A R U N A I

E n g i n e e r i n g   C o l l e g e

(An Autonomous Institution)
Tiruvannamalai

(Approved by AICTE, Affiliated to Anna University, 'A' Grade

Accredited by NAAC, NBA Accredited, ISO 9001: 2015 Certified)

CURRICULA AND SYLLABI

B.E. Civil Engineering

(Regulations 2024)

A R U N A I

E n g i n e e r i n g C o l l e g e

(An Autonomous Institution)
Tiruvannamalai

DNV
ISO 9001

(Approved by AICTE, Affiliated to Anna University, 'A' Grade

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CURRICULA AND SYLLABI

B.E. Civil Engineering

(Regulations 2024)

R. Kathir
HoD/BOS Chairman

Principal

ARUNAI ENGINEERING COLLEGE, THIRUVANNAMALAI
(Autonomous)
B.E CIVIL ENGINEERING
REGULATIONS 2024
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B E Civil Engineering will

I. Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations

II. Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.

III. Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.

IV. Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.

V. Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

PROGRAM OUTCOMES (POs)

PO#   Graduate Attribute

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

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

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

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

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

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

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

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

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

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

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

Washington Accord Knowledge and Attitude Profile (WKs)

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

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

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
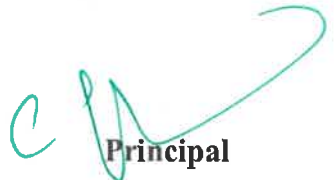
WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the Civil Engineering Degree programme, the Graduates shall exhibit the following:

PSO1 Knowledge of Civil Engineering discipline demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Civil Engineering problems and innovation critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering issues Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio cultural factors.

PEO / PO Mapping:

PEOs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
I	3	3	3	3	3	3	3	3	3	3	3	3	3	3
II	3	3	3	3	3	3	3	3	3	3	3	3	3	3
III	3	3	3	3	3	3	3	3	3	3	3	3	3	3
IV	3	3	3	3	3	3	3	3	3	3	3	3	3	3
V	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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Mapping of Course Outcome and Programme Outcome

S.No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
	YEAR I — SEMESTER I														
	Professional English - I	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-
	Matrices and Calculus	3	3	1	1	0	0	0	2	0	2	3	-	-	-
	Engineering Physics	3	3	1.6	1.2	1.8	1	-	-	-	-	1	-	-	-
	Engineering Chemistry	2.8	1.3	1.6	1	-	1.5	-	-	-	-	1.5	-	-	-
	Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	2	2	3	3	-
	தமிழர் மரபு /Heritage of Tamils														
	Problem Solving and Python Programming Laboratory	2	3	3	3	2	-	-	-	-	2	2	3	3	-
	Physics and Chemistry Laboratory	3	2.4	2.6	1	1									
	English Laboratory$	2.6	1.3	1.6	1	1	1.4	-	-	-	-	1.3	-	-	-
	SEMESTER II														
	Professional English - II	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-
	Statistics and Numerical Methods	3	3	1	1	1	0	0	2	0	2	3ˈ	-	-	-
	Physics for Civil Engineering	3	1.75	2	2	1.2	1.4								
	Basic Electrical, Electronics and Instrumentation Engineering	2	1	1				1							-
	Engineering Graphics	3	1	2		2				3		2	2	2	
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology														
	NCC Credit Course Level 1#														
	Engineering Practices Laboratory	3	2			1	1					2	2	1	1
	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	1.6	1.4	0.8	1.6			1.2	1.6						
	Communication Laboratory / Foreign Language$	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-

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Course	1	2	3	4	5	6	7	8	9	10	11	12	13	14
YEAR II — SEMESTER III														
Fourier Series and Boundary Value Problems	3	3	1	1	0	0	0	2	0	0	3	-	-	-
Applied Mechanics	3	2	3	1	2						2	3	3	2
Fluid Mechanics	3	2	3	2	1	2	1	1	1	1	2	3	3	3
Surveying and Levelling	3	2	3	2	3	3	2	2		2	2	3	3	3
Construction Materials and Technology	2	2	1	2	1	1		1	2	2	2	3	2	2
Water Supply and Waste Water Engineering	3	3	3	2	2	3	2	2	2	2	3	3	3	2
Surveying and Levelling Laboratory	3	2	3	3	3	3	3	3	3	3	1	3	3	3
Water and Waste Water Analysis Laboratory	2	2	2	2	2	2	3	2	2	2	3	2	2	2
Professional Development														
SEMESTER IV														
Probability and Linear Programming Problems	3	3	2	2	2	-	-	-	-	-	2	-	-	-
Applied Hydraulics Engineering	3	3	3	3	1	2	1	2	1	1	3	3	3	3
Strength of Materials	3	3	3	3	2	3	3	2	3	1	3	3	3	3
Concrete Technology	3	1	2	2	1	3	2	1	1	1	2	3	3	3
Soil Mechanics	3	3	2	2	2	1	1	2	1	2	3	2	2	3
Environmental Sciences and Sustainability**	2.8	1.8	1	1	-	2.2	-	-	-	-	1.8	-	-	-
Hydraulic Engineering Laboratory	3	3	2	3	1	2	1	2	1	1	2	3	2	1
Materials Testing Laboratory	3	3	2	3	1	2	1	3	1	1	2	3	2	2
Soil Mechanics Laboratory	1	2	3	3	1	1	1	3	1	1	3	2	3	3

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Year	Semester	Course	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
YEAR III	SEMESTER V	Design of Reinforced Concrete Structural Elements	3	3	3	3	1	3	3	1	3	2	1	2	3	3	3
		Structural Analysis I	3	3	3	3	1	3	3	1	3	2	1	1	3	3	3
		Foundation Engineering	2	3	3	3	1	2	1	1	1	1	2	3	3	2	3
		Professional Elective I															
		Professional Elective II															
		Professional Elective III															
		Open Elective I*															
		Mandatory Courses – I															
	SEMESTER VI	Highway Engineering Laboratory	3	1	3	2	1	1	3	3	1	3	3	3	3	3	2
		Survey Camp (2 weeks)	3	3	2	3	2	2	2	2	2	3	2	3	3	3	3
		Design of Steel Structural Elements	2	2	3	2	2	2	2	1	2	2	2	2	2	2	3
		Structural Analysis II	3	3	3	3	1	3	3	1	2	1	1	3	3	3	3
		Professional Elective IV															
		Professional Elective V															
		Professional Elective VI															
		Open Elective – II*															
		Mandatory Course II															
		Computer Aided Design and Drafting Laboratory	3	2	3	–	3	1	1	1	3	3	2	3	3	3	2

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Course														
Estimation, Costing and Valuation Engineering	3	2	3	3	3	3	2	3	2	3	2	3	3	3
Prestressed Concrete Structures	3	2	3	1	1	1	2	1	1	2	1	3	1	2
Human Values and Ethics														
Management Elective														
Open Elective - III														
Open Elective - IV														
Creative Design Project	3	2	2	2	2	2	2	3	2	2	2	3	3	3
Project Work / Internship	3	2	2	2	2	2	2	3	2	2	2	3	3	3
Value Added Course (VAC)	3	2	2	2	2	2	2	3	2	2	2	3	3	3

SEMESTER VII
SEMESTER VIII
YEAR IV

1 – Low; 2 – Medium; 3 – High.

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PROFESSIONAL ELECTIVE COURSES

S.No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1.	Construction Equipment & Machinery	2	2	3	2	2	3	2	3	2	2	2	2	2	3
2.	Shoring, Scaffolding and Formwork	2	3	3	2	1	1		3		2	2	3	2	2
3.	Advanced Construction Techniques	2	3	3	3	2	2	2	1	1	1	2	3	3	3
4.	Energy Efficient Buildings	3	2	3	2	1	1	1	3	2	3		3	3	3
5.	House Planning and Management	3	3	3	2	3	3	3	3	2	2	3	3	3	3
6.	Pre-Engineered Building	3	3	2	3	3	2	3	2	3	3	3	3	3	3
7.	Prefabricated Structures	3	2	3	2	2	3	3	2	2	1	2	3	2	2
8.	Earthquake Engineering	3	2	3	2	2	2	1	2	1	2	2	2	2	2
9.	Concrete Structures	3	3	2	3	3	1	3	1	2	1	2	3	3	3
10.	Bridge Engineering	2	2	3	2	3	2	2	3	2	3	3	2	2	2
11	Sustainable Construction and Lean Construction	3	1	3	2	2	2	1	1	1	3	2	3	3	3
12.	Green Building Techniques	3	3	3	2	3	2	2	2	3	2	3	2	2	2
13.	Repair and Rehabilitation of Structures	3	2	3	-	-	-	1	1	1	-	-	1	1	2
14.	Modern Construction Materials	2	2	1	2	1	1	2	-	1	-	2	3	2	2
15.	Non Destructive Testing	3	2	3	-	-	-	1	1	1	-	-	1	1	2

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No.	Course															
16.	Pavement Engineering	3	3	3	2	2	3	3	2	1	3	3	3	3	3	2
17.	Smart cities	3	2	3	2	2	2	2	2	2	3	2	2	3	3	3
18.	Urban Planning and Development	3	2	2	2	2	3	2	2	2	3	2	2	2	2	2
19.	Traffic Engineering and Management	3	2	3	2	2	2	2	2	2	3	1	2	2	2	3
20.	Intelligent Transport Systems	2	2	2	3	3	2	2	3	2	3	2	2	3	2	3
21.	Air and Noise Pollution Control Engineering	2	3	3	3	2	2	1	2	1	2	2	2	2	2	2
22.	Solid and Hazardous Waste Management	3	2	3	2	2	2	2	2	1	2	1	3	2	2	3
23.	Industrial Wastewater Management	2	3	3	2	2	1	3	3	2	3	2	2	2	2	3
24.	Climate Change Adaptation and Mitigation	2	3	2	3	2	2		3	1	3	2	2	2	2	3
25.	Environmental Impact Assessment	3	2	3	2	2	3	3	3	2	1	1	2	2	2	2

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ARUNAI ENGINEERING COLLEGE
(Autonomous)
THIRUVANNAMALAI
REGULATIONS 2024
CHOICE BASED CREDIT SYSTEM

B.E CIVIL ENGINEERING
CURRICULUM & SYLLABI I – VIII SEMESTERS

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP24101	Induction Programme	-	-	-	-	-	0
THEORY								
2	HS24101	Professional English-I	HSMC	3	0	0	3	3
3	MA24101	Matrices and Calculus	BSC	3	1	0	4	4
4	PH24101	Engineering Physics	BSC	3	0	0	3	3
5	CY24101	Engineering Chemistry	BSC	3	0	0	3	3
6	GE24101	Problem Solving and Python Programming	ESC	3	0	0	3	3
7	GE24102	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	GE24111	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9	BS24111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE24112	English Laboratory ^{S}	EEC	0	0	2	2	1
		TOTAL		16	1	10	27	22

$ Skill Based Course

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS24201	Professional English – II	HSMC	2	0	0	2	2
2	MA24201	Statistics and Numerical Methods	BSC	3	1	0	4	4
3	PH24207	Physics for Civil Engineering	BSC	3	0	0	3	3
4	BE24204	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5	GE24201	Engineering Graphics	ESC	2	0	4	6	4
6	GE24202	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	1	0	0	1	1
7		NCC Credit Course Level 1$^#$		2	0	0	2	2$^#$
PRACTICALS								
8	GE24211	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	BE24211	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
10	GE24212	Communication Laboratory / Foreign Language^S	EEC	0	0	4	4	2
		TOTAL		14	1	16	31	23

NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

$ Skill Based Course

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SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24303	Fourier Series and Boundary Value Problems	BSC	3	1	0	4	4
2.	CE24301	Applied Mechanics	PCC	3	0	0	3	3
3.	CE24302	Fluid Mechanics	PCC	3	0	0	3	·3
4.	CE24303	Construction Materials and Technology	PCC	3	0	0	3	3
5.	CE24304	Water Supply and Wastewater Engineering	PCC	3	0	0	3	3
6.	CE24351	Surveying and Levelling	PCC	3	0	0	3	3
PRACTICALS								
7.	CE24361	Surveying and Levelling Laboratory	PCC	0	0	3	3	1.5
8.	CE24311	Water and Wastewater Analysis Laboratory	PCC	0	0	3	3	1.5
9.	GE24903	Professional Development	EEC	0	0	2	2	1
			TOTAL	18	1	8	27	23

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24404	Probability and Linear Programming Problems	BSC	3	1	0	4	4
2.	CE24401	Applied Hydraulics Engineering	PCC	3	0	0	3	3
3.	CE24402	Strength of Materials	PCC	3	0	0	3	3
4.	CE24403	Concrete Technology	PCC	3	0	0	3	3
5.	CE24404	Soil Mechanics	PCC	3	0	0	3	3
6.	GE24901	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7.		NCC Credit Course Level 2#		3	0	0	3	3#
PRACTICALS								
8.	CE24411	Hydraulic Engineering Laboratory	PCC	0	0	3	3	1.5
9.	CE24412	Material Testing Laboratory	PCC	0	0	4	4	2
10.	CE24413	Soil Mechanics Laboratory	PCC	0	0	3	3	1.5
			TOTAL	17	1	10	28	23

NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

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SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CE24501	Design of Reinforced Concrete Structural Elements	PCC	3	0	0	3	3
2.	CE24502	Structural Analysis I	PCC	3	0	0	3	3
3.	CE24503	Foundation Engineering	PCC	3	0	0	3	3
4.		Professional Elective - I	PEC	3	0	0	3	3
5.		Professional Elective -II	PEC	3	0	0	3	3
6.		Professional Elective -III	PEC	3	0	0	3	3
7.		Open Elective I	OEC	3	0	0	3	3
8.		Mandatory Courses- I &	MC	2	0	0	2	NC
PRACTICALS								
8.	CE24511	Highway Engineering Laboratory	PCC	0	0	4	4	2
9.	CE24512	Survey Camp	EEC	0	0	2	2	1
			TOTAL	21	0	6	27	24

Mandatory Course is a Non-credit Course (Student shall select one course from the list given under MC-I)

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CE24601	Design of Steel Structural Elements	PCC	3	1	0	4	4
2.	CE24602	Structural Analysis II	PCC	3	0	0	3	3
3.		Professional Elective -IV	PEC	3	0	0	3	3
4.		Professional Elective- V	PEC	3	0	0	3	3
5.		Professional Elective- VI	PEC	3	0	0	3	3
6.		Open Elective- II	OEC	3	0	0	3	3
7.		Mandatory Course -II&	MC	2	0	0	2	NC
8.		NCC Credit Course Level 3#		3	0	0	3	3#
PRACTICALS								
9.	CE24611	Computer Aided Design and Drafting Laboratory	PCC	0	0	4	4	2
			TOTAL	20	1	4	25	21

& Mandatory Course is a Non-credit Course (Student shall select one course from the list given under MC-II)
# NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

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SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CE24701	Estimation, Costing and Valuation Engineering	PCC	3	1	0	4	4
2.	CE24702	Prestressed Concrete Structures	PCC	3	1	0	4	4
3.	GE24902	Human Values and Ethics	HSMC	2	0	0	2	2
4.		Management Elective	HSMC	3	0	0	3	3
5.		Open Elective - III	PEC	3	0	0	3	3
6.		Open Elective - IV	OEC	3	0	0	3	3
PRACTICALS								
7.	CE24711	Creative Design Project	PCC	0	0	4	4	2
			TOTAL	17	1	6	24	21

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CE24811	Project Work / Internship	EEC	0	0	20	20	8
2.		VAC	EEC	0	0	0	0	2
			TOTAL	0	0	20	20	10

TOTAL CREDITS: 166

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SUMMARY

S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	4	3					5		12
2.	BSC	12	7	4	6					29
3.	ESC	5	11							16
4.	PCC			18	17	11	9	10		65
5.	PEC					9	9			18
6.	OEC					3	3	6		12
7.	EEC	1	2	1		1			10	15
8.	Mandatory Course (Non – Credit)					✓	✓			
	Total	22	23	23	23	24	21	21	10	167

Name of the Programme: B.E. Civil Engineering

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Vertical I Construction Techniques and Practices	Vertical II Structural Engineering	Vertical III Sustainable Building Maintenance	Vertical IV Transportation Engineering	Vertical V Environmental Engineering
Construction Equipment and Machinery	Pre-Engineered Buildings	Sustainable Construction and Lean Construction	Pavement Engineering	Air and Noise Pollution Control Engineering
Shoring, Scaffolding & Formwork	Prefabricated Structures	Green Building Technique	Smart Cities	Solid and Hazardous Waste Management
Advanced Construction Techniques	Earthquake Engineering	Repair & Rehabilitation of Structures	Urban Planning and Development	Industrial Wastewater Management
Energy Efficient Buildings	Concrete Structures	Modern Construction Materials	Traffic Engineering and Management	Climate Change Adaptation and Mitigation
House Planning & Management	Bridge Engineering	Non-Destructive Testing	Intelligent Transport Systems	Environmental Impact Assessment

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PROFESSIONAL ELECTIVE COURSES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
VERTICAL I: CONSTRUCTION TECHNIQUES AND PRACTICES								
1.	CE 24001	Construction Equipment and Machinery	PEC	3	0	0	3	3
2.	CE 24002	Shoring, Scaffolding & Formwork	PEC	3	0	0	3	3
3.	CE 24003	Advanced Construction Techniques	PEC	3	0	0	3	3
4.	CE 24004	Energy Efficient Buildings	PEC	3	0	0	3	3
5.	CE 24005	House Planning & Management	PEC	3	0	0	3	3
VERTICAL II: STRUCTURAL ENGINEERING								
6.	CE 24006	Pre-Engineered Buildings	PEC	3	0	0	3	3
7.	CE 24007	Prefabricated Structures	PEC	3	0	0	3	3
8.	CE 24008	Earthquake Engineering	PEC	3	0	0	3	3
9.	CE 24009	Concrete Structures	PEC	3	0	0	3	3
10.	CE 24010	Bridge Engineering	PEC	3	0	0	3	3
VERTICAL III: SUSTAINABLE BUILDING MAINTENANCE								
11.	CE 24011	Sustainable Construction and Lean Construction	PEC	3	0	0	3	3
12.	CE 24012	Green Building Technique	PEC	3	0	0	3	3
13.	CE 24013	Repair & Rehabilitation of Structures	PEC	3	0	0	3	3
14.	CE 24014	Modern Construction Materials	PEC	3	0	0	3	3
15.	CE 24015	Non-Destructive Testing	PEC	3	0	0	3	3
VERTICAL IV: TRANSPORTATION ENGINEERING								
16.	CE 24016	Pavement Engineering	PEC	3	0	0	3	3
17.	CE 24017	Smart Cities	PEC	3	0	0	3	3
18.	CE 24018	Urban Planning and Development	PEC	3	0	0	3	3
19.	CE 24019	Traffic Engineering and Management	PEC	3	0	0	3	3
20.	CE 24020	Intelligent Transport Systems	PEC	3	0	0	3	3

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			VERTICAL V: ENVIRONMENTAL ENGINEERING						
21.	CE 24021	Air and Noise Pollution Control Engineering	PEC	3	0	0	3	3
22.	CE 24022	Solid and Hazardous Waste Management	PEC	3	0	0	3	3
23.	CE 24023	Industrial Wastewater Management	PEC	3	0	0	3	3
24.	CE 24024	Climate Change Adaptation and Mitigation	PEC	3	0	0	3	3
25.	CE 24025	Environmental Impact Assessment	PEC	3	0	0	3	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

OPEN ELECTIVE – I
EMERGING TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS2401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS2402	Data science fundamentals	OEC	2	0	2	4	3
3.	OCS2403	Augmented Reality/ Virtual Reality	OEC	2	0	2	4	3
4.	OCS2404	IOT and its applications	OEC	2	0	2	4	3
5.	OCS2405	Deep Learning Techniques	OEC	2	0	2	4	3
6.	OEC2401	Introduction to ASIC design	OEC	2	0	2	4	3

OPEN ELECTIVE – II
INDUSTRIAL

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OME2401	Applied design thinking	OME	3	0	0	3	3
2.	OME2402	Introduction to Industrial Automation Systems	OME	3	0	0	3	3
3.	OME2403	Industrial Management	OME	3	0	0	3	3
4.	OME2404	Quality Engineering	OME	3	0	0	3	3
5.	OME2405	Sustainable Manufacturing	OME	3	0	0	3	3
6.	OME2406	Industrial Design and Rapid Prototyping Techniques	OME	3	0	0	3	3
7.	OEE2401	Industrial IOT and Industry 4.0	OEE	3	0	0	3	3
8.	OEC2402	Robotics and Industrial Automation	OEC	3	0	0	3	3

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OPEN ELECTIVE – III & IV
OTHER DOMAINS

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	OAG2401	Urban agriculture	OEC	3	0	0	3	3
2	OAG2402	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
3	OBT2401	Basics of Biomolecules	OEC	3	0	0	3	3
4	OBT2402	Basics of Microbial Technology	OEC	3	0	0	3	3
5	OBT2403	Biotechnology for Waste Management	OEC	3	0	0	3	3
6	OBT2404	Food Processing Technology	OEC	3	0	0	3	3
7	OEC2403	VLSI Design	OEC	3	0	0	3	3
8	OEC2404	Remote Sensing Concepts	OEC	3	0	0	3	3
9	OEC2405	Drone technologies	OEC	3	0	0	3	3
10	OEE2402	Basics of Electric Vehicle Technology	OEC	3	0	0	3	3
11	OEE2403	Introduction To Control Systems	OEC	3	0	0	3	3
12	OEE2404	Integrated energy planning for sustainable development	OEC	3	0	0	3	3
13	OHS2401	Nano technology	OEC	3	0	0	3	3
14	OHS2402	Operations research	OEC	3	0	0	3	3
15	OME2407	Additive Manufacturing	OEC	3	0	0	3	3

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MANDATORY COURSES – I (SOCIETY)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS
				L	T	P	
1.	MX24101	Introduction to Women and Gender Studies	MC	3	0	0	3
2.	MX24102	Elements of Literature	MC	3	0	0	3
3.	MX24103	Disaster Risk Reduction and Management	MC	3	0	0	3
4.	MX24104	History of Science and Technology in India	MC	3	0	0	3
5.	MX24105	State, Nation Building and Politics in India	MC	3	0	0	3
6.	MX24106	Political and Economic Thought for a Humane Society	MC	3	0	0	3
7.	MX24107	Understanding Society & Culture through Literature	MC	3	0	0	3
8.	MX24108	Work Ethics & Social Responsibility	MC	3	0	0	3

MANDATORY COURSES – II (HEALTH & WELL BEING)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS
				L	T	P	
1.	MX24201	Industrial Safety	MC	3	0	0	3
2.	MX24202	Well Being with Traditional Practices - Yoga, Ayurveda and siddha	MC	3	0	0	3
3.	MX24203	Application of Psychology in Everyday Life	MC	3	0	0	3
4.	MX24204	Stress Management & Well Being	MC	3	0	0	3
5.	MX24205	Health & Well Being in Education	MC	3	0	0	3
6.	MX24206	Physical Fitness & Mental Resilience	MC	3	0	0	3
7.	MX24207	Food, Nutrition and Health	MC	3	0	0	3
8.	MX24208	Life Style Diseases	MC	3	0	0	3

*Mandatory Courses are offered as Non-Credit Courses

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MANAGEMENT ELECTIVES

S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	GE24M01	Principles of Management	HSMC	3	0	0	3	3
2	GE24M02	Total Quality Management	HSMC	3	0	0	3	3
3	GE24M03	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4	GE24M04	Human Resource Management	HSMC	3	0	0	3	3
5	GE24M05	Knowledge Management	HSMC	3	0	0	3	3
6	GE24M06	Industrial Management	HSMC	3	0	0	3	3
7	GE24M07	Foundations of Entrepreneurship	HSMC	3	0	0	3	3

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Subject Code	Subject Name	Category	L	T	P	C
IP24101	Induction Programme		0	0	0	0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

" Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i)   Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii)   Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

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(iv) Literary Activity

    Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

    This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

    Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

    A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

    They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

    About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

    Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE

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Subject Code	Subject Name	Category	L	T	P	C
HS24101	PROFESSIONAL ENGLISH- I	HSMC	3	0	0	3

Course Objectives:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT – I	INTRODUCTION TO EFFECTIVE COMMUNICATION	1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT – II	NARRATION AND SUMMATION	9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT – III	DESCRIPTION OF A PROCESS / PRODUCT	9

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	9

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT – V	EXPRESSION	9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and

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Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.	
	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To use appropriate words in a professional context
CO2	To gain understanding of basic grammatical structures and use them in right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To read and interpret information presented in tables, charts and other graphic forms
CO5	To write definitions, descriptions, narrations and essays on various topics

Textbooks:	
1.	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/webresources:	
1.	Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi
2.	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3.	English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House. 5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.
5.	Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO2	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO3	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO4	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO5	2	3	3	3	-	3	3	2	3	-	3	-	-	-
Average:	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24101	MATRICES AND CALCULUS	BSC	3	1	0	4

Course Objectives:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT – I	MATRICES	9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT – II	DIFFERENTIAL CALCULUS	9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT – III	FUNCTIONS OF SEVERAL VARIABLES	9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT – IV	INTEGRAL CALCULUS	9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT – V	MULTIPLE INTEGRALS	9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

	Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use the matrix algebra methods for solving practical problems.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

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Textbooks:	
1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3.	James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

Reference books/other materials/webresources:	
1.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K.,"Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics " Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	2	0	2	3	-	-	-
Average:	3	3	1	1	0	0	0	2	0	2	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
PH24101	ENGINEERING PHYSICS	BSC	3	0	0	3

Course Objectives:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I	MECHANICS	9

Multiparticle dynamics: Centre of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II	ELECTROMAGNETIC WAVES	9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

UNIT III	OSCILLATIONS, OPTICS AND LASERS	9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics- Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV	BASIC QUANTUM MECHANICS	9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes-Normalization, probabilities and the correspondence principle.

UNIT V	APPLIED QUANTUM MECHANICS	9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunnelling(qualitative)- Tunnelling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the importance of mechanics.
CO2	Express their knowledge in electromagnetic waves.
CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4	Understand the importance of quantum physics.
CO5	Comprehend and apply quantum mechanical principles towards the formation of energy bands.

Textbooks:	
1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference books/other materials/webresources:	
1.	R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer- Verlag, 2012.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	-	-	-	-	1	-	-	-
CO4	3	3	1	1	2	1	-	-	-	-	-	-	-	
CO5	3	3	1	1	2	1	-	-	-	-	-	-	-	-
Average:	3	3	1.6	1.2	1.8	1	-	-	-	-	1	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
CY24101	ENGINEERING CHEMISTRY	BSC	3	0	0	3

Course Objectives:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination). **Desalination of brackish water:** Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water:** Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.

UNIT II	NANOCHEMISTRY	9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials:** Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; **Constitution:** Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of:** Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites -** definition and examples.

UNIT IV	FUELS AND COMBUSTION	9

Fuels: Introduction: Classification of fuels; **Coal and coke:** Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil- cetane number; **Power alcohol and biodiesel. Combustion of fuels: Introduction:** Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Ignition temperature:** spontaneous ignition temperature, Explosive range; **Flue gas analysis** - ORSAT Method. **CO_2 emission and carbon foot print.**

UNIT V	ENERGY SOURCES AND STORAGE DEVICES	9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and

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applications of solar cells; **Recent developments in solar cell materials. Wind energy;**
Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery
- lead acid battery and lithium-ion-battery; **Electric vehicles-working principles; Fuel cells:**
H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3	To apply the knowledge of phase rule and composites for material selection requirements.
CO4	To recommend suitable fuels for engineering processes and applications.
CO5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

Textbooks:	
1.	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

Reference books/other materials/webresources:	
1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	1	-	-	-	-	1	-	-	-
CO2	2	-	-	1	-	2	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	-	-	-	-	-	-	-	-
CO5	3	1	2	1	-	2	-	-	-	-	2	-	-	-
Average:	**2.8**	**1.3**	**1.6**	**1**	**-**	**1.5**	**-**	**-**	**-**	**-**	**1.5**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
GE24101	**PROBLEM SOLVING AND PYTHON PROGRAMMING**	**ESC**	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I	**COMPUTATIONAL THINKING AND PROBLEM SOLVING**	9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II	**DATA TYPES, EXPRESSIONS, STATEMENTS**	9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III	**CONTROL FLOW, FUNCTIONS, STRINGS**	9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV	**LISTS, TUPLES, DICTIONARIES**	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V	**FILES, MODULES, PACKAGES**	9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems.
CO2	Develop and execute simple Python programs.
CO3	Write simple Python programs using conditionals and looping for solving problems.
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuples, dictionaries etc.
CO6	Read and write data from/to files in Python programs.

Textbooks:	
1.	Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, " Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill,2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	2	-	-	2	-	-	-	-	1	-	2	-	-
Average:	2	3	3	3	2	-	-	-	-	2	2	3	3	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	தமிழர் மரபு	HSMC	1	0	0	1

அலகு 1	மொழி மற்றும் இலக்கியம்	3

இந்திய மொழிக்குடும்பங்கள் - திராவிடமொழிகள் – தமிழ் ஒரு செம்மொழி -தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்றதன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க்காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை ஐம்பொன்சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் தேர்செய்யும் கலை சுடுமண்சிற்பங்கள் நாட்டுப்புறத் தெய்வங்கள் -குமரிமுனையில் திருவள்ளுவர் சிலை இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III	நாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகள்	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம். தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்க கால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு புத்தகங்களின் அச்சு வரலாறு. கல்வெட்டுகள், கையெழுத்துப்படிகள்–தமிழ்ப் புத்தகங்களின் அச்சுவரலாறு

	Total Contact Hours :15

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	Text-cum-Reference Books
1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்.
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (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 Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & 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 Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL - Reference Book.

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	HERITAGE OF TAMILS	HSMC	1	0	0	1

UNIT I	LANGUAGE AND LITERATURE	3
	Language Families in India - Dravidian Languages – Tamil as 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.	
UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3
	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.	
UNIT III	FOLK AND MARTIAL ARTS	3
	Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	
UNIT IV	THINAI CONCEPT OF TAMILS	3
	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.	
UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
	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.	
		Total Contact Hours : 15

	Text-cum-Refference Books
1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (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:

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		International Institute of Tamil Studies)
9.		Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & 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.

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Subject Code	Subject Name	Category	L	T	P	C
GE24111	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**ESC**	0	0	4	2

Course Objectives:
• To understand the problem solving approaches.
• To learn the basic programming constructs in Python.
• To practice various computing strategies for Python-based solutions to real world problems.
• To use Python data structures - lists, tuples, dictionaries.
• To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

	Total Contact Hours : 60

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems
CO2	Develop and execute simple Python programs.
CO3	Implement programs in Python using conditionals and loops for solving problems.
CO4	Deploy functions to decompose a Python program.
CO5	Process compound data using Python data structures.
CO6	Utilize Python packages in developing software applications.

Textbooks:	
1.	Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/webresources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	3	2	3	3	-
CO2	3	3	3	3	3	-	-	-	-	3	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	3	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	-	-	-	2	-	-	-	-	1	-	2	-	-
Average:	2	3	3	3	2	-	-	-	-	2	2	3	3	-

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Subject Code	Subject Name	Category	L	T	P	C
BS24111	PHYSICS AND CHEMISTRY LABORATORY	BSC	0	0	4	2

PHYSICS LABORATORY

Course Objectives:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

EXPERIMENTS:

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

	Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyze laboratory data.
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4	Access, process and analyze scientific information.
CO5	Solve problems individually and collaboratively.

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO5	3	2	3	1	1	-	-	-	-	-	-	-	-	-
Average:	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-

CHEMISTRY LABORATORY

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

EXPERIMENTS

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

	Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3	To analyse and determine the composition of alloys.
CO4	To learn simple method of synthesis of nanoparticles
CO5	To quantitatively analyse the impurities in solution by electroanalytical techniques"

Textbooks:

1.	J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	-	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	-	-	-	-	1	-	-	-
Average:	2.6	1.3	1.6	1	1	1.4	-	-	-	-	1.3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24112	ENGLISH LABORATORY	EEC	0	0	2	1

Course Objectives:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	6

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).

UNIT II	NARRATION AND SUMMATION	6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III	DESCRIPTION OF A PROCESS PRODUCT	6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking — Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V	EXPRESSION	6

Listening — Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

	Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To listen to and comprehend general as well as complex academic information
CO2	To listen to and understand different points of view in a discussion
CO3	To speak fluently and accurately in formal and informal communicative contexts
CO4	To describe products and processes and explain their uses and purposes clearly and accurately
CO5	To express their opinions effectively in both formal and informal discussions

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	-	-	-
Average:	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
HS24201	PROFESSIONAL ENGLISH - II	HSMC	2	0	0	2

Course Objectives:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I	MAKING COMPARISONS	6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar — Mixed Tenses, Prepositional phrases

UNIT II	EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING	6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints.Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III	PROBLEM SOLVING	6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Errorcorrection; If conditional sentences

UNIT IV	REPORTING OF EVENTS AND RESEARCH	6

Reading –Newspaper articles;Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech,Modals Vocabulary – Conjunctions- use of prepositions

UNIT V	THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	6

Reading — Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar –Numerical adjectives, Relative Clauses.

	Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To compare and contrast products and ideas in technical texts.
CO2	To identify and report cause and effects in events, industrial processes through technical texts
CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4	To present their ideas and opinions in a planned and logical manner
CO5	To draft effective resumes in the context of job search.

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Textbooks:

1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2.	English for Science & Technology Cambridge University Press 2021.
3.	Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/webresources:

1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3.	Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO2	3	3		3	3	3	3	2	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO4	3	3	3	3	2	3	3	2	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Average:	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24201	**STATISTICS AND NUMERICAL METHODS**	**BSC**	**3**	**1**	**0**	**4**

Course Objectives:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	**TESTING OF HYPOTHESIS**	9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) — Tests for single variance and equality of variances — Chi square test for goodness of fit — Independence of attributes.

UNIT II	**DESIGN OF EXPERIMENTS**	9+3

One way and two way classifications - Completely randomized design — Randomized block design — Latin square design - 2^2 factorial design.

UNIT III	**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**	9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**	9+3

Lagrange's and Newton's divided difference interpolations — Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

	Total Contact Hours : 60

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Textbooks:	
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference books/other materials/webresources:	
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	2	0	2	3	-	-	-
Average:	3	3	1	1	1	0	0	2	0	2	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
PH24207	PHYSICS FOR CIVIL ENGINEERING	BSC	3	0	0	3

Course Objectives:

- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

UNIT I	THERMAL APPLICATIONS	9

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations, thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating.

UNIT II	VENTILATION AND REFRIGERATION	9

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

UNIT III	ACOUSTICS AND LIGHTING DESIGNS	9

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multistored buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV	NEW ENGINEERING MATERIALS	9

Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

UNIT V	NATURAL DISASTERS	9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.
CO2	Gain knowledge on the ventilation and air conditioning of buildings
CO3	Understand the concepts of sound absorption, noise insulation and lighting designs
CO4	Know about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics
CO5	Get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures

Textbooks:	
1.	Marko Pinteric, Building Physics, Springer 2017.
2.	D.S.Mathur. Elements of Properties of Matter. S Chand & Company, 2010.
3.	Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017

Reference books/other materials/webresources:	
1.	W.R.Stevens. Building Physics: Lighting. Pergamon Press, 2013..
2.	Hugo Hens, Applied Building Physics, Wiley, 2016
3.	K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. Pearson Education, 2016.
4.	Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
5.	Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	1	1	-	-	-	-	-	-	-	-
CO2	3	2	2	-	1	1	-	-	-	-	-	-	-	-
CO3	3	2	2	-	1	1	-	-	-	-	-	-	-	-
CO4	3	-	2	2	2	1	-	-	-	-	-	-	-	-
CO5	3	1	-	-	1	3	-	-	-	-	-	-	-	-
Average:	3	1.75	2	2	1.2	1.4	-	-	-	-	-	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
BE24204	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3

Course Objectives:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I	ELECTRICAL CIRCUITS	9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor — Ohm's Law - Kirchhoff's Laws — Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply — star and delta connection — power in three- phase systems

UNIT II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	9

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.

Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT IV	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium — PN Junction Diodes, Zener Diode –Characteristics Applications — Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT — Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics

UNIT V	SENSORS AND TRANSDUCERS	9

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Compute the electric circuit parameters for simple problems
CO2	Explain the concepts of domestics wiring and protective devices
CO3	Explain the working principle and applications of electrical
CO4	Analyze the characteristics of analog electronic devices
CO5	Explain the types and operating principles of sensors and transducers

Textbooks:	
1.	D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3.	S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
	James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

Reference books/other materials/webresources:	
1.	John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2.	Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition,
4.	Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India,2019.
5.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	1	-	-	-	-	-	-	-
Average:	2	1	1	-	-	-	1	-	-	-	-	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24201	**ENGINEERING GRAPHICS**	ESC	2	0	4	4

Course Objectives:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)	

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I	**PLANE CURVES**	**6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III	**PROJECTION OF SOLIDS AND FREEHAND SKETCHING**	**6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis .is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three-dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**6+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three-dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**

Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three-dimensional modeling of isometric projection of simple objects by CAD

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Software(Not for examination)	
	Total Contact Hours : (L =30 + P = 60) 90

Course Outcomes: Upon completion of the course students should be able to:	
CO1	Use BIS conventions and specifications for engineering drawing.
CO2	Construct the conic curves, involutes and cycloid.
CO3	Solve practical problems involving projection of lines.
CO4	Draw the orthographic, isometric and perspective projections of simple solids.
CO5	Draw the development of simple solids.

Textbooks:	
1.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charota Publishing House,53 Edition, 2019.
2.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

Reference books/other materials/webresources:	
1.	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:
1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	3	-	2	2	2	-
Average:	3	1	2	-	2	-	-	-	3	-	2	2	2	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24202	தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1

அலகு I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள்		

அலகு II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3
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.		

அலகு III	உற்பத்தித் தொழில் நுட்பம்	3
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.		

அலகு IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	3
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.		

அலகு V	அறிவியல் தமிழ் மற்றும் கணிதத் தமிழ்	3
அறிவியல் தமிழின் வளர்ச்சி -கணித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் தமிழ்மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்		

		Total Contact Hours :15

Text-cum-Referrence Books	
1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை

R. kathi

HoD/BOS Chairman

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	(வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
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.

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Subject Code	Subject Name	Category	L	T	P	C
GE24202	TAMILS AND TECHNOLOGY	HSMC	1	0	0	1

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) — Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

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 Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	3

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 Stone beads - Glass beads- Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of 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.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

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.

	Total Contact Hours : 15

Textbook-cum-Refrerence Book:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
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).

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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) (Published by: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) — Reference Book.

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Subject Code	Subject Name	Category	L	T	P	C
	(ARMY WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	Total Contact Hours : 30	

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Subject Code	Subject Name	Category	L	T	P	C
	(AIR FORCE WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	Total Contact Hours : 30	

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Subject Code	Subject Name	Category	L	T	P	C
	(NAVAL WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	Total Contact Hours : 30	

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C **Principal**

Subject Code	Subject Name	Category	L	T	P	C
GE24211	ENGINEERING PRACTICES LABORATORY	ESC	0	0	4	2

Course Objectives:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

<table>
<tr><td colspan="3" align="center">GROUP – A (CIVIL & ELECTRICAL)</td></tr>
<tr><td>PART I</td><td>CIVIL ENGINEERING PRACTICES</td><td align="right">15</td></tr>
</table>

PART I **CIVIL ENGINEERING PRACTICES** **15**

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers,elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II **ELECTRICAL ENGINEERING PRACTICES** **15**

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using

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Diac/Triac/quadrac)

g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III   **MECHANICAL ENGINEERING PRACTICES**   **15**

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV   **ELECTRONIC ENGINEERING PRACTICES**   **15**

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a)   Study an element of smart phone.
b)   Assembly and dismantle of LED TV.
c)   Assembly and dismantle of computer/ laptop

Total Contact Hours : 60

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CO1		Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2		Wire various electrical joints in common household electrical wire work.
CO3		Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipment's; Make a tray out of metal sheet using sheet metal work.
CO4		Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	-	-	-	-	2	2	-	-
CO3	3	2	-	-	1	1	-	-	-	-	2	2	-	-
Average:	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
BE24211	**BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY**	**ESC**	**0**	**0**	**4**	**2**

Course Objectives:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

List of Experiments
1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

Total Contact Hours:60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phase power
CO2	Analyze experimentally the load characteristics of electrical machines
CO3	Analyze the characteristics of basic electronic devices
CO4	Use LVDT to measure displacement

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO2	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO3	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO4	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
Average:	1.6	1.4	0.8	1.6	-	-	1.2	1.6	-	-	-	-		

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Subject Code	Subject Name	Category	L	T	P	C
GE24212	COMMUNICATION LABORATORY	EEC	0	0	4	2

Course Objectives:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I		12

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life-discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II		12

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements- discussing plans and decisions- discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNIT III		12

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages- making comparisons-discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV		12

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V		12

Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.

	Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Speak effectively in group discussions held in a formal/semi formal contexts.
CO2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
CO3	Write emails, letters and effective job applications.
CO4	Write critical reports to convey data and information with clarity and precision
CO5	Give appropriate instructions and recommendations for safe execution of tasks

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	2	2	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Average:	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-

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Subject Code:	Subject Name	Category	L	T	P	C
MA24303	**FOURIER SERIES AND BOUNDARY VALUE PROBLEMS**	**BSC**	**3**	**1**	**0**	**4**

Course Objectives:
• To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
• To introduce the effective mathematical tools for the solutions of partial differential equations in various situations.
• To acquaint the student with Fourier series techniques in solving wave equations used in various situations.
• To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
• To acquaint the student with Non- Parametric tests problems used in various situations.

UNIT – I	**FOURIER SERIES**	9+3

Dirichlet's conditions – General Fourier series – Odd and Even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT – II	**PARTIAL DIFFERENTIAL EQUATIONS**	9+3

Formation of PDE - Eliminating arbitrary constants- Eliminating arbitrary functions – First order nonlinear PDE: $f(p , q)= 0, f(z ,p ,q)= 0, f(x, p)= g(y , q)$, Clairaut's equation - Lagrange's linear equation – Homogeneous linear PDE of Higher order with constant coefficients.

UNIT – III	**WAVE EQUATION**	9+3

Classification of second order Quasi linear partial differential equation - Solution of one dimensional wave equation with one non-zero boundary conditions – one dimensional wave equation by explicit method

UNIT – IV	**HEAT EQUATION**	9+3

.One dimensional heat equation – Steady of state solution of two dimensional heat equation (Insulated edge excluded).

UNIT – V	**NON-PARAMETRIC TESTS**	9+3

Sign test for paired data. Rank sum test. Kolmogorov-Smirnov test –Mann – Whitney U test and Kruskal Wallis test. One sample run test.

	Total Contact Hours : 60

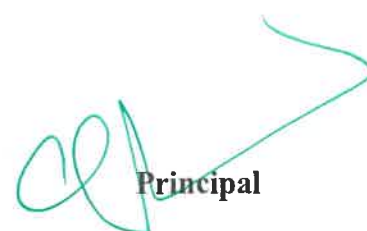| Course Outcomes:	Upon completion of the course students should be able to:
CO1	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO2	Solve differential equations using Partial differential equations which plays a vital role in engineering applications.
CO3	Appreciate the physical significance of Fourier series techniques in solving one dimensional wave equations.
CO4	Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems

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CO5	Appreciate the physical significance of Non-Parametric tests techniques in solving problems in Engineering field.

	Reference books/other materials/webresources:
1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt.Ltd, 2015.
2.	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3.	Ramana.B.V.,"Higher Engineering Mathematics",McGraw Hill Education Pvt.Ltd, New Delhi, 2018.
4.	Conover, W.J. (1971). Practical Non-Parametric Statistics. David, H.A. (1970). Order Statistics. Fraser, D.A.S. (1957). Nonparametric Methods in Statistics.

PO& PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	2	0	0	3	-	-	-
Average:	3	3	1	1	0	0	0	2	0	0	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
CE24301	APPLIED MECHANICS	PCC	3	0	0	3

Course Objectives:

- To impart knowledge on the following topics
  - To learn the use of analytical techniques for analysing forces in Statically determinate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and stress distribution
- To know about the bending theory.

UNIT I	STATICS OF PARTICLES	9

Fundamental Concepts and Principles, Systems of Units, Statics of Particles-Forces in a Plane, Resultant of Forces, Resolution of a Force into Components. Equilibrium of a Particle - Newton's First Law of Motion, Free-Body Diagrams.

UNIT II	EQUILIBRIUM OF RIGID BODIES	9

Moment of a Force about a Point, Varignon's Theorem, Resolution of a Given Forces, Moment of a Forces& Couple, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III	DISTRIBUTION AND TRANSFER OF LOADS IN BEAMS	9

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Distributed Loads on Beams, Centre of Gravity & Centroid of a Volume. Moments of Inertia of Areas –Polar Moment of Inertia, Radius of Gyration of an Area, Parallel & Perpendicular axis Theorem. Stresses in simple and compound bars – Elastic constants.

UNIT IV	BENDING OF BEAMS	9

Types of beams and transverse loadings, Shear force and bending moment for simply supported, cantilever and over-hanging beams. Theory of simple bending – Bending stress distribution – Shear stress distribution.

UNIT V	DEFLECTION OF BEAMS	9

Double Integration method – Macaulay's method –Moment Area method – Conjugate beam method - Strain energy methods for determinate beams.

	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Illustrate the scalar representation of forces.
CO2	Analyse the rigid body in equilibrium and moment of forces.
CO3	Evaluate the distribution of loads and simple stresses.
CO4	Determine concept Shear force and theory of simple bending.
CO5	Calculate the slope and deflection of beams by different methods.

Textbooks:

1.	VelaMurali, "Engineering Mechanics- Statics and Dynamics", Oxford University Press, 2018.
2.	Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi, 2008
3.	Bansal .R.K. "Strength of Materials", Laxmi Publications Pvt Ltd.,NewDelhi, 2010.
4.	Rajput. R.K. "Strength of Materials" ,S. Chand and Co, NewDelhi, 2015.

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	Reference books/other materials/webresources:
1.	Beer Ferdinand P, Russel Johnston Jr., David F Mazurek,Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11th Edition, 2017.
2.	Gambhir.M.L.,"Fundamentals of Solid Mechanics" , PHIL earning Private Limited ., NewDelhi , 2009.
3.	Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013
4.	Rattan.S.S, "Strength of Materials", Tata Mc Graw Hill Education Private Limited, NewDelhi, 2012.
5.	5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5th Edition, McGraw Hill Higher Education, 2013.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	-	1	-	-	-	-	-	-	2	3	2
CO2	3	3	1	-	1	-	-	-	-	-	-	2	3	1
CO3	3	3	1	-	1	-	-	-	-	-	-	2	3	1
CO4	3	3	1	-	1	-	-	-	-	-	-	3	3	1
CO5	3	3	1	-	1	-	-	-	-	-	-	3	3	1
Average:	3	3	1	-	1	-	-	-	-	-	-	2.4	3	1.2

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Subject Code	Subject Name	Category	L	T	P	C
CE24302	FLUID MECHANICS	PCC	3	0	0	3

Course Objectives:

- To introduce the students about properties and behaviour of the fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

UNIT I	FLUIDS PROPERTIES AND FLUID STATICS	10

Scope of fluid mechanics – Definitions of a fluid – Methods of analysis – Continuum hypothesis – System and Control volume approach – Reynold's transportation theorem – Fluid properties – Fluid statics – Manometry – Forces on plane and curved surfaces – Buoyancy and floatation – Stability of floating bodies.

UNIT II	BASIC CONCEPTS OF FLUID FLOW	10

Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets;

Dynamics : Application of control volume to continuity, energy and momentum – Euler's equation of motion along a stream line — Bernoulli's equation — Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT III	DIMENSIONAL ANALYSIS AND MODEL STUDIES	7

Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

UNIT IV	INCOMPRESSIBLE VISCOUS FLOW	10

Reynolds experiment – Laminar flow in pipes and between parallel plates – Development of laminar and turbulent flows in pipes – Darcy-Weisbach equation – Moody diagram – Major and minor losses of flow in pipes – Total energy line – Hydraulic grade line – Siphon – Pipes in series and parallel – Equivalent pipes.

UNIT V	BOUNDARY LAYERS	8

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer — Drag and Lift forces.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performance of prototypes by model studies.
CO4	Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
CO5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

Textbooks:	
1.	Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines Standard Book House New Delhi. 2015.
2.	Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, New Delhi, 1998.

Reference books/other materials/webresources:	
1.	S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
2.	Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3.	Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
4.	Narayana Pillai N. Principles of Fluid Mechanics and Fluid Machines, (3rd Ed.) University Press (India) Pvt. Ltd. 2009.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	1	1	1	1	2	3	2	1
CO2	3	2	1	1	1	2	1	1	1	1	2	3	2	1
CO3	3	2	3	2	1	2	1	1	1	1	2	3	3	2
CO4	3	3	3	2	1	3	1	1	1	1	3	3	3	3
CO5	3	3	2	2	1	3	1	1	1	1	3	3	3	3
Average:	3	2	3	2	1	2	1	1	1	1	2	3	3	3

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Subject Code	Subject Name	Category	L	T	P	C
CE24303	CONSTRUCTION MATERIALS AND TECHNOLOGY	PCC	3	0	0	3

Course Objectives:

- To introduce students to various construction materials and the techniques those are commonly used in civil engineering construction.

UNIT I	STONES - BRICKS - CONCRETE BLOCKS – LIME	9
	Stone as building material — Criteria for selection — Tests on stones — Bricks — Classification — Manufacturing of clay bricks — Tests on bricks — Compressive strength — Water Absorption — Efflorescence – Lime – Preparation of lime mortar – Concrete hollow blocks – Lightweight concrete blocks.	
UNIT II	**OTHER MATERIALS**	9
	Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminum – Uses – Market forms – Glass – Ceramics – Refractories — Composite Materials — Types and applications — FRP — Fibre textiles — Geomembranes and Geotextiles for earth reinforcement.	
UNIT III	**CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS**	9
	Types of Foundations — Shallow and Deep Foundations — Stone Masonry — Brick Masonry — Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering — Shoring — Scaffolding — Underpinning — Roofing — Flooring — Joints in concrete — Contraction/Construction/Expansion joints – Fire Protection – Thermal Insulation – Ventilation and Air conditioning – Acoustics and Sound Insulation – Damp Proofing.	
UNIT IV	**CONSTRUCTION EQUIPMENTS**	9
	Selection of equipment for earthwork excavation, concreting, material handling and erection of structures — Dewatering and pumping equipment.	
UNIT V	**CONSTRUCTION PLANNING**	9
	Introduction to construction planning – Scheduling for activities – Critical path method (CPM) and PERT network modelling and time analysis – Case illustrations	
	Total Contact Hours : 45	

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Identify the good quality brick, stone and blocks for construction.
CO2	Recognize the market forms of timber, steel, aluminum and applications of various composite materials.
CO3	Identify the best construction and service practices such as thermal insulations and air conditioning of the building
CO4	Select various equipments for construction works conditioning of building
CO5	Understand the construction planning and scheduling techniques

Textbooks:	
1.	Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015.
2.	Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons, 2013.

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Reference books/other materials/webresources:

1.	Varghese.P.C, Building Construction, Second Edition PHI Learning ltd., 2016.
2.	Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.
3.	Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment and Methods, Tata McGraw-hill, 2011.
4.	Srinath L.S.,PERT and CPM -Principles and applications, Affliated East West Press 2001

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	3	-	2	-	-	-	-	2	3	-	-
CO2	3	-	-	2	-	-	-	-	-	-	2	3	-	2
CO3	3	-	-	2	-	-	-	-	-	2	-	3	-	2
CO4	2	-	-	-	-	-	-	-	-	2	-	3	3	-
CO5	2	3	2	3	2	2	-	2	-	3	2	3	3	3
Average:	2	2	1	2	1	1	-	1	-	2	2	3	2	2

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Subject Code	Subject Name	Category	L	T	P	C
CE24304	**WATER SUPPLY AND WASTEWATER ENGINEERING**	**PCC**	**3**	**0**	**0**	**3**

Course Objectives:

- To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal and deign of intake structures and sewerage system.

UNIT I	WATER SUPPLY	9
Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases- Standards for potable water – Intake of water- Pumping and Gravity Systems.		
UNIT II	**WATER TREATMENT**	**9**
Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation — Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspects		
UNIT III	**WATER STORAGE AND DISTRIBUTION**	**9**
Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.		
UNIT IV	**PLANNING AND DESIGN OF SEWERAGE SYSTEM**	**9**
Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation-.Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control — Sewage pumping-drainage in buildings - Plumbing systems for drainage		
UNIT V	**SEWAGE TREATMENT AND DISPOSAL**	**9**
Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission
CO2	Understand the process of conventional treatment and design of water and gain knowledge of selection of treatment process´ and biological treatment process
CO3	Ability to design and evaluate water distribution system and water supply in buildings.

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CO4	Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations
CO5	Able to understand and design the various advanced treatment system and understand the self-purification of streams and sludge and sewage disposal methods and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage.

Textbooks:	
1.	Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2.	Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2016.
3.	Garg, S.K., Environmental Engineering Vol.II, Khanna Publishers, New Delhi, 2015.
4.	Duggal K.N., "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.
5.	Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

Reference books/other materials/webresources:	
1.	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.
2.	Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
3.	Syed R. Qasimand Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
4.	Of Urban Development, Government of India, New Delhi, 2013.
5.	Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2010.
6.	Syed R.Qasim "Waste water Treatment Plants", CRCPress,WashingtonD.C
7.	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	-	2	-	-	1	1	-	-	-	3	-	-
CO2	2	3	-	2	-	-	1	1	-	-	-	3	-	-
CO3	3	3	3	-	-	3	2	2	-	2	-	3	2	2
CO4	3	3	3	-	2	3	2	3	-	2	-	3	2	2
CO5	3	3	3	2	2	3	2	3	2	2	3	3	2	3
Average:	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
CE24351	SURVEYING AND LEVELLING	PCC	3	0	0	3

Course Objectives:

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers and to learn the various methods of plane and geodetic surveying to solve the real-world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying

UNIT I	FUNDAMENTALS OF CONVENTIONAL SURVEYING	9

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining– Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles– Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNIT II	LEVELLING	9

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking– Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT III	THEODOLITE SURVEYING	9

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances — Tacheometric surveying — Stadia Tacheometry — Tangential Tacheometry — Trigonometric leveling – Single Plane method – Double Plane method.

UNIT IV	CONTROL SURVEYING AND ADJUSTMENT	9

Horizontal and vertical control — Methods — Triangulation — Traversing — Gale's table — Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustment methods - Least square methods – Angles, lengths and levelling network.

UNIT V	MODERN SURVEYING	9

Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories— Working principle — Observables — Errors - COGO functions — Field procedure and applications.GPS: Advantages – System components – Signal structure – Selective availability and antispoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors inGPS – Field procedure and applications.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Introduce the rudiments of various surveying and its principles.
CO2	Imparts knowledge in computation of levels of terrain and ground features
CO3	Imparts concepts of Theodolite Surveying for complex surveying operations
CO4	Understand the procedure for establishing horizontal and vertical control
CO5	Imparts the knowledge on modern surveying instruments

Textbooks:	
1.	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2.	T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

Reference books/other materials/webresources:	
1.	R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
3.	Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
4.	S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice^ Hall of India2010.
5.	K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	3	2	2	-	2	-	3	3	3
CO2	3	3	2	2	2	3	2	2	-	2	-	3	3	3
CO3	3	3	3	2	3	3	2	2	-	2	-	3	3	3
CO4	3	3	3	3	3	3	2	3	-	2	2	3	-	3
CO5	3	3	3	3	3	3	3	2	-	2	2	3	-	3
Average:	3	3	3	2	3	3	2	2	-	2	2	3	-	3

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Subject Code	Subject Name	Category	L	T	P	C
CE24361	SURVEYING AND LEVELLING LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- At the end of the course the student will possess knowledge about survey field techniques

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff

4. Fly levelling using Dumpy level &Tilting level
5. Check levelling

Theodolite - Study of Theodolite

6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

1. Determination of Tacheometric Constants
2. Heights and distances by stadia Tacheometry
3. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

4. Traverse using Total station and Area of Traverse
5. Determination of distance and difference in elevation between two inaccessible points using Total station

	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Impart knowledge on the usage of basic surveying instruments like chain/tape, compass and levelling instruments
CO2	Able to use levelling instrument for surveying operations
CO3	Able to use theodolite for various surveying operations
CO4	Able to carry out necessary surveys for social infrastructures
CO5	Able to prepare planimetric maps

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Reference books/other materials/webresources:

1.	T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2015.
2.	Dr. B. C. Punmia, Ashok K. Jainand Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001
4.	Bannisterand S. Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane and Geodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
5.	David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, VolumeII, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
6.	S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice 'Hall of India 2004
7.	K. R. Arora, Surveying Vol. I & II, Standard Book house, Eleventh Edition, 2013.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	2	3	-	3	3	3	3	3	3	1	3	3	3
CO3	3	1	2	-	3	2	-	3	-	-	2	3	3	3
CO4	3	3	2	3	2	3	2	3	3	3	1	3	3	3
CO5	3	3	3	2	2	3	2	3	3	3	1	3	3	3
Average:	3	2	3	3	3	3	3	3	3	3	1	3	3	3

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Subject Code	Subject Name	Category	L	T	P	C
CE24311	WATER AND WASTEWATER ANALYSIS LABORATORY	PCC	0	0	3	1.5

Course Objectives:
- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

LIST OF EXPERIMENTS: ANALYSIS OF WATER SAMPLE
1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

ANALYSIS OF WASTEWATER SAMPLE
8. Estimation of suspended, volatile and fixed solids
9. Determination of Sludge Volume Index in waste water
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of TKN and Ammonia Nitrogen in wastewater
14. Determination of total and faecal coliform (Demonstration only)

	Total Contact Hours: 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Calibrate and standardize the equipment
CO2	Collect proper sample for analysis
CO3	To know the sample preservation methods
CO4	To perform field oriented testing of water, wastewater
CO5	To perform coliform analysis

	Reference books/other materials/webresources:
1.	APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2012.
2.	"Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. — Second Edition, VCH, Germany, 3rd Edition, 1999.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	2	1	1	1	3	1	2	2
CO2	2	1	1	1	1	2	2	1	1	2	3	2	2	2
CO3	1	1	1	1	1	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	3	3	2	3	2	3	3	3
CO5	2	3	3	3	3	2	3	2	2	2	3	2	2	2
Average:	2	2	2	2	3	2	3	2	2	2	3	2	2	2

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Subject Code	Subject Name	Category	L	T	P	C
GE24903	PROFESSIONAL DEVELOPMENT	EEC	0	0	2	1

Course Objectives:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros and Protecting data and Securing the workbook

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MS POWERPOINT:	10 Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

Course Outcomes:	On successful completion the students will be able to
CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

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Subject Code:	Subject Name	Category	L	T	P	C
MA24404	PROBABILITY AND LINEAR PROGRAMMING PROBLEMS	BSC	3	1	0	4

Course Objectives:
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of Special distribution.
- To introduce the basic concepts of classifications of design of experiments.
- To apply quantitative techniques in modelling.
- To solving business related problems.

UNIT – I	PROBABILITY AND RANDOM VARIABLES	9+3

Axioms of Probability - Conditional Probability-Baye's Theorem- One dimensional Discrete and Continuous random variables -Moments - Moment generating functions.

UNIT – II	SPECIAL DISTRIBUTIONS	9+3

Discrete distributions: Binomial, Poisson, Geometric – Continuous distributions: Uniform, Exponential and Normal distribution.

UNIT – III	STATISTICAL QUALITY CONTROL	9+3

Control charts for Measurements ($\bar{x}$ and R Charts))- Control charts for Attributes (p, c, and np charts)- Tolerance limits- Acceptance Sampleng.

UNIT – IV	LINEAR PROGRAMMING PROBLEMS	9+3

Linear Programming formulation, Solution by Graphical method - Simplex methods – Big-M method.

UNIT – V	TRANSPORTATION AND ASSIGNMENT PROBLEMS	9+3

Transportation Models – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, least cost and Vogel's approximation methods. Check for optimality. Solution by MODI. Assignment Problems– Balanced and Unbalanced Problems-Hungarian Method.

	Total Contact Hours: 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the basic concepts of Probability and Random variables and apply in Engineering applications.
CO2	Understand he fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real
CO3	Apply the basic concepts of classifications of design of experiments in the field of Agriculture and statistical quality control.

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CO4	Understand the Linear programming in product mix decisions.
CO5	Apply the Transportation and assignment in logistics and job allocation scenarios

Textbooks:	
1.	Johnson. R.A., Miller. I.RandFreund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia,9th Edition, 2016.
2.	JohnE.Freund,"MathematicalStatistics",PrenticeHall,5thEdition,1992.
3.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007
4.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018
5	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

Reference books/other materials/webresources:	
1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand &Sons, New Delhi, 12th Edition, 2020
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Walpole.R.E.,Myers.R.H.,Myers.S.L.andYe.K.,"Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9thEdition, 2010.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

PO& PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	2	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	2	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	2	-	-	-
Average:	3	2.8	2.6	2	1.6	-	-	-	-	-	1.6	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
CE24401	APPLIED HYDRAULICS ENGINEERING	PCC	3	0	0	3

Course Objectives:

- To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

UNIT I	UNIFORM FLOW	9

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow – Velocity distribution in open channel - Steady uniform flow: Chezy's equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II	VARIED FLOWS	9

Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method — Change in Grades.

UNIT III	RAPIDLY VARIED FLOWS	9

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation — Positive and Negative surges.

UNIT IV	TURBINES	9

Turbines - Classification - Impulse turbine — Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed — Minimum Speed to start the pump.

UNIT V	PUMPS	9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done.

		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application
CO2	Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.
CO3	Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
CO4	Design turbines and explain the working principle
CO5	Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

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Textbooks:

1.	Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2.	Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

Reference books/other materials/webresources:

1.	Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2.	Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3.	Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019
4.	Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	2	1	2	1	1	3	3	2	2
CO2	3	3	2	3	2	2	1	2	1	1	3	3	2	2
CO3	3	3	2	3	1	2	1	2	1	1	3	3	2	3
CO4	3	3	3	3	1	2	1	2	1	1	3	3	2	3
CO5	3	3	3	3	1	2	1	2	1	1	3	3	2	3
Average:	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**2**	**1**	**1**	**3**	**3**	**2**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
CE24402	STRENGTH OF MATERIALS	PCC	3	0	0	3

Course Objectives:

- To learn unsymmetrical bending and analyse plane trusses.
- To estimate the various states of stresses and study about the failure theories.
- To understand the method of finding the unknown indeterminate beams.
- To estimate the load carrying capacity and failure modes of columns and cylinders.
- To understand about theory of torsion and deflection of springs.

UNIT I	TRUSSES AND UNSYMMETRICAL BENDING	9

Analysis of pin jointed plane determinate trusses by method of joints and method of sections. Unsymmetrical bending of beams - Shear Centre.

UNIT II	STATE OF STRESS	9

State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes - Mohr's circle method - Stress tensor – Stress invariants - Volumetric strain. Theories of failures – Application problems.

UNIT III	INDETERMINATE BEAMS	9

Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports -Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT IV	COLUMNS & CYLINDERS	9

Euler's column theory – critical load for prismatic columns with different end conditions - Rankine-Gordon formula - Eccentrically loaded columns – core of a section – Thin and thick cylinders.

UNIT V	TORSION & SPRINGS	9

Theory of Torsion –Stresses and Deformation in Solid and Hollow Circular Shafts combined bending moment and torsion of shafts - Closed and Open Coiled helical springs.

	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Analyze pin jointed trusses.
CO2	Determine principal stresses in 2D state and analyse various theories of failures.
CO3	Analyze indeterminate beams for external loadings and support settlements.
CO4	Find the load carrying capacity & stresses in columns and cylinders.
CO5	Solve for torsion problems and deflection of springs.

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Textbooks:

1.	Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2018.
2.	Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3.	Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol -II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
4.	Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016
5.	Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.

Reference books/other materials/webresources:

1.	Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2.	William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series,Tata McGraw Hill Publishing company, 2017.
3.	Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021
4.	Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., NewDelhi, 2015
5.	Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
6.	Beer. F.P. &Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.
7.	James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
8.	Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	2	3	1	3	3	3	3
CO2	3	3	3	3	2	3	3	2	3	1	3	3	3	3
CO3	3	3	3	3	2	3	3	2	3	1	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	1	3	3	3	3
CO5	3	3	3	3	2	3	3	2	3	1	3	3	3	3
Average:	3	3	3	3	2	3	3	2	3	1	3	3	3	3

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Subject Code	Subject Name	Category	L	T	P	C
CE24403	CONCRETE TECHNNOLOGY	PCC	3	0	0	3

Course Objectives:

- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete.
- To familiarize with the IS method of mix design as per the latest code.
- To understand the fresh and hardened properties of concrete. To know the importance and applications of special concretes

UNIT I	CONSTITUENT MATERIALS	9

Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water- Quality of water for use in concrete.

UNIT II	CHEMICAL AND MINERAL ADMIXTURES	9

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III	PROPORTIONING OF CONCRETE MIX	9

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples

UNIT IV	FRESH AND HARDENED PROPERTIES OF CONCRETE	9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.

UNIT V	SPECIAL CONCRETES	9

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete - SIFCON - Shotcrete — Polymer concrete - High performance concrete- self compacting concrete - Geopolymer Concrete.

	Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the requirements of cement, aggregates and water for concrete
CO2	Select suitable admixtures for enhancing the properties of concrete
CO3	Design concrete mixes as per IS method of mix design
CO4	Determine the properties of concrete at fresh and hardened state.
CO5	Know the importance of special concretes for specific requirements.

Textbooks:	
1.	Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2.	Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

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Reference books/other materials/webresources:
1.	Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
2.	Gambhir.M.L.Concrete Technology,Fifth Edition, McGraw Hill Education,2017.
3.	Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.
4.	IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	3	2	1	1	1	2	3	2	3
CO2	3	1	1	1	1	3	1	1	1	1	2	3	2	3
CO3	3	2	3	3	1	3	1	1	1	1	2	3	2	3
CO4	3	1	1	1	1	3	2	1	1	1	2	3	2	3
CO5	3	1	1	1	1	3	2	1	1	2	2	3	2	3
Average:	3	1	2	2	1	3	2	1	1	1	2	3	2	3

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Subject Code	Subject Name	Category	L	T	P	C
CE24404	SOIL MECHANICS	PCC	3	0	0	3

Course Objectives:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I	SOIL CLASSIFICATION AND COMPACTION	9

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles — Particle behaviour — Soil structure – Phase relationship — Index properties — Significance — BIS classification system — Unified classification system — Compaction of soils — Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II	EFFECTIVE STRESS AND PERMEABILITY	9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction — Hydraulic conductivity — Darcy's law — Determination of Hydraulic Conductivity — Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III	STRESS DISTRIBUTION AND SETTLEMENT	9

Stress distribution in homogeneous and isotropic medium – Boussiness theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - $\sqrt{t}$ and log t methods– e-log p relationship.

UNIT IV	SHEAR STRENGTH	9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V	SLOPE STABILITY	9

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method - Slope protection measures.

	Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems
CO2	Show the basic understanding of flow through soil medium and its impact of engineering solution
CO3	Understand the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation
CO4	Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.
CO5	Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications

Textbooks:	
1.	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2.	Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.

Reference books/other materials/web resources:	
1.	McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2.	Coduto, D.P., "Geotechnical Engineering — Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3.	Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013. .
4.	Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	1	1	2	1	2	3	3	3	2
CO2	3	2	3	2	3	1	1	2	1	2	3	2	2	3
CO3	3	3	2	2	2	2	1	2	1	2	3	2	2	3
CO4	2	3	3	2	2	1	1	1	1	2	3	2	2	3
CO5	3	3	2	2	2	1	1	1	1	1	3	2	3	2
Average:	3	3	2	2	2	1	1	2	1	2	3	2	2	3

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Subject Code	Subject Name	Category	L	T	P	C
GE24901	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	BSC	2	0	0	2

Course Objectives:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND BIODIVERSITY	6

Definition, scope and importance of environment — need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation — hot-spots of biodiversity — threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts — endangered and endemic species of India — conservation of biodiversity: In-situ and ex-situ.

UNIT II	ENVIRONMENTAL POLLUTION	6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III	RENEWABLE SOURCES OF ENERGY	6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV	SUSTAINABILITY AND MANAGEMENT	6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

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UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

	Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

Textbooks:	
1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5.	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

Reference books/other materials/webresources:	
1.	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
2.	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.

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| 4. | Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015. |
| 5. | Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013. |

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	3	-	-	-	-	-	-	-	-
CO3	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO4	3	2	1	1	-	2	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	2	-	-	-	-	1	-	-	-
Average:	2.8	1.8	1	1	-	2.2	-	-	-	-	1	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
CE24411	**HYDRAULIC ENGINEERING LABORATORY**	PCC	0	0	3	1.5

Course Objectives:

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

LIST OF EXPERIMENTS (Any 10 of the following)

A. FLOW MEASUREMENT
1. Calibration of Rotameter
2. Flow through Orifice meter/mouthpiece, Venturimeter and Notches
3. Bernoulli's Experiment

B. LOSSES IN PIPES
4. Determination of friction factor in pipes.
5. Determination of minor losses

C. PUMPS
6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D. TURBINES
10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine

E. DETERMINATION OF METACENTRIC HEIGHT
12. Determination of metacentric height of floating bodies.

Total Contact Hours: 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply Bernoulli equation for calibration of flow measuring devices.
CO2	Measure friction factor in pipes and compare with Moody diagram
CO3	Determine the performance characteristics of rotodynamic pumps
CO4	Determine the performance characteristics of positive displacement pumps.
CO5	Determine the performance characteristics of turbines.

	Reference books/other materials/webresources:
1.	Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
2.	Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.
3.	Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd. 2011

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	1	2	1	1	2	2	1	1
CO2	3	2	1	3	1	2	1	2	1	1	2	3	1	1
CO3	3	3	2	3	1	2	1	3	1	1	2	3	2	1
CO4	3	3	2	3	1	2	1	3	1	1	2	3	2	1
CO5	3	3	2	3	1	2	1	3	1	1	2	3	2	1
Average:	3	3	2	3	1	2	1	2	1	1	2	3	2	1

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Subject Code	Subject Name	Category	L	T	P	C
CE24412	MATERIALS TESTING LABORATORY	PCC	0	0	4	2

Course Objectives:
- To develop skills to test various construction materials.

LIST OF EXPERIMENTS

I. TESTS ON METALS
a. Tension test on steel rod
b. Torsion test on mild steel rod
c. Deflection test on metal beam
d. Double shear test on metal
e. Impact test on metal specimen (Izod and Charpy)
f. Hardness test on metals (Rockwell and Brinell Hardness Tests)
g. Compression test on helical spring
h. Deflection test on carriage spring

II. TESTS ON CEMENT
a. Determination of fineness of cement
b. Determination of consistency of cement
c. Determination of specific gravity of cement
d. Determination of initial and final setting time of cement

III. TESTS ON FINE AGGREGATE
a. Determination of specific gravity and water absorption of fine aggregate
b. Determination of grading of fine aggregate
c. Determination of water absorption for fine aggregate

IV. TESTS ON COARSE AGGREGATE
a. Determination of compacted and loose bulk density of coarse aggregate
b. Determination of impact value of coarse aggregate
c. Determination of elongation index of coarse aggregate
d. Determination of flakiness index of coarse aggregate
e. Determination of aggregate crushing value of coarse aggregate
f. Determination of specific gravity and water absorption of coarse aggregate

V. TESTS ON BRICKS
a. Determination of compressive strength of bricks
b. Determination of water absorption of bricks
c. Determination of efflorescence of bricks

VI. TESTS ON CONCRETE
a. Determination of slump of concrete
b. Determination of compressive strength of concrete
c. Determination of flowability of self-compacting concrete (Demo only)

VII. TEST ON WOOD
a. Determination of Compression test on wood

	Total Contact Hours : 60

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Determine the mechanical properties of steel.
CO2	Determine the physical properties of cement
CO3	Determine the physical properties of fine and coarse aggregate.
CO4	Determine the workability and compressive strength of concrete.
CO5	Determine the strength of brick and wood.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	1	3	1	1	2	2	2	2
CO2	3	2	1	3	1	2	1	3	1	1	2	3	2	2
CO3	3	3	2	3	1	2	1	3	1	1	2	3	2	2
CO4	3	3	2	3	1	2	1	3	1	1	2	3	2	2
CO5	3	3	2	3	2	2	1	3	1	1	2	3	2	2
Average:	3	3	2	3	1	2	1	3	1	1	2	3	2	2

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Subject Code	Subject Name	Category	L	T	P	C
CE24413	**SOIL MECHANICS LABORATORY**	PCC	0	0	3	1.5

Course Objectives:

- To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

LIST OF EXPERIMENTS

1.   DETERMINATION OF INDEX PROPERTIES

Specific gravity of soil solids

a.   Grain size distribution – Sieve analysis

b.   Grain size distribution - Hydrometer analysis

c.   Liquid limit and Plastic limit tests

d.   Shrinkage limit and Differential free swell tests

2.   DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

a.   Field density Test (Sand replacement method)

b.   Determination of moisture – density relationship using standard proctor compaction test.

3.   DETERMINATION OF ENGINEERING PROPERTIES

a.   Permeability determination (constant head and falling head methods)

b.   One dimensional consolidation test (Determination of co-efficient of consolidation only)

c.   Direct shear test in cohesion less soil

d.   Unconfined compression test in cohesive soil

e.   Laboratory vane shear test in cohesive soil

f.   Tri-axial compression test in cohesion less soil (Demonstration only)

g.   California Bearing Ratio Test

4.   TEST ON GEOSYNTHETICS (Demonstration only)

a.   Determination of tensile strength and interfacial friction angle.

b.   Determination of apparent opening sizes and permeability.

	Total Contact Hours: 45

Course Outcomes:	On completion of the course, the student is expected to
CO1	Conduct tests to determine the index properties of soils
CO2	Determine the insitu density and compaction characteristics.
CO3	Conduct tests to determine the compressibility, permeability and shear strength of soils.
CO4	Understand the various tests on Geosynthetics.

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Reference books/other materials/webresources:

1.	Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operative Society, Anna University, Chennai, 2010.
2.	"Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
3.	Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
4.	IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5.	G.Venkatappa Rao and Goutham.K. Potable, "Geosynthetics Testing – A laboratory Manual", Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition 2008.
6.	Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	1	1	3	1	1	3	3	3	3
CO2	1	2	3	3	1	1	1	3	2	1	3	2	3	2
CO3	3	3	3	3	1	1	1	3	1	1	3	2	3	3
CO4	1	2	2	3	2	1	1	3	1	1	3	2	2	3
Average:	1	2	3	3	1	1	1	3	1	1	3	2	3	3

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