B.Tech.

IN

CIVIL ENGINEERING

CURRICULUM

AND

SYLLABI OF FIRST YEAR COURSES

(Applicable from 2023 Admission onwards)

Department of Civil Engineering
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
Kozhikode - 673601, KERALA, INDIA

The Program Educational Objectives (PEOs) of B.Tech. in Civil Engineering

After four to five years of graduation, the graduates should

PEO1	Be employed in the Civil Engineering profession or a profession consistent with one's career goals, or engaged in higher academic pursuits
PEO2	Demonstrate a progressive career path, steadily evolving as a leader
PEO3	Show a commitment to ethical practice, quality, performance, and self-directed life-long learning
PEO4	Engage in activities that contribute to sustainable societal development

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of B.Tech. in Civil Engineering

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1	**Research and Development**: The students will have the ability to identify, formulate, solve, and pursue research on civil engineering and infrastructure development related problems.
PSO2	**Sustainable Development**: The students will be able to function effectively within multi-disciplinary teams and apply the fundamental principles of civil engineering for sustainable development.

CURRICULUM

Total credits for completing B.Tech. in Civil Engineering is 150 – 153.

COURSE CATEGORIES AND CREDIT REQUIREMENTS:

The structure of B.Tech. programmes shall have the following Course Categories:

Sl. No.	Course Category	Number of Courses	Minimum Credits
1.	Institute Core (IC)	8	22
2.	Program Core (PC) and Program Electives (PE)		80 - 82
3.	Open Electives (OE)	8 or 9	24 - 27
4.	Institute Electives (IE) (Entrepreneurship Innovation (EI) + Digital / Automation Technologies (DA) + Humanities, Social Science, Management (HM))	6	18
5.	Activity Credits (AC)	--	4

COURSE REQUIREMENTS

The effort to be put in by the student is indicated in the tables below as follows:
L: Lecture (One unit is of 50 minute duration)
T: Tutorial (One unit is of 50 minute duration)
P: Practical (One unit is of one hour duration)
O: Outside the class effort / self-study (One unit is of one hour duration)

1. INSTITUTE CORE (IC)

a) Mathematics

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	MA1003E	Mathematics I	3	1*	0	5	3
2.	MA1013E	Mathematics II	3	1*	0	5	3
3.	MA2003E	Mathematics III	3	1*	0	5	3
4.	MA2013E	Mathematics IV	3	1*	0	5	3
		Total	**12**	**4***	**0**	**20**	**12**

*Optional for Students (can be replaced by self-study)

b) Basic Sciences and Drawing

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	CY1001E	Chemistry for Civil Engineers	3	0	0	6	3
2.	CE1011E	Engineering Graphics	2	0	2	5	3
		Total					**6**

c) Professional Communication and Professional Ethics

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	MS1001E	Professional Communication	3	0	0	6	3
2.	CE3004E	Professional Ethics	1	0	0	2	1
		Total	**4**	**0**	**0**	**8**	**4**

2A. PROGRAMME CORE (PC)

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1	CE1001E	Engineering Mechanics	3	1	0	5	3
2	CE1002E	Building Technology	3	0	0	6	3
3	CE1003E	Engineering Geology	3	0	0	6	3
4	CE1012E	Mechanics of Solids	3	1	0	5	3
5	CE1013E	Mechanics of Fluids	3	1	0	5	3
6	CE1014E	Surveying	3	1	0	5	3
7	CE2001E	Structural Analysis I	3	1	0	5	3
8	CE2002E	Open Channel Hydraulics and Hydraulic Machines	3	1	0	5	3
9	CE2003E	Highway Engineering	3	1	0	5	3
10	CE2004E	Geotechnical Engineering	3	1	0	5	3
11	CE2005E	Functional Design of Buildings	3	0	0	6	3
12	CE2011E	Structural Analysis II	3	1	0	5	3
13	CE2012E	Foundation Engineering	3	1	0	5	3
14	CE2013E	Environmental Engineering I	3	1	0	5	3
15	CE3001E	Design of Reinforced Concrete Structures	3	1	0	5	3
16	CE3002E	Environmental Engineering II	3	1	0	5	3
17	CE3003E	Engineering Hydrology	3	1	0	5	3
18	CE3011E	Design of Steel Structures	3	1	0	5	3
19	CE3012E	Irrigation Engineering and Hydraulic Structures	3	1	0	5	3
20	CE3013E	Airport and Railway Engineering	3	1	0	5	3
21	CE1091E	Surveying Lab	0	0	2	1	1

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
22	CE2091E	Materials Testing Lab I	0	0	2	1	1
23	CE2092E	Building Design and Drawing	0	0	3	3	2
24	CE2093E	Material Testing Lab II	0	0	2	1	1
25	CE2094E	Geotechnical Engineering Lab	0	0	2	1	1
26	CE3091E	Environmental Engineering Lab	0	0	2	1	1
27	CE3092E	Computer Applications Laboratory	0	0	2	1	1
28	CE3097E	Project: Part I	0	0	0	9	3
29	CE4091E	Internship	0	0	0	*	2
		Total					**73**

**Decided by the organisation in which the internship is done.*

2B. LIST OF ELECTIVES

Following courses may be credited under the categories mentioned in the table below, in addition to the Programme Electives.

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Additional Categories			
								PE	EI	DA	HM
1.	CE1021E	Computer Programming	2	0	2	5	3	N	N	Y	N
2.	CE3021E	Numerical Methods in Civil Engineering	3	1	0	5	3	Y	N	Y	N
3	CE3022E	Remote Sensing and GIS	2	0	2	5	3	Y	N	Y	N
4	CE3023E	Project Economics and Appraisal	3	0	0	6	3	Y	N	N	Y
5	CE3024E	Construction Management and Quantity Surveying	3	0	0	6	3	Y	N	N	Y
6	MS****E	Any Indian / Foreign Language	3	0	0	6	3	N	N	N	Y
7	CE4098E	Project: Part II	0	0	0	9	3	Y	N	N	N
8	CE4099E	Project: Part III	0	0	0	18	6	Y	N	N	N
9	CE2021E	Advanced Construction Techniques and Equipment	3	0	0	6	3	Y	N	N	N
10	CE2022E	Concrete Technology	3	0	0	6	3	Y	N	N	N
11	CE2023E	Air Pollution Control Engineering	3	1	0	5	3	Y	N	N	N
12	CE2024E	Circular Economy and Sustainability	3	0	0	6	3	Y	N	N	N
13	CE2025E	Environmental Impact Assessment	3	0	0	6	3	Y	N	N	N
14	CE2026E	Advanced Surveying	3	1	0	5	3	Y	N	N	N

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Additional Categories			
								PE	EI	DA	HM
15	CE2027E	Ground Improvement	3	0	0	6	3	Y	N	N	N
16	CE2028E	Pavement Construction and Maintenance	3	1	0	5	3	Y	N	N	N
17	CE2029E	Traffic Engineering	3	1	0	5	3	Y	N	N	N
18	CE2030E	Hydraulic Machinery	3	0	0	6	3	Y	N	N	N
19	CE2031E	Water Conveyance Systems	3	1	0	5	3	Y	N	N	N
20	CE3025E	Characterisation of Construction Materials	3	0	0	6	3	Y	N	N	N
21	CE3026E	Non-Destructive Testing and Evaluation for Concrete Structures	3	0	0	6	3	Y	N	N	N
22	CE3027E	Special Concrete	3	0	0	6	3	Y	N	N	N
23	CE3028E	Advanced Waste Water Engineering	3	1	0	5	3	Y	N	N	N
24	CE3029E	Environmental Law and Policy	3	0	0	6	3	Y	N	N	N
25	CE3030E	Life Cycle Assessment	3	0	0	6	3	Y	N	N	N
26	CE3031E	Solid Waste Management	3	0	0	6	3	Y	N	N	N
27	CE3032E	Waste to Energy Techniques	3	0	0	6	3	Y	N	N	N
28	CE3033E	Advanced Geotechnical Engineering	3	1	0	5	3	Y	N	N	N
29	CE3034E	Disaster Management	3	0	0	6	3	Y	N	N	N
30	CE3035E	Earth and Earth retaining Structures	3	1	0	5	3	Y	N	N	N
31	CE3036E	Environmental Geotechnics	3	0	0	6	3	Y	N	N	N
32	CE3037E	Reinforced Earth and Geotextiles	3	1	0	5	3	Y	N	N	N
33	CE3038E	Advanced Concrete Design	3	1	0	5	3	Y	N	N	N
34	CE3039E	Computational Elasticity	3	1	0	5	3	Y	N	N	N
35	CE3040E	Finite Element Method	3	1	0	5	3	Y	N	N	N
36	CE3041E	Matrix Methods of Structural Analysis	3	1	0	5	3	Y	N	N	N
37	CE3042E	Pre-stressed Concrete Design	3	1	0	5	3	Y	N	N	N
38	CE3043E	Intelligent Transportation Systems	3	1	0	5	3	Y	N	N	N
39	CE3044E	Pavement Analysis and Design	3	1	0	5	3	Y	N	N	N

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Additional Categories			
								PE	EI	DA	HM
40	CE3045E	Transportation Infrastructure Design	3	1	0	5	3	Y	N	N	N
41	CE3046E	Transportation Planning	3	1	0	5	3	Y	N	N	N
42	CE3047E	Environmental Hydraulics	3	0	0	6	3	Y	N	N	N
43	CE3048E	Groundwater Hydrology	3	1	0	5	3	Y	N	N	N
44	CE3049E	Optimisation of Engineering Systems	3	1	0	5	3	Y	N	N	N
45	CE3050E	Soft Computing Techniques	3	0	0	6	3	Y	N	Y	N
46	CE3051E	Statistical Techniques in Water Resources Engineering	3	1	0	5	3	Y	N	Y	N
47	CE4021E	Contract Laws and Specifications	3	1	0	5	3	Y	N	N	N
48	CE4022E	Forensic Engineering and Rehabilitation of Structures	3	0	0	6	3	Y	N	N	N
49	CE4023E	Health Monitoring of Structures	3	0	0	6	3	Y	N	N	N
50	CE4024E	Quality and Safety Management	3	0	0	6	3	Y	N	N	N
51	CE4025E	Sustainable Construction and Lean Construction	3	0	0	6	3	Y	N	N	N
52	CE4026E	Environmental Risk Assessment	3	1	0	5	3	Y	N	N	N
53	CE4027E	Environmental System Modelling	3	1	0	5	3	Y	N	N	N
54	CE4028E	Hazardous and Special Waste Management	3	0	0	6	3	Y	N	N	N
55	CE4029E	Industrial Waste Engineering	3	1	0	5	3	Y	N	N	N
56	CE4030E	Geoinformatics	2	0	2	5	3	Y	N	N	N
57	CE4031E	Earth and Rock Fill Dam Engineering	3	1	0	5	3	Y	N	N	N
58	CE4032E	Modelling and Simulation of Earth Systems	3	1	0	5	3	Y	N	N	N
59	CE4033E	Soil Dynamics and Design of Machine Foundations	3	1	0	5	3	Y	N	N	N
60	CE4034E	Advanced Steel Design	3	1	0	5	3	Y	N	N	N
61	CE4035E	Dynamics of Structures	3	1	0	5	3	Y	N	N	N
62	CE4036E	Fracture Mechanics	3	1	0	5	3	Y	N	N	N

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Additional Categories			
								PE	EI	DA	HM
63	CE4037E	Seismic Design of Structures	3	1	0	5	3	Y	N	N	N
64	CE4038E	Public Transportation	3	1	0	5	3	Y	N	N	N
65	CE4039E	Road Safety and Management	3	1	0	5	3	Y	N	N	N
66	CE4040E	Traffic Flow Modelling	3	1	0	5	3	Y	N	N	N
67	CE4041E	Transportation and Land use	3	1	0	5	3	Y	N	N	N
68	CE4042E	Coastal Engineering and Coastal Zone Management	3	0	0	6	3	Y	N	N	N
69	CE4043E	Finite Element Method in Fluid Flow	3	1	0	5	3	Y	N	N	N
70	CE4044E	Hydroclimatology	3	0	0	6	3	Y	N	N	N
71	CE4045E	Hydropower	3	0	0	6	3	Y	N	N	N
72	CE4046E	Statistics, Probability and Reliability Methods in Engineering	3	1	0	5	3	Y	N	N	N
73	CE4047E	Urban Hydrology and Drainage	3	1	0	5	3	Y	N	N	N
74	CE4048E	Water Quality Modelling and Management	3	0	0	6	3	Y	N	N	N

3. OPEN ELECTIVES (OE)

Courses offered by Other Departments/Schools/Centres or Approved Online Platforms, with a limit on the maximum number of courses from such platforms specified as per BTech Ordinances and Regulations. In addition, PE courses offered by the Parent department shall be included in this category for students of the Parent department.

4. INSTITUTE ELECTIVES (IE)

In case of the Institute Electives, courses in the appropriate categories offered by other departments/schools/centres also can be credited instead of the courses offered by the Department of Civil Engineering, subject to the approval from the Course Faculty and Faculty Advisor.

a) Entrepreneurship / Innovation Basket (EI):

Courses proposed by the Departments/Schools/Centres and approved by Institute Innovation Council. Total credits required is 3.

b) Digital Automation Technologies (DA):

Courses related to programming / automation tools & techniques / Industry 4.0. Total credits required is 6.

c) Humanities, Social Science, Management (HM):

Courses such as Indian and Foreign languages, Economics, Engineering Management, Financial Management and Design Thinking. Total credits required is 9.

5. ACTIVITY CREDITS (AC)

A minimum of 80 Activity Points are to be acquired for obtaining the 4 Activity Credits required in the curriculum.

Activity points acquired should be a minimum of 20 at the end of S4.
Activity points acquired should be a minimum of 40 at the end of S6.

PROGRAMME STRUCTURE

Semester I

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1003E	Mathematics I	3	1	0	5	3	IC
2.	CY1001E	Chemistry for Civil Engineers	3	0	0	6	3	IC
3.	MS1001E	Professional Communication	3	1	0	5	3	IC
4.	CE1001E	Engineering Mechanics	3	1	0	5	3	PC
5.		DA – Elective 1					3	DA
6.	CE1002E/ CE1003E	Building Technology/ Engineering Geology	3	0	0	6	3	PC
		Total					**18**	

Semester II

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1013E	Mathematics II	3	1	0	5	3	IC
2.	CE1011E	Engineering Graphics	2	0	2	5	3	IC
3.	CE1012E	Mechanics of Solids	3	1	0	5	3	PC
4.	CE1013E	Mechanics of Fluids	3	1	0	5	3	PC
5.	CE1014E	Surveying	3	1	0	5	3	PC
6.	CE1003E/ CE1002E	Engineering Geology / Building Technology	3	0	0	6	3	PC
7.	CE1091E	Surveying Lab	0	0	2	1	1	PC
		Total					**19**	

Semester III

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2003E	Mathematics III	3	1	0	5	3	IC
2.	CE2001E	Structural Analysis I	3	1	0	5	3	PC
3.	CE2002E	Open Channel Hydraulics and Hydraulic Machines	3	1	0	5	3	PC
4.	CE2003E	Highway Engineering	3	1	0	5	3	PC
5.	CE2004E	Geotechnical Engineering	3	1	0	5	3	PC
6.	CE2005E	Functional Design of Buildings	3	0	0	6	3	PC
7.	CE2091E	Materials Testing Lab I	0	0	2	1	1	PC
8.	CE2092E	Building Design and Drawing	0	0	3	3	2	PC
		Total					**21**	

Semester IV

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2013E	Mathematics IV	3	1	0	5	3	IC
2.	CE2011E	Structural Analysis II	3	1	0	5	3	PC
3.	CE2012E	Foundation Engineering	3	1	0	5	3	PC
4.	CE2013E	Environmental Engineering I	3	1	0	5	3	PC
5.		Entrepreneurship / Innovation Elective	3	0	0	6	3	EI
6.		Open Elective - 1	3	0	0	6	3	OE
7.	CE2093E	Material Testing Lab II	0	0	2	1	1	PC
8.	CE2094E	Geotechnical Engineering Lab	0	0	2	1	1	PC
		Minor Course - 1	3	0	0	6	3	MC
Total (Excluding the Minor Courses)							**20**	

Semester V

Sl. No	Course Code	Course Title	L	T	P	O	Credits	Category
1.	CE3001E	Design of Reinforced Concrete Structures	3	1	0	5	3	PC
2.	CE3002E	Environmental Engineering II	3	1	0	5	3	PC
3.	CE3003E	Engineering Hydrology	3	1	0	5	3	PC
4.	CE3004E	Professional Ethics	1	0	0	2	1	IC
5		DA – Elective 2					3	DA
6.		HM – Elective 1					3	HM
7.		Open Elective - 2	3	0	0	6	3	OE
8.	CE3091E	Environmental Engineering Lab	0	0	2	1	1	PC
		Minor Course - 2	3	0	0	6	3	MC
Total (Excluding the Minor Courses)							**20**	

Semester VI

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	CE3011E	Design of Steel Structures	3	1	0	5	3	PC
2.	CE3012E	Irrigation Engineering and Hydraulic Structures	3	1	0	5	3	PC
3.	CE3013E	Airport and Railway Engineering	3	1	0	5	3	PC
4.		HM – Elective 2					3	HM
5.		Open Elective - 3	3	0	0	6	3	OE
6.		Open Elective - 4	3	0	0	6	3	OE
7.	CE3092E	Computer Applications Laboratory	0	0	2	1	1	PC
8.	CE3097E	Project: Part I	0	0	0	9	3	PC
		Minor Course - 3	3	0	0	6	3	MC
Total (Excluding the Minor Courses)							**22**	

Semester VII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MS****E	HM – Elective 3 (Indian / Foreign Language)					3	HM
2.		Open Elective - 5	3	0	0	6	3	OE
3.		Open Elective - 6	3	0	0	6	3	OE
4.		Open Elective - 7	3	0	0	6	3	OE
5.		Open Elective - 8	3	0	0	6	3	OE
6.	CE4091E	Internship	0	0	0	*	2	PC
7.	CE4098E/ CE40**E	Project: Part II / Programme Elective-1	0/3	0/0	0/0	9/6	3	PE
8.		Minor Course - 4	3	0	0	6	3	MC
Total (Excluding the Minor Courses)							**20**	

**Decided by the organisation in which the internship is done*

Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	CE4099E/ CE40**E, CE40**E	Project: Part III / Programme Elective – 2 & Programme Elective – 3	0/3 &3	0	0	18/6&6	6	PE
2.		Activity Credits (minimum of 80 points)	-	-	-	-	4	AC
Total							**10**	

MA1003E MATHEMATICS I

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Find the limits, check for continuity and differentiability of real valued functions of one variable.
CO2: Find the limits, check for continuity and differentiability of real valued functions of two variables.
CO3: Find the maxima and minima of real valued functions of one or two variables.
CO4: Test the consistency of the system of linear equations and then solve it.
CO5: Diagonalise symmetric matrices and use it to find the nature of quadratic forms.

System of linear equations: Gauss elimination method, row echelon form, row space, row rank, existence and uniqueness, homogeneous system, Linear independence and span of row vectors, Linearly independent solutions, rank-nullity relation for homogeneous linear system.
Eigenvalues and eigenvectors of a matrix, Cayley-Hamilton theorem, eigenvectors associated with distinct eigenvalues, diagonalisation of matrices, symmetric, skew-symmetric and orthogonal matrices and their eigenvalues, orthogonal diagonalisation of symmetric matrices, bilinear and quadratic forms, definiteness of quadratic forms, transformation into principal axes.

Functions of one variable: limit, continuity, differentiability, local maxima and local minima, mean value theorems, Taylor's theorem, indeterminate form, L'hôpital's rule, integration, fundamental theorem of calculus, applications: finding volume and area, improper integrals, Gamma and Beta functions. Parameterised curves in space, arc length, tangent and normal vectors, curvature and torsion.

Functions of several variables: limit, continuity, partial derivatives, partial differentiation of composite functions, directional derivatives, gradient, applications like finding local maxima and local minima of functions of two variables, critical point, saddle point, Taylor's formula for two variables, Hessian, second derivative test, method of Lagrange multipliers.
Evaluation of double integral, improper integrals, change of variables, Jacobian, polar coordinates, triple integral, cylindrical and spherical coordinates, applications: mass of a lamina, centre of gravity, moments of inertia.

References:

1. Anton H., Bivens I. and Davis S., *Calculus*, 10th ed, John Wiley & Sons, 2015.
2. Thomas G. B., Hass W. J., and Thomas, M.D., Calculus, 12th ed, Pearson, 2015.
3. Kreyszig, E., *Advanced Engineering Mathematics*, 10th ed, John Wiley & Sons, 2015.
4. Strang G., Introduction to Linear Algebra, Wellesley MA: Cambridge Press, 2016.

CY1001E CHEMISTRY FOR CIVIL ENGINEERS

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Apply the basic concepts of physical chemistry to solve engineering problems.
CO2: Utilise the basic concepts and principles of equilibrium chemistry for various applications
CO3: Choose appropriate analysis for quantitative estimation with high precision for innovative products.

Concepts from physical chemistry - Thermodynamics, Enthalpy, Entropy, Gibb's free energy, Vapour pressure of liquids. Membrane processes - Osmosis, Dialysis. Concepts from electrochemistry - Conductivity, Electrochemical cell, Current and chemical change. Chemical kinetics - Zero order, First order, and Second order reactions, Catalysis, Adsorption, Adsorption isotherms.

Concepts from equilibrium chemistry (including numerical) – Acid-base equilibria, Solubility product, Solubility of salts and gases, Factors affecting solubility, Oxidation-reduction reactions. Carbonate chemistry. Portland cements - Manufacturing, Chemical composition, Hydration of cement, Alkali-aggregate reactions, Sulphate attack on cement. Corrosion of steel - Electrochemical theory of corrosion, Factors affecting the rate of corrosion, Types of corrosions, Corrosion control - Anodizing, Galvanization, Cathodic protection, Sacrificial anode and Impressed current methods.

Concepts from quantitative chemistry - Gravimetric analysis, Volumetric analysis, Calorimetry. Instrumental methods of analysis (working principles only) - Nephelometry, Optical methods - UV, IR, AAS, AES, ICP, Flame photometer. Electrical methods -Potentiometric, Polarographic, Conductimetry, Coulometry. Chromatography - GC, HPLC, IC. Other methods - mass spectrometry.

References:

1. Atkins P. and Paula J., *Physical Chemistry*, 8th edition, W. H. Freeman and Company, New York 2006.
2. Mehta P. K. and Monteiro P. J. M., *Concrete- Microstructure, Properties and Materials*, McGraw Hill Education, 2014.
3. Puri B. R., Sharma L. R. and Pathania M.S., *Principles of Physical Chemistry* (48th Edition), Vishal Publishing Co., India, 2021.
4. Sawyer C. N., McCarty P. L., and Parkin G. F., *Chemistry for Environmental Engineering and Science*, McGraw Hill Education, 2017.
5. West D., Skoog D., Holler F., and Crouch S., *Fundamentals of Analytical Chemistry*, 9th edition, Brooks/Cole Publication, 2014.

MS1001E PROFESSIONAL COMMUNICATION

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Distinguish the role and purpose of communication at the workplace and for academic purposes.

CO2: Decide strategies and modes for effective communication in a dynamic workplace.

CO3: Combine multiple approaches for successful and ethical information exchange.

CO4: Estimate best communication practices to assist productivity and congeniality at the workplace.

Listening and Reading Comprehension

Conversation starters: introductions and small talk - Seek and provide information, clarification, polite enquiries, requests, congratulate people, apologise, give and respond to feedback - Describe graphs, tables, and charts - Words often confused: Lexicon and Meaning - Sense Groups - Listening for specific purposes: Listening to lectures, Summarise academic lectures for note-taking - Appropriate Language to Request and Respond - Public Speaking

Vocabulary and Speaking

Developing professional vocabulary - Basic Sentence Structures from Reading Texts - Concord - Functions of Auxiliary Verbs and Modals - Strategies for Effective Reading - Skimming and Scanning, Determine themes and main ideas, Predicting content using photos, images and titles - Critical Reading: Discussing and Summarising text points - Understanding Text Structures: sequencing, comparing and contrasting, relating cause and effect, problems and problem-solving - Discussing Rhetorical and Cultural Aspects in Texts - Text Appreciation: Drawing inferences, Framing Opinions and Judgments on Reading Text

Effective Writing

Note Making and Summarising: Prepare notes from reading texts, Paraphrasing - Use of Multimedia for Assistive Purposes - Paragraph Writing: cohesive devices to connect sentences in a paragraph - transitional devices - Use Text Structures in Paragraphs: sequencing, comparing and contrasting, relating cause and effect, problems and problem-solving - Avoiding Ambiguity and Cleft Sentences - Applications-Writing Instructions, Descriptions and Explanations - Official Letters of Request and Denial - Official E-mails - Abstract Writing - Digital Resources for Effective Communication

Communication at Workplace

Communication Theory - Process of Communication - Modes of Communication - Verbal and Non-Verbal Communication - Tone in Communication - Formal and Informal Communication at Workplace - Passive, Assertive and Aggressive Styles of Communication - Positive Body Language - Group Discussions - Presentation - Workplace Communication - Active Listening - Giving Feedback - Communication Etiquette - Persuasion - Negotiation - Tone and Voice - Telephone etiquette - Establishing Credibility in Conversations - Digital Communication and Netiquette: Conducting Oneself in Virtual Interactions, Constructive use of Social media - Ethical and Culturally Sensitive Communication: Ethical considerations in professional communication, Addressing diversity, Inclusive Communication Practices

References:

1. Bhatnagar, N., and Bhatnagar, M., *Communicative English for engineers and professionals*, Dorling Kindersley.2010.
2. Foley, M., and Hall, D., *Longman advanced learners 'grammar: A self-study reference & practice book with answers*, Pearson Education, 2018.
3. Garner, B. A., *HBR Guide to better business writing: Engage readers, tighten and Brighten, make your case,* Harvard Business Review Press, 2012.
4. Hewings, M. *Advanced grammar in use: A reference and practice book for Advanced learners of English*, Cambridge University Press, 2013.
5. Ibbotson, M. *Cambridge English for Engineering*, Cambridge University Pres, 2015.
6. Kumar, S., and Lata, P. *Communication Skills*, Oxford University Press, 2015.
7. Sudarshana, N., and Savitha, C., *English for Technical Communication,* Cambridge English, 2016.

CE1001E ENGINEERING MECHANICS

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total lecture sessions: 39

Course Outcomes:

CO1: Solve rigid body static problems using equations of equilibrium

CO2: Analyse truss using method of joints and method of sections

CO3: Draw SFD and BMD of statically determinate beams

CO4: Analyse chains and cables, calculate friction forces and properties of surfaces

Fundamentals of mechanics: Introduction - idealisations of mechanics - vector and scalar quantities - equality and equivalence of vectors - laws of mechanics.
Important vector quantities: Elements of vector algebra - position vector - moment of a force about a point - moment of a force about an axis - the couple and couple moment - couple moment as a free vector - addition and subtraction of couples - moment of a couple about a line.
Equivalent force systems: Translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems.
Equations of equilibrium: Free body diagram - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy.

Introduction to structural mechanics: Trusses - The structural model - the simple truss - solution of simple trusses - method of joints - method of sections.
Section forces in beams: Shear force - axial force and bending moment - differential relations for equilibrium - SFD - BMD - various types of statically determinate beams.

Chains and cables: Coplanar cables - parabolic and catenary cables - elementary problems.
Friction forces: Laws of Coulomb friction - simple contact friction problems.
Properties of surfaces: First moment of area and centroid - theorems of Pappus-Guldinus, second moments and the product of a plane area, transfer theorems, computations involving second moments and products of area - relation between second moments and products of area - polar moment of area - principal axes.

References:

1. Beer F.P. and Johnston E.R., *Vector Mechanics for Engineers – Statics*, McGraw Hill Book Co., Hill Education. 10th Edition,2012.
2. Hibbeler, R. C., *Engineering Mechanics – Statics*, Pearson Prentice Hall, 14th Edition, 2016.
3. Meriam J.L. and Kraige L.G., *Engineering Mechanics - Statics*, John Wiley & Sons. 5th Edition, 2006.
4. Shames I. H., *Engineering Mechanics - Statics and Dynamics*, Prentice Hall of India. 4th Edition, 2016.
5. Timoshenko, S., Young, D.H., Rao, J.V., and Pati S., *Engineering Mechanics*, McGraw Hill, 5th Edition, 2017.

CE1002E BUILDING TECHNOLOGY

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

Total lecture sessions: 39

Course Outcomes:

CO1: Apply the knowledge about building materials for construction practices.

CO2: Identify the functions of building components and their construction methods.

CO3: Apply appropriate construction techniques for different applications.

Building materials and construction

Stone masonry: Types of stones and classification of stone masonry – Aggregate: Classification, physical, mechanical properties, and tests – Brick: manufacturing, classification, properties, and tests – Brick masonry: bonds in brick masonry – Composite masonry – Partition Wall – Cavity walls – Reinforced brick work – Tiles: types, properties and uses - Lime: classification and properties – Cement: types, chemical composition of raw materials, tests – Mortar: types, Steel rebars – Structural steel sections –Timber: seasoning, preservation, Industrial timber – Geo-synthetics – Glass.

Building components

Components of a typical building: Framed and loading bearing structures – Foundations: improvement of soil bearing capacity, timbering of foundation trenches, types of Shallow and deep foundations – Floors and roofs: Types and applications – Lintels and sunshades – Wall Finishes: Plastering, pointing and painting – Doors, windows and ventilators: types and applications.

Concrete and construction techniques

Concrete: Properties of fresh and hardened concrete, test methods, grades of concrete, proportioning of concrete mixes – Mineral and chemical admixtures – Concrete Production: Batching, mixing, placing, compacting and curing – Formwork – Plain and reinforced concrete – cast-in-situ, Pre-cast – Introduction to special concretes – prestressed construction – slip form and lift slab constructions – Termite proof and damp-proof construction – Building repairs: types of scaffoldings, shoring, underpinning.

References:

1. Chudley R., Construction Technology, Longman Publishing Group, 1973.
2. Duggal S. K., Building Materials, Oxford & IBH publishing Co. Ltd., New Delhi, 2019
3. Mehta, Scarborough, and Armpriest, Building Construction: Principles, Materials, and Systems, Pearson, 2017.
4. Neville A. M., Concrete Technology, Pearson Education Ltd., 2019.
5. Rangwala, S. C., Engineering Materials, Charotar Publishing House, 2019.
6. Sahu G.C. and Jena J, Building Materials and Construction, McGraw Hill Education, 2017
7. Varghese, P. C., Building Materials, Prentice Hall of India, 2015.

CE1003E ENGINEERING GEOLOGY

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

Total lecture sessions: 39

Course Outcomes:

CO1: Demonstrate the dynamic nature of earth, and their surface and subsurface process.

CO2: Illustrate the various geological hazards and their mitigation.

CO3: Identify the minerals and rocks and their application to civil engineering projects.

Introduction: Introduction to Geology and its importance in Civil Engineering practices. Internal structure and composition of the earth, Plate tectonics.
Mineralogy: Study of rock forming minerals and crystallization. Physical properties, chemical composition, uses and contribution of the following minerals in preparation of construction materials, Quartz and its varieties: Feldspar group: Mica Group: Carbonate group: Calcite, Asbestos, Kaolin and Garnet. Important Ore minerals.

Petrology: Rock cycle and Physical and chemical weathering of rocks. Definition, origin, classification, and forms of Igneous, Sedimentary, Metamorphic rocks. Texture, Structure, Petrological description and Engineering importance of the Igneous, Sedimentary, and Metamorphic rocks. Geological formation of India, Engineering classification of Rocks. Origin and classification soils.

Structural geology: Introduction, Stress and Strain in rocks, Outcrop, Dip and Strike. Description of Folds, Faults, Unconformities and Joints, their identification in the field. Preparation of Geological maps. Site selection for Dams, Reservoirs, and Tunnels.
Hydrogeology: Hydrological cycle, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Types of Aquifers - Confined and unconfined Aquifers, Artificial recharge of ground water Geological and Geophysical technique and its relevance to engineering application, Geological hazards. Geological action of river, wind, sea.

References:

1. Bell, F.G., *Fundamentals of Engineering Geology*, Elsevier, 2016.
2. Blyth, F.G.H. and de Freitas, M.H. A, *Geology for Engineers*, Elsevier, 2017.
3. Gangopadhyay, S., *Engineering Geology*, Oxford university press, 2013.
4. Kesavulu N. C., *Text book of Engineering Geology*, Macmillan India Limited, 1996.
5. Singh, P*., Engineering Geology and General Geology*, S.K Kataria and Sons, 2013.
6. Varghese P.C., *Engineering Geology for Civil Engineers*, Prentice Hall of India, 2012.

MA1013E MATHEMATICS II

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total lecture sessions: 39

Course Outcomes

CO1: Find the parametric representation of curves and surfaces in space and evaluate integrals over curves and surfaces.
CO2: Understand the convergence of sequences and series and various methods of testing for convergence.
CO3: Solve linear ODEs with constant coefficients.
CO4: Formulate some engineering problems as ODEs and hence solve such problems.
CO5: Use Laplace transform and its properties to solve differential equations and integral equations.

Vector field: divergence, curl, identities involving divergence and curl, scalar potential.
Line integral, independence of path, irrotational and solenoidal vector fields, Green's theorem for plane, parameterized surface, surface area and surface integral, flux, Gauss' divergence theorem, Stokes' theorem.

Numerical sequences, Cauchy sequence, convergence of sequences, series, convergence of series, tests for convergence, absolute convergence. Sequence of functions, power series, radius of convergence, Taylor series, periodic functions and Fourier series expansions, half-range expansions.

Existence and uniqueness of solution of first order ordinary differential equations(ODE)s, methods of solutions of first order ODE, linear ODE, linear homogeneous second order ODEs with constant coefficients, fundamental system of solutions, Wronskian, linear independence of solutions, method of undetermined coefficients, solution by variation of parameters, Euler-Cauchy differential equations, applications of ODEs.

Laplace transform, sufficient condition for existence, inverse Laplace transform, Dirac delta function, transforms of derivatives and integrals, shifting theorems, convolution, differentiation and integration of transform, solution of differential equations and integral equations using Laplace transform.

References:

1. Anton, H., Bivens I. and Davis, S., *Calculus*, 10th edition, New York: John Wiley & Sons, 2015.
2. Arnold, V.I., *Ordinary Differential Equations*, New York: Springer, 2006.
3. Dyke, P., *An Introduction to Laplace Transforms and Fourier Series,* Springer, 2014.
4. Kreyszig, E., *Advanced Engineering Mathematics*, 10th edition, New Delhi, India: Wiley, 2015.

CE1011E ENGINEERING GRAPHICS

Pre-requisites: Nil

L	T	P	O	C
2	0	2	5	3

Total sessions: 26L + 26D

Course Outcomes:

CO1: Make use of the Indian Standard Code of Practice in Engineering Drawing.

CO2: Represent any engineering object by its orthographic views.

CO3: Convert orthographic views of an engineering object into its isometric view.

CO4: Use software for drawing and visualization of engineering objects.

Introduction: Drawing instruments and their uses; lines, lettering and dimensioning; Introduction Auto CAD software, geometrical construction; constructions of plain and diagonal scales.
Orthographic projection—first and third angle projections (using CAD); orthographic projection of points on principal, profile, and auxiliary planes.
Orthographic projection of straight line in simple and oblique positions; application of orthographic projection of line

Orthographic projection of planes in simple and oblique position on principal and profile planes; orthographic projection of lines and planes on auxiliary planes. Orthographic projection of solids in simple and oblique positions on principal and profile planes; orthographic projections of solids in oblique position

Orthographic projection of solids in section; development of surfaces of solids; method of isometric projection (Using CAD). Introduction to perspective projection (no drawing)

References:

1. Agrawal B. and Agrawal C. M., *Engineering Drawing*, 3rd ed. McGraw Hill Education, 2019.
2. Bhatt, N. D., *Engineering Drawing*, 54th ed. Charotar Publishing House, 2023.
3. Venugopal K. and Raja V P, *Engineering Drawing + Auto CAD*, 6th Edition, New Age Intl. Pvt Ltd., 2022.

CE1012E MECHANICS OF SOLIDS

Pre-requisites: Engineering Mechanics or equivalent

L	T	P	O	C
3	1	0	5	3

Total Lecture sessions: 39

Course Outcomes:

CO1: Evaluate the stress-strain behaviour of linear elastic solids

CO2: Assess bending and shear stresses in beams of different cross-sections

CO3: Analyse stresses at inclined planes and calculate principal stresses and strains

CO4: Apply the appropriate method for finding the deflections of beams under different loading

CO5: Determine the buckling load of columns subjected to different end conditions

Tension, compression and shear: Types of external loads - self weight - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams - working stress - elongation of bars of constant and varying sections - statically indeterminate problems in tension and compression - thermal stresses - strain energy in tension, compression and shear.
Theory of simple bending: limitations - bending stresses in beams of different cross sections - moment of resistance - beams of two materials - shear stresses in bending - principal stresses in bending - strain energy in bending.
Torsion: Torsion of circular solid and hollow shafts - strain energy in shear and torsion - helical springs. Concept of shear flow and shear centre.

Analysis of stress and strain: Stress on inclined planes for axial and biaxial stress fields - principal stresses - concept of Mohr's circle - principal stress problem as an eigenvalue problem - principal strains - strain rosette.
Deflection of beams: Differential equation of elastic curve - slope and deflection of beams by successive integration - Macaulay's method - moment area method - conjugate beam method.

Theory of columns: Axial loading of short strut - long columns - differential equation of elastic curve – Euler's formula - eccentric loading - direct and bending stresses – buckling load as an eigenvalue problem.

References:

1. Beer, F. P. and Johnston, E. R., *Mechanics of Materials*, Tata McGraw Hill, New Delhi, 2005
2. Gere, J.M., *Mechanics of Materials*, Thomson, Singapore, 2001.
3. Nash, W.A., *Strength of Materials*, Schaum's Outline Series, McGraw Hill, New York, 1988.
4. Popov, E.P., *Mechanics of Materials*, Prentice Hall India, New Delhi, 2002.
5. Timoshenko, S.P., Young, D.H., *Elements of Strength of Materials*, East West Press, New Delhi, 2003.

CE1013E MECHANICS OF FLUIDS

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Estimate hydrostatic forces on structures.

CO2: Describe fluid motion and analyse fluid flow using energy and momentum equations.

CO3: Design and analyse piping systems and pipe-networks.

CO4: Formulate necessary equations and plan experimental studies in fluid mechanics.

Fluid statics

Fluids: Definition, types, and properties, Viscosity, Fluid as a continuum, System and control volume concepts.
Fluid Statics: Fluid pressure, measurement of pressure, Fundamental equation of fluid statics, Hydrostatic forces on immersed surfaces, Application of fluid pressure analysis in engineering problems. Buoyancy and stability of immersed and floating bodies. Pressure in case of accelerated rigid body motion.

Fluid kinematics and dynamics

Fluid kinematics: Methods of describing fluid motion, Types of fluid motion, Inviscid flows, Velocity and acceleration, Rotational and irrotational flows, Reynolds transport equation, Continuity equation, Potential flows, Velocity potential and Stream function, Cauchy-Reimann equations, Flownet, Circulation and vorticity.
Fluid dynamics: Types of forces, Forces influencing fluid motion, Energy and Head, Energy correction factor, Euler and Bernoulli's equations, Application of Bernoulli's equation, Flow measurement, Linear momentum equation, Momentum correction factor, Applications of momentum equation.

Pipe flow and Dimensional Analysis

Pipe flow: Laminar and turbulent flows, Reynolds' number, Head loss - Major loss in pipe flow. Friction loss, Hagen-Poiseulle and Darcy-Weisbach equations, Minor losses, Moody's diagram, Total energy and hydraulic gradient lines, Compound pipes, Pipes in series and parallel, Branching pipes, Pipe networks, Hardy-Cross method.
Introduction to boundary layer theory: Boundary layer growth in flow over a plate, Flow past immersed bodies.
Dimensional analysis and similitude: Methods of dimensional analysis, Dimensionless numbers. Principles of similarity - Modelling using Reynolds and Froude model laws, Distorted models and scale effects.

References:

1. Modi, P.N., and Seth, S.M., *Hydraulics and Fluid Mechanics including Hydraulics Machines*, Standard Book House, New Delhi, 2022.
2. Shames, I.H., *Mechanics of Fluids*, McGraw Hill, New York, 2002.
3. Streeter, V.L., Wylie, E.B., Bedford, K.W., *Fluid Mechanics*, McGraw Hill, New York, 2017.
4. Subramanya, K., *Theory and Applications of Fluid Mechanics*, McGraw Hill, New York, 1993.

CE1014E SURVEYING

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Carry out field surveys for location, design and construction of engineering projects.

CO2: Adopt suitable survey technique and select equipment based on the required level of accuracy.

CO3: Work effectively with modern surveying equipment to improve quality of surveys.

CO4: Analyse and synthesise survey data.

Surveying - Basic Concepts: Surveying definition - principles of surveying - plane surveying - geodetic surveying – Types of errors.
Distance Measurement: Measurement methods (Tape, Tacheometry, EDM) - Taping Equipments - Taping on smooth level ground and sloping ground – Ranging - Systematic errors in taping and corrections (Tape standardization, Temperature, Tension, Sag, Slope and Alignment) – Electronic Distance Measurement – Principle of EDMs – Systematic errors and accuracy of EDM systems.
Vertical Control: Levelling - Definitions (Level line, Horizontal line, Datum, Bench mark, Reduced Level) – Curvature and refraction –Methods of Booking (Height of collimation, Rise and fall) - Differential levelling – Reciprocal levelling -– Applications of levelling (profile levelling and contouring).

Angle and Direction Measurement: Definitions (True meridian, Magnetic meridian, Bearings, Azimuths, Interior angles, Deflection angles) – Methods of determining angles and directions (Magnetic compass, Theodolite, Total station) – Prismatic compass – WCB system – Magnetic declination – Local attraction.
Traversing: Traverse – Traverse stations – Types of traverse – Closed traverse computations and adjustments.
Triangulation and Trilateration: Triangulation – Principle – Classification of triangulation system– Triangulation figures and layouts- Well conditioned triangle – Strength of figure–Intervisibility of stations.

Combined Distance and Angular measurement: Tacheometric surveying - Stadia method – Stadia constants – Elevation difference - Staff held vertical - Tangential tacheometry – Trignometric levelling
Total station systems - Features and functions – applications.
Route surveying – Curves: Curves - Types - Elements of a curve - Simple curves - Setting out of curves using various methods – Geometry of compound curves and reverse curves – Introduction to transition and vertical curves.

References:

1. Anderson J. and Mikhail E., *Surveying: Theory and Practice*, McGraw Hill Education; 7th edition, 2017.
2. Schofield W and Breach M, *Engineering Surveying*, Elsevier, CBSPD, 6th edition, 2007.
3. Subramanian R., *Surveying and Levelling*, Oxford University Press, 2nd edition, 2012.

CE1091E SURVEYING LAB

Pre-requisites: CE1014D Surveying or its concurrent

L	T	P	O	C
0	0	2	1	1

Total Practical Sessions: 26

Course Outcomes:

CO1: Use the surveying equipment to carryout field surveys for engineering projects.

CO2: Analyse and synthesise survey data from the field notes.

CO3: Work effectively as a member of a survey party in completing the assigned field work

Syllabus / List of Exercises:

1. Setting out of a building
2. Levelling using auto level
3. Contour surveying – Determination of coordinates using total station and preparation of contour map using QGIS
4. Measurement horizontal and vertical angles – using Micro-optic theodolite
5. Tacheometric surveying – Stadia method – Determination of heights and distances using Micro-optic theodolite
6. Traversing – using Total station
7. Curve setting – Simple curves using Micro-optic theodolite
8. Drone and DGPS survey -Demo

References:

1. Anderson J. and Mikhail E., *Surveying: Theory and Practice*, McGraw Hill Education; 7th edition, 2017.
2. Kanetkar T.P., and Kulkarni S.V., *Surveying and Levelling – Part 1*, Pune Vidyarthi Griha Prakashan, Pune, 1994.
3. Schofield W and M Breach, *Engineering Surveying*, Elsevier, CBSPD, 6th edition, 2007.
4. Subramanian R., *Surveying and Levelling*, Oxford University Press, 2nd edition, 2012.

CE1021E COMPUTER PROGRAMMING

Pre-requisites: Nil

L	T	P	O	C
2	0	2	5	3

Total Sessions: 26L + 26P

Course Outcomes:

CO1: Recall the keywords, functions and control statements in the C or Python programming language.

CO2: Design of algorithms for simple computational problems.

CO3: Express algorithmic solutions in the C or Python programming language.

Option I: C Programming

Identification of Computational Problems – Pseudocodes and Flowcharts – Algorithms – Introduction to C Programming – Character set – Keywords – Constants and Variables – Data types – Declarations – Operators: Arithmetic, Relational, Logical, Assignment, Increment/Decrement – Operator precedence and Associativity – Input and Output operations
Control Flow: if-else, switch, conditional operator, goto statement – Loops: for, while, do-while loops – break and continue

Functions and Program structure: Basics of functions, Parameter passing – scope rules – recursion.

Aggregate data types: Single and multidimensional arrays, structures and unions – Pointers to arrays and structures – passing arrays and pointers as arguments to functions – File management.

Option II: Python Programming

Identification of Computational Problems – Pseudocodes and Flowcharts – Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and data types in Python – Arithmetic Operators– Values and Types.

Control Flow: If-Else Constructs – Loop Structures– While Loop – For Loop – Break Statement

Functions and Program structure: Basics of functions, Parameter passing – scope rules – recursion.

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – List Loop.

List of Exercises for Practical Sessions:

1. Developing Algorithm and Flow chart for solving a simple problem.
2. Installation of Python or C and writing small programs (using Arithmetic, Relational, Logical, Assignment Operators and I/O operation)
3. Implementing programs using conditional statements
4. Implementing programs using iterative loops
5. Implementing programs using functions
6. Implementing programs using file handling
7. Implementing programs using list/array

References:

C Programming

1. Balagurusamy E, *Programming in ANSI C*, 8th edition, McGraw Hill Education, 2019
2. Kanetkar, Y., *Let Us C: Authentic guide to C programming language*, 18th edition, BPB Publications, 2021.

Python Programming

1. Thareja, R., *Python Programming: Using Problem Solving Approach*, Oxford University Press, 2017.
2. Downey, A., B., *Think Python: How to Think Like a Computer Scientist*, Second Edition, Shroff/O'Reilly Publishers, 2016.