427.
3. An Introduction to Spatial Data Analysis: Remote Sensing and GIS with Open Source Software. By Martin Wegmann, Jakob Schwalb-Willmann, Stefan Dech, Pelagic Publishing, 2020. ISBN: 9781784272142.

4. Remote Sensing and Image Interpretation, 7th Edition. By Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, Wiley, 2015. ISBN: 9781118343289.
5. Fundamentals of Remote Sensing, 3rd Edition. By George Joseph, C. Jeganathan, Universities Press, 2018. ISBN: 9789386235232.

E Resources:

1. NASA. Fundamentals of Remote Sensing. - https://appliedsciences.nasa.gov/sites/default/files/202211/Fundamentals_of_RS_Edited_SC.pdf
2. **Copernicus Data Space Ecosystem:** Sentinel-1 (SAR), Sentinel-2 (Optical), Sentinel-3 (Ocean, Land, and Atmosphere), Sentinel-5p
3. **NASA Earthdata:** MODIS, Landsat, ASTER, VIIRS, SRTM
4. **USGS Earth Explorer**: Landsat (Optical), MODIS, ASTER, SRTM
5. **PlanetScope**: High resolution Optical Data with University access
6. **NASA POWER, NRSC Bhoonidhi, NRSC Bhuvan**

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the principles of electromagnetic radiation and its interaction with atmosphere and earth surface features.	-	-	-	-
CO2	Interpret remote sensing data acquired from various satellite platforms and sensors based on resolution and data characteristics.	PO1 (3) PO2 (3)	2	3	2
CO3	Analyze and preprocess satellite data using visual and digital image interpretation techniques.	PO1 (2) PO2 (3)	2	3	3
CO4	Select appropriate remote sensing data products for specific engineering and environmental applications.	PO1 (2) PO2 (3)	2	3	3

GI25303	Principles of Photogrammetry	L	T	P	C
		3	0	0	3

Course Objective:

To enable students to apply analytical and digital methods for accurate terrain modeling, orthophoto generation, and large-scale map production using modern tools.

Aerial Photography, Flight Planning: Principles, types of aerial photographs, camera systems, overlaps, and coverage; Flight planning, project design, and corrections for drift and crab in aerial surveys..

Activity: Poster presentation on aerial photography

Geometry, Stereoscopy: Photo coordinate system – Geometry and scale of vertical photographs – Relief displacement – Parallax and parallax equations – Stereoscopes and stereoscopic vision – Photo interpretation – Measurement of heights and distances – Coordinate transformations – Interior, relative, and absolute orientation – Collinearity and coplanarity conditions.

Activity: Seminar on baseline and photo interpretation

Aero triangulation, Terrain Modeling: Neat model, strip and block adjustment – Aerotriangulation methods (independent model, strip adjustment, bundle block adjustment, GPS integration) – Feature collection – DTM/DEM generation – Contour mapping – Orthorectification – Stereo plotting – Mono plotting.

Activity: Group Discussion on terrain modeling techniques

Digital Photogrammetry, Applications: Photogrammetric scanners and digital workstations – Digital stereo viewing systems – Image matching techniques (template and feature-based) – DEM and DSM generation – Satellite photogrammetry – Accuracy standards in large-scale mapping – Map production standards – Engineering Applications.

Activity: Case study on digital photogrammetry applications in engineering projects

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz - 10%, Case study report – 20%; Seminar report – 20%, Internal Examinations – 50%

References:

1. Paul R. Wolf, Bon A. De Witt, *Elements of Photogrammetry with Applications in GIS*, 4th Edition, McGraw Hill International Book Co., 2014.
2. Matt Weilberg, *GIS Approaches for Remote Sensing and Photogrammetry*, Callisto Reference, 2018.
3. J. Chris McGlone, *Manual of Photogrammetry*, 6th Edition, American Society for Photogrammetry and Remote Sensing, 2013.
4. E.M. Mikhail, J.S. Bethel, J.C. McGlone, *Introduction to Modern Photogrammetry*, Wiley Publisher, 2001.
5. Gollfried Konecny, *Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems*, 2nd Edition, CRC Press, 2014.

E-Resources:

1. NPTEL Course: “Advanced Geomatics Engineering” by Prof. Pradeep Kumar Garg , IIT Roorkee.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the principles of aerial photography, flight planning, and geometric characteristics of aerial photographs.	-	-	-	-
CO2	Apply stereoscopic principles and orientation methods for photogrammetric measurements and mapping.	PO1 (3) PO2 (3) PO5 (3)	2	3	2
CO3	Perform aerotriangulation, terrain modeling, and orthophoto generation using analytical and digital techniques.	PO1 (2) PO2 (3) PO5 (3)	2	3	3
CO4	Evaluate and implement digital photogrammetric tools and standards for accurate large-scale map production.	PO1 (2) PO2 (3) PO5 (3)	2	3	3

CE25C04	Surveying and Geomatics Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

List of Experiments:

1. Levelling Operations: Fly levelling, check levelling, and benchmark transfer.
2. Contouring and Mapping: Grid levelling, contour mapping, and cut & fill volume estimation.
3. Theodolite Surveying: Measurement of horizontal angles by repetition and reiteration methods.
4. Total Station Surveying: Angle, distance, coordinate measurement, orientation, and resection methods.
5. Height and Distance Measurement: Determination of height using REM/trigonometric methods.
6. GPS Surveying: Navigation and feature collection using handheld GPS.

Tasks: (Perform any 2 tasks)

Task 1: Site Levelling and Earthwork Estimation: Perform levelling and contour mapping to estimate cut and fill volumes for a construction site.
Task 2: Precision Survey and Layout: Measure horizontal angles using theodolite methods and apply them for setting out a simple structure.
Task 3: Total Station Mapping: Conduct a topographic survey using Total Station and prepare contour and feature maps for planning.
Task 4: Height and GPS Survey: Determine heights using REM method and integrate GPS data for mapping infrastructure features.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Methodology for Continuous Assessment: Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)

References:

1. Subramanian. R., Surveying and Levelling, Oxford University Press, Second Edition, 2013.
2. Bannister and Raymond. S., Surveying, Seventh Edition, Longman 2004.
3. Roy.S. K, Fundamentals of Surveying, Second Edition, Prentice' Hall of India 2011.
4. Arora.K.R., Surveying Vol I & II, Standard Book house, Twelfth Edition.2018.

E-Resources

1. Surveying Virtual Lab - https://vlab.co.in
2. MIT Open Course Ware - https://ocw.mit.edu

CO – PO Mapping

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Perform levelling and angular measurements using conventional surveying instruments.	PO1 (2) PO4 (3) PO5 (3) PO8 (2)	2	1	-
CO2	Apply modern surveying tools (Total Station and GPS) for field data collection and mapping.	PO1 (3) PO4 (2) PO5 (3) PO8 (2)	3	3	1
CO3	Analyze survey data to prepare maps, contours, and compute elevations and distances.	PO1 (2) PO2 (2) PO4 (3) PO5 (3)	3	2	1

GI25304	Remote Sensing and Photogrammetry Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To facilitate the students with hands on experience on visual interpretation of satellite data products and conventional and digital interpretation of aerial photographs.

List of Experiments:

Remote Sensing Exercises

1. Preparation of base map using Survey of India toposheets and familiarization with satellite data products
2. Image interpretation and preparation of Land Use / Land Cover (LULC) map using satellite data
3. Spectral measurements using spectroradiometer and analysis for water, soil, and vegetation

Photogrammetry Exercises

1. Stereovision and photo interpretation using stereogram card and mirror stereoscope
2. Determination of height and scale using parallax bar and vertical photographs
3. Generation of Digital Terrain Model (DTM), contour mapping, and orthophoto generation

Tasks

1. Preparation of base map and satellite data interpretation to generate Land Use / Land Cover (LULC) maps for applications in urban planning and environmental management.
2. Stereovision analysis and parallax-based height determination to develop Digital Terrain Models (DTM) and contours for terrain analysis and infrastructure planning.
3. Digital photogrammetry processing for orthophoto generation and planimetric mapping for applications in cadastral mapping and GIS database development.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Methodology for Continuous Assessment : Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)

References:

1. Thomas M. Lillesand, Ralph W. Kieferand Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press,2022 first edition.
3. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.
4. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4thEdition, 2014.
5. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.

E-Resources

NASA Earth Observatory – Provides satellite imagery, case studies, and tutorials useful for understanding Earth observation and image interpretation.
USGS EarthExplorer – A comprehensive platform to download satellite data (Landsat, DEM, etc.) for LULC mapping and terrain analysis.

CO – PO Mapping

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Apply remote sensing techniques to interpret satellite data and generate Land Use / Land Cover (LULC) mapping.	PO1 (3) PO5 (2) PO11 (2)	3	2	-
CO2	Analyze aerial photographs for terrain modeling and height determination.	PO1 (3) PO5 (2) PO11 (2)	3	3	2
CO2	Use photogrammetry tools for orthophoto and planimetric map generation.	PO4 (3) PO5 (2)	2	3	1

EN25C03	English Communication Skills Laboratory– I	L	T	P	C
		0	0	2	1

Course Objectives:

- The objectives of the course are to foster students' confidence and fluency in professional and social communication and to bridge the gap between academic English and industry expectations.

List of Activities

A. Elements of Effective Speaking and Listening

(i) Sharing life experience/ turning point in their life – SATORI

(ii) Situational Conversation – eg. Talking to a Senior about Internship Tips

(iii) Welcoming a Guest Speaker at a Seminar

(iv) Pictography to represent data using images or symbols

(v) B2-C1 Listening exercises include lectures, interviews, and discussions.

B. Mastering Presentations

(i) Presentation Skills – Non-verbal communication

(ii) Mini-Presentations: Topics like "My Dream Project," "Engineering in 2050,"3-minute technical pitches with logical flow

(iii) Technical Presentations with PPT

C. Group Discussion Strategies:

(i) Introduction to Group Discussions - Key skills for effective participation

(ii) Phases in a GD and Conversational Phrases in GD.

(iii) Group Discussions – Abstract and Factual topics

D. Resume & LinkedIn Optimization

(i) Building LinkedIn Profile – Drafting headlines and summaries

(ii) Social Media Optimisation

(iii) Preparing Video Resume

E. Podcast-Based Language Learning:

(i) Listening to podcast (motivational, career oriented, success stories)

(ii) Podcast Preparation – Purpose – Topic – Structure – Recording Tips - Publication of the Podcast

F. Mock Interviews and Communication Strategies:

(i) Listening – Job interview

(ii) Speaking – Mock interviews

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%.

Internal Assessment: 1. Listening (20 marks)
2. Video Resume (20 marks)
3. Creating a Podcast (30 marks)
4. Mock interview (30 marks)

End Semester Assessment: 1. Presentation with PPT (50 marks)
2. Group Discussion (50 marks)

References:

1. Floyd Kory, “Interpersonal Communication”, McGraw Hill Publication, 2023.
2. Bharadwaj Apoorva, “Leadership Communication Skills for Intercultural Management: Strategies for Effective Intercultural Management (Contemporary Themes in Business and Management)”, Routledge India; 1st edition, 2024.
3. Helen Spencer-Oatey and DomnaLazidou**, “**Making Working Relationships Work: The TRIPS Toolkit for Handling Relationship Challenges and Promoting Rapport”,Castledown Publishers,2023.
4. Presentations - Cambridge
5. Speaking Extra -
6. Listening Extra – Miles Craven by Cambridge University Press
7. CVs, Resumes, and LinkedIn: A Guide to Professional English – Springer International Publishing

E-resources:

1. Train your mind to perform under pressure- Simon Sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3. Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0

	Description of CO	**PO**	**PSO1**
CO1	Communicate effectively in everyday professional situations with confidence	-	-
CO2	Deliver well-organised and effective presentations.	PO9(3)	PSO1(1) PSO3(2)
CO3	Participate in group discussions and express ideas clearly and confidently.	PO8(2) PO9(3)	PSO3(2)
CO4	Create professional video resumes and participate in interviews effectively.	PO9(2)	PSO3(3)
CO5	Create, record and publish motivational podcasts.	PO9(2) PO11(1)	PSO2(2) PSO3(3)

Semester IV

GI25401	Cartography and GIS	L	T	P	C
		3	0	4	5

Course Objectives:

- To develop skills in GIS data input, management, analysis, quality assessment, and production of standard-compliant maps using modern geospatial tools.

Elements of Cartography and Map Projections

Fundamentals of cartography – Types of maps and map scales – Elements of a map – Map projections: properties (shape, area, distance, direction) – Perspective and mathematical projections – Indian maps and projections – Map coordinate systems: UTM and UPS references – Tracing features from Survey of India Toposheets.

Practical:

1. Tracing and interpretation of features from Survey of India Toposheet.
2. Conversion of geographic coordinates to UTM coordinates and scale calculation.

Map Design and Cartographic Production

Map layout principles – Symbols and conventional signs – Graded and ungraded symbols – Color theory in cartography – Map lettering and visualization – Map generalization – Geometric transformations: Bilinear and affine transformations – Map production and printing techniques – Preparation of thematic maps using appropriate symbolization and layout design.

Practical:

1. Preparation of thematic map using appropriate symbolization (choropleth / proportional symbols).
2. Designing a complete map layout with title, legend, scale, north arrow, and color scheme.

Fundamentals of GIS and Data Models

Introduction to GIS – History and components of GIS (hardware, software, data, people, methods) – Spatial and attribute data – Raster, vector, TIN and GRID data models – Raster vs vector data structures – Raster data compression – Basic spatial database concepts – Exploration of raster and vector data using GIS software.

Practical:

1. Creation of raster and vector layers using GIS software.
2. Creation and management of attribute tables and basic spatial queries.

GIS Data Input, Topology and Data Quality

Scanner and raster data input – Vector data input and on-screen digitization – Georeferencing – Coordinate transformation and reprojection – Datum and projection concepts – Topology: adjacency, connectivity, containment – Linking attribute data to spatial data – Raster–vector conversions – Data quality (completeness, positional and thematic accuracy) – Metadata and GIS standards – Map compilation and output generation.

Practical:

1. Georeferencing and digitization of a scanned map with topology creation.
2. Projection, reprojection, and raster–vector conversion with final map output generation.

Tasks:

1. Toposheet interpretation, coordinate conversion, and georeferencing for applications in cadastral mapping and spatial data creation.
2. Raster–vector data creation, attribute management, spatial queries, and topology for applications in GIS database development and spatial analysis.
3. Thematic mapping, geometric transformation, and map layout design for applications in cartographic visualization and decision support systems.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Arthur H Robinson et al, “Elements of Cartography”, 7th Edition, Wiley, 2002.
2. Kang – TsungChang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 4th edition, 2008, ISBN: 0073051152, 9780073051154
3. Ian Heywood, Sarah Cornelius, Steve Carver, “An Introduction to Geographical Information Systems, Pearson Education, 4th edition, 2011, ISBN: 027372259X, 9780273722595.
4. John Campbell, “Introductory Cartography”,Wm. C. Brown Publishers, 3rd Edition, 2004.
5. Chor Pang LO, Albert K W Yeung, “Concepts and Techniques of Geographic Information Systems”, Pearson Education, 2nd edition, 2016, ISBN: 9789332581883.

E-Resources:

1. NPTEL Course: Geographic Information Systems by Prof. Arun K. Saraf, IIT Roorkee: https://onlinecourses.nptel.ac.in/noc22_ce26/preview
2. Copernicus Data Space Ecosystem: Sentinel-1 (SAR), Sentinel-2 (Optical), Sentinel-3 (Ocean, Land, and Atmosphere), Sentinel-5p
3. Survey of India (SOI): Toposheets, Administrative boundaries
4. NRSC Bhoonidhi: CartoSAT, CartoDEM, RISAT (SAR), OceanSat, ResourceSat, LISS1, LISS2, LISS3, LISS4
5. NRSC Bhuvan: Thematic Maps (Geomorphology, Land Degradation, LULC, Glacial Lakes, Satellite Data.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain cartographic principles, projections, and map design elements for spatial representation.	-	-	-	-
CO2	Apply GIS data models and perform spatial data input, georeferencing, and coordinate transformations.	PO2 (3) PO4 (2) PO5 (3)	3	3	1
CO3	Analyze and manage raster and vector datasets using GIS tools.	PO2 (3) PO3 (3) PO5 (2)	3	3	-
CO4	Evaluate GIS data quality and generate standard-compliant digital maps.	PO2 (3) PO3 (2) PO5 (3)	3	3	2

GI25402	Electronic Surveying	L	T	P	C
		3	0	4	5

Course Objective:

To impart knowledge on the principles, working, and applications of Total Station and GPS/GNSS systems in modern surveying.

Fundamentals of Total Station and Electromagnetic Waves: Principles of distance measurement – Evolution and components of Total Station – Electro-optical distance measurement – Classification and applications – Comparison with conventional surveying – Electromagnetic waves: properties, frequency, wavelength, velocity – Wave propagation characteristics – Applications of EM waves in surveying – Basics of infrared and laser systems.

Practical:

1. Study of Total Station: Components, setup, temporary adjustments, and basic measurements.
2. Measurement of coordinates, distance, and elevation using Total Station (MLM/REM functions).

Atmospheric Corrections and Electro-Optical Systems: Refractive index and influencing parameters – First velocity correction – Atmospheric parameters (temperature, pressure, humidity) – Mean refractive index and total atmospheric correction – Electro-optical and microwave systems: principles and sources of error – Comparison of systems – Care and maintenance – Traversing, trilateration, COGO functions and stakeout operations.

Practical:

1. Traversing and area computation using Total Station (coordinate method).
2. Setting out of simple curve / alignment using Total Station (coordinates and offsets).

GPS/GNSS System and Observation Techniques: Basic concepts and history of GPS – Segments of GPS (Space, Control, User) – GNSS, IRNSS, GAGAN – Satellite motion and Kepler's laws – Geoid and ellipsoid – GPS signal structure – Doppler effect – Anti-spoofing and selective availability – Types of GPS receivers – Static, kinematic and differential positioning techniques.

Practical:

1. Mapping of point, line, and area features using handheld GPS receiver.
2. GPS observation using survey-grade receiver (Static/Differential mode).

GPS Data Processing and Accuracy Analysis: GPS observables: Code and carrier phase – Linear combinations – RINEX format – Cycle slips and ambiguities – Baseline processing – Network adjustment – Parameter estimation – Satellite geometry and dilution of precision (DOP) – Accuracy measures – Applications in engineering surveys.

Practical:

1. Baseline processing and network adjustment using GPS processing software.
2. Accuracy analysis and comparison of Total Station and GPS observations.

Tasks

1. Conduct a closed traverse survey using Total Station, compute coordinates and area, and perform stakeout of a simple alignment for application in highway or building layout projects.
2. Carry out GPS/GNSS survey to map point, line, and area features, and generate a georeferenced dataset for application in land surveying and GIS-based asset mapping.
3. Process GPS observations for baseline and network adjustment, and compare accuracy with Total Station measurements for application in control survey and geodetic accuracy assessment.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Jean M. Rueger, Electronic Distance Measurement: An Introduction, 4th Edition, Springer Science and Business Media, 2012. ISBN: 3642802338, 9783642802331.
2. Satheesh Gopi, Sathikumar R, Madhu N, Advanced Surveying: Total Station GPS and Remote Sensing, Pearson Education, Reprint, 2007. ISBN: 8131700674, 9788131700679.
3. Subramanian R, *Surveying and Levelling*, 2nd Edition, Oxford University Press, 2012.
4. Laurila S. H., *Electronic Surveying in Practice*, John Wiley and Sons Inc, 1983.

E-Resources:

1. NPTEL Course: GPS Surveying by Prof.J.K Ghosh, IIT Roorke
2. NPTEL Course: Digital Land Surveying And Mapping (DLS&M) by Prof.J.K Ghosh, IIT Roorke.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the principles, components, and applications of Total Station and electromagnetic wave-based distance measurement systems.	-	-	-	-
CO2	Analyze atmospheric effects and instrumental errors in electro-optical and microwave systems and apply necessary corrections.	PO1 (3) PO2 (3) PO5 (3)	3	3	3

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO3	Describe the architecture, signal structure, and operational principles of GPS/GNSS systems.	PO1 (3) PO5 (2)	3	3	2
CO4	Process GPS observations, perform baseline adjustments, and evaluate the accuracy of Total Station and GPS systems for various surveying applications.	PO1 (3) PO2 (3) PO3 (3) PO5 (3)	3	3	2

GI25403	Digital Image Processing	L	T	P	C
		3	0	4	5

Course Objectives:

To provide comprehensive knowledge of remote sensing image formation, preprocessing, and digital image processing techniques.

Image Formation and preprocessing: Image representation and properties – Visual perception and image formation – Sampling and quantization – Image acquisition and sensor characteristics – Histograms and scattergrams – Univariate and multivariate statistics – Geometry and radiometry – Noise models – Atmospheric, radiometric and geometric corrections – Interpolation and resampling techniques.

Practical:

1. Data download, visualization, histogram and scattergram generation, and image statistics computation.
2. Image resampling, reprojection, and geometric correction.

Google Earth Engine (GEE) Programming: Overview of Google Earth Engine – JavaScript fundamentals for GEE – Data types, arrays, objects – Image and Image Collection handling – Feature Collection creation and filtering – Higher-order functions – Band operations – Image clipping, mosaicking, and visualization – Spectral indices (NDVI, NDBI, NDWI).

Practical:

1. Creating and manipulating ImageCollections; band combinations and index generation in GEE.
2. Image transformation, filtering, and export of processed outputs in GEE.

Image Enhancement and Transformation: Point, local and regional operations – Contrast stretching and histogram equalization – Spatial filtering and edge detection – Frequency domain processing (DFT/FFT concepts) – Band ratioing – Principal Component Analysis (PCA) – Multi-image fusion – Image transformations and visualization techniques.

Practical:

1. Image enhancement using contrast stretching, histogram equalization, and filtering.
2. Band ratioing, PCA implementation, and feature extraction for vegetation/urban analysis.

Image Classification and Accuracy Assessment: Spectral signatures and training datasets – Supervised classification (Minimum Distance, Parallelepiped, Maximum Likelihood) – Unsupervised classification (K-means, ISODATA) – Neural network concepts – Change detection and time-series analysis – Accuracy assessment: Error matrix, Kappa statistics, RMSE, ROC – Evaluation of classification performance.

Practical:

1. Supervised and unsupervised classification using GEE.

2. Accuracy assessment using confusion matrix, Kappa coefficient, and change detection analysis.

Tasks:

1. Perform image preprocessing, enhancement, and spectral index generation using GEE to analyze land cover characteristics for application in environmental monitoring and resource assessment.
2. Develop and apply supervised and unsupervised classification models on satellite imagery with feature extraction techniques for application in urban growth analysis and land use planning.
3. Conduct accuracy assessment and change detection using multi-temporal satellite data for application in climate impact studies and sustainable development monitoring.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, Prentice Hall, New Jersey, Pearson Education, 2016. ISBN: 013405816X, 9780134058160.
2. Robert A. Schowengergt, Techniques for Image Processing and Classification in Remote Sensing, Academic Press, 2012. ISBN: 0323138551, 9780323138550.
3. Robert G. Reeves, *Manual of Remote Sensing Vol. I & II*, American Society of Photogrammetry, Falls Church, USA, 1983.
4. John A. Richards, *Remote Sensing Digital Image Analysis - An Introduction*, 5th Edition, Springer Verlag, 2014.
5. Rafael C. Gonzalez, Richard Eugene Woods, *Digital Image Processing*, 4th Edition, Pearson/Prentice Hall, 2022.

E-Resources:

1. **NPTEL** – Remote Sensing and Digital Image Processing course by Prof. Arun K. Saraf, Indian Institute of Technology Roorkee.
2. **Copernicus Data Space Ecosystem** – Access to Sentinel satellite data (SAR, optical, ocean, atmosphere).
3. **NASA Earthdata** – Global datasets such as MODIS, Landsat, ASTER, SRTM.
4. **USGS EarthExplorer** – Download Landsat, DEM, and other geospatial datasets.
5. **NRSC Bhuvan** – Indian thematic maps, satellite data, and geospatial services.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain remote sensing image formation processes and preprocessing techniques.	-	-	-	-

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO2	Apply Google Earth Engine programming concepts for image manipulation and spectral analysis.	PO1 (2) PO2 (3) PO5 (3)	3	3	3
CO3	Implement image enhancement, transformation, and classification techniques for information extraction.	PO1 (3) PO4 (2) PO5 (3)	3	3	2
CO4	Evaluate classification results and select appropriate image processing methods based on accuracy metrics and application needs.	PO1 (3) PO3 (3) PO5 (3)	3	3	2

GI25404	Geodesy	L	T	P	C
		3	0	0	3

Course Objectives:

To develop analytical skills in geodetic computations, celestial positioning, and interferometric techniques for modern geospatial and geodynamic studies.

Fundamentals of Geodesy and Earth's Figure: Definition and importance of geodesy – Classification and historical development – Shape of the Earth: Geoid, ellipsoid, spheroid – Geodetic datums and reference systems – Distance, angle and height measurement methods – Selenodesy and planetary geodesy – Role of terrain characteristics in mapping.

Activity: Computation of geodetic parameters (radius of curvature, reduced latitude) for a reference ellipsoid.

Geometric Geodesy and Coordinate Transformations: Geometric geodesy principles – Geodetic and geocentric coordinate systems – Horizontal and vertical datums – Reduced latitude and curvature – Coordinate transformations (Geodetic ↔ Geocentric ↔ Cartesian) – Datum transformation and shifts – Azimuth and geodetic control networks – Mapping applications.

Activity: Poster presentation on Two- and three-dimensional datum transformation.

Geodetic Astronomy and Positioning: Spherical trigonometry in geodesy – Celestial sphere and celestial coordinate systems – Equatorial, ecliptic and galactic systems – Transformation between terrestrial and celestial systems – Time systems (UT, GST, LST) – Astronomical azimuth and latitude determination – Applications in navigation and positioning.

Activity: Case study on applications.

Physical and Interferometric Geodesy: Earth's gravity field and geopotential theory – Gravity anomalies and their interpretation – Geoid determination methods – Satellite missions (GRACE, Jason) – Applications in geophysics and plate tectonics – Principles of interferometry – InSAR, SBAS, PSInSAR – VLBI concepts – Applications in deformation monitoring.

Activity: Reproduction of research paper on Applications in geophysics and plate tectonics

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Methodology for Continuous Assessment : Quiz - 10%, Case study report – 20%; Seminar report – 20%, Internal Examinations – 50%

References

1. Wolfgang Torge, *Geodesy*, 2nd Edition, Walter De Gruyter Inc., Berlin, 2015. ISBN: 3110170728, 9783110170726.
2. Guy Bomford, *Geodesy*, Nabu Press, 2015. ISBN: 1172029091.

3. Petr Vanicek, Edward J. Krakiwsky, *Geodesy: The Concepts*, 2nd Edition, North Holland Publications Co., Amsterdam, 2014.
4. Thomas H. Meyer, Wolfgang Torge, *Physical Geodesy*, 2nd Edition, De Gruyter, 2018. ISBN: 978-3110468359.
5. David J. Getling, *Geodesy for Geomatics and GIS Professionals*, CRC Press, 2018. ISBN: 978-1138393325

E-Resources:

1. GRACE Satellite: Provides data on Earth's gravity field, monitoring changes in water storage, ice mass, and sea level.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the principles of geometric and physical geodesy, Earth's figure, and geodetic reference systems.	-	-	-	-
CO2	Apply coordinate transformations, spherical trigonometry, and astronomical methods for geodetic positioning.	PO1 (3) PO2 (3)	3	3	3
CO3	Analyze gravity anomalies and model the geoid using terrestrial and satellite data.	PO1 (3) PO3 (3)	3	3	2
CO4	Evaluate interferometric geodesy techniques (InSAR, SBAS, VLBI) for deformation and geodynamic studies.	PO1 (3) PO2 (3) PO5 (3)	2	3	2

GI25405	Hyperspectral and Thermal Remote Sensing	L	T	P	C
		2	0	2	3

Course Objective:

To impart comprehensive knowledge on the principles of hyperspectral and thermal remote sensing, including image characteristics, sensor systems, and data acquisition processes.

Fundamentals of Hyperspectral Remote Sensing: Diffraction principles; imaging spectrometry; spectral reflectance, BDRF and field spectroscopy; hyperspectral sensors – characteristics and applications; image cube concept, spectral dimensionality and Hughes phenomenon; calibration and normalization; red-edge concept; spectral libraries and response functions.

Practical:

1. Hyperspectral data visualization and spectral profile analysis with basic preprocessing.

Hyperspectral Data Processing and Analysis: Preprocessing of hyperspectral data – atmospheric correction and noise removal; MNF transformation; PCA and WPCA; band selection techniques; spectral angle mapper (SAM); library matching; spectral mixture analysis; endmember extraction; linear mixture models; dimensionality reduction; overview of software tools such as ENVI, ERDAS and processing using Python/MATLAB.

Practical:

2. Dimensionality reduction and classification of hyperspectral imagery.

Fundamentals of Thermal Remote Sensing: Thermal infrared radiation principles and radiation laws; thermal properties of terrain; emissivity; thermal sensors and image characteristics; data acquisition methods; environmental considerations; image degradation and correction techniques.

Practical:

3. Thermal image calibration and emissivity mapping.

Thermal Data Analysis and Applications: Land Surface Temperature (LST) retrieval; thermal brightness temperature conversion; evapotranspiration estimation; soil moisture assessment; urban heat island analysis; applications in agriculture, geology and water resources; integration of hyperspectral and thermal datasets for thematic mapping.

Practical:

4. Land Surface Temperature (LST) estimation and hotspot analysis.

Tasks

1. Perform hyperspectral data preprocessing, dimensionality reduction, and classification for application in mineral exploration and vegetation health assessment.
2. Process thermal imagery to estimate Land Surface Temperature (LST) and analyze hotspots for application in urban heat island and water resource studies.

3. Integrate hyperspectral and thermal datasets for feature extraction and thematic mapping for application in precision agriculture and environmental monitoring.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Methodology for Continuous Assessment : Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Dale A. Quattrochi and Jeffrey C. Luvall (2005). Thermal Remote Sensing in Land Surface Processes. Taylor & Francis. ISBN: 0-203-50217-5.
2. John A. Richards and Xiuping Jia (2012). Remote Sensing Digital Image Analysis: An Introduction (5th Edition). Springer Verlag. ISBN: 978-3-642-30061-5.
3. Chein-I Chang (2003). Hyperspectral Imaging: Techniques for Spectral Detection and Classification. Kluwer Academic / Plenum Publishers, New York. ISBN: 0-306-47483-2.
4. Marcus Borengasser, William C. Hungate, and Russel Watkins (2008). Hyperspectral Remote Sensing: Principles and Applications. CRC Press, 1st Edition.
5. Claudia Kuenzer and Stefan Dech (Eds.) (2013). Thermal Infrared Remote Sensing: Sensors, Methods, Applications. Springer.
6. Qihao Weng (Series Editor). Hyperspectral Remote Sensing: Fundamentals and Practices. Taylor & Francis, CRC Press.

E-Resources:

1. USGS Earth Explorer: Landsat (Thermal Bands), MODIS thermal data.
2. NASA POWER: Atmospheric, meteorological, and solar energy data, including temperature, humidity, solar radiation, wind speed, etc.
3. PRISMA: Medium-resolution hyperspectral imaging satellite.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain principles of hyperspectral and thermal remote sensing including image formation and sensor characteristics.	-	-	-	-
CO2	Apply preprocessing and dimensionality reduction techniques using standard tools.	PO2 (3) PO5 (3)	3	3	3
CO3	Analyze data using classification, spectral unmixing, and temperature retrieval methods.	PO1 (3) PO3 (3) PO4 (2)	3	3	2
CO4	Evaluate and integrate datasets for environmental and geospatial applications.	PO1 (3) PO5 (3)	2	3	2

EN25C04	English Communication Skills Laboratory– II	L	T	P	C
		0	0	2	1

Course Objectives:

- The objectives of the course are to build students' advanced communication skills for workplace readiness and develop intercultural competence for effective collaboration in global and virtual teams. Prepare students for competitive exams with focused skill-building and test-oriented practice.

List of Activities

Stage Ready – Impactful Public Speaking.

(i) Simulate a formal event such as an academic conference, convocation, or awards ceremony, where students roles including Master of Ceremonies (MC), Role as a dignitary, and a Commentator

(ii) Visual Prompt Storytelling: Use random images to create spontaneous stories, focusing on plot, setting, and character,

(iii) **Digital Presentation - Record** a short video explaining a project or technical concept, using slides, voiceover, and visual aids (to be uploaded using google classroom or drive link)

Professional and Application-Oriented Writing

(i) Résumé Preparation: Design ATS-friendly résumés tailored to various job descriptions, using action verbs and quantifiable impact. ·

(ii) Design engaging content for poster presentation relevant to their domain.

Receptive Skills in Workplace Communication·

(i) Reading articles related to their domain and discuss in groups

(ii) Visit company websites, make inferences and present in the class

(iii) Listen to recorded mock interviews and take detailed notes. Summarise key points and action items in a professional format and make a presentation.

Intercultural Communication

(i) Assertive vs Aggressive communication

(ii) Role play activities – workplace communication in intercultural/crosscultural contexts

From Campus to Career: Industry Skills and Global Exam Preparation

(i) Participate in HR interviews using AI tools or peer interviewers, responding to behavioural questions using methods like STAR (Situation, Task, Action, Result)

(ii) Practice Verbal Ability in competitive exams like UPSC, SSC, CDS, TNPSC, etc.

Weightage: Continuous Assessment: 60%, End Semester Lab Examinations: 40%.

Internal Assessment Methodology: 1. Oral story telling using visual prompts (30 marks)
2. Poster presentation (40 marks)
3. ATS resume writing (30 marks)

End Semester Assessment:

1. Interview (50 marks)
2. Verbal Ability test (50 marks)
   (students must bring the resume but evaluation must be done based on the performance in the interview)

References:

1. Lucas, Stephen, and Paul Stob. The Art of Public Speaking. Thirteenth edition, McGraw- Hill Education, 2020.
2. Abrahams, Matt. Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot. Simon & Schuster, 2023.
3. Beshara, Tony. Powerful Phrases for Successful Interviews, Rev. ed., McGraw-Hill, 2023.
4. Papalia, Anna. Interviewology: The New Science of Interviewing. Harper Business, 2024.
5. Verbal Ability and Reading Comprehension by Ajay Singh McGraw Hill Education 2020

E-Resources:

1. Purdue OWL – Online Writing Lab (Academic and professional writing help) https://owl.purdue.edu/
2. Canva Resume Builder (Creative, ATS-friendly resume design) https://www.canva.com/resumes/
3. BBC Learning English – Pronunciation https://www.bbc.co.uk/learningenglish/english/features/pronunciation
4. India Bix website.

	Description of CO	PO	PSO1
CO1	Understand basic industry-related reading materials.	-	-
CO2	Design and present a domain specific poster	PO9(3)	PSO1(2) PSO3(3)
CO3	Deliver effective digital presentations	PO9(3)	PSO2(1)
CO4	Communicate appropriately in intercultural/cross cultural contexts	PO9(3)& PO11(1)	PSO3(3)
CO5	Perform in interviews and competitive exams successfully	PO9(3)	PSO3(1)