NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI

www.nec.edu.in

REGULATIONS – 2023

CURRICULUM & SYLLABUS

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

(Outcome Based Education & Choice Based Credit System)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I. VISION

To produce Electronics and Communication Engineers capable of generating a knowledge economy with social responsibility.

II. MISSION

- To impart high quality education with ethical behaviour.
- To equip the students compatible with recent trends in Electronic industries.
- To develop leadership qualities with humanity, wisdom, creativity and team spirit
- To provide a passionate environment for continual learning.

III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will have successful technical careers in core and related fields.

PEO 2: Graduates will pursue higher education and work in Research and Development for solving real world problems.

PEO 3: Graduates will have leadership qualities with social consciousness and ethics.

IV. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Design and Analyze analog, digital circuits or systems for a given specification and verify its functionality using simulation tools.

PSO 2: Design and Development of algorithms for Signal/Image processing.

V. PROGRAM OUTCOMES (POs)

PO 1: An ability to apply knowledge of mathematics, science, engineering and technology to solve complex Electronics and communication Engineering problems.

PO 2: An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering sciences.

PO 3: An ability to provide solution and to design Electronics and Communication systems that meets out the social needs.

PO 4: An ability to investigate the problems in an Electronics and Communication systems and rectifying it.

PO 5 : An ability to use latest hardware and software tools to solve complex engineering problems.

PO 6: An ability to gain knowledge on contemporary issues which influence engineering design.

PO 7: Awareness on society and environment to have sustainable solution for Electronics and Communication engineering problems

PO 8: An ability to demonstrate understanding of professional and ethical responsibilities.

PO 9: An ability to work efficiently as an individual and in multidisciplinary teams.

PO 10: An ability to communicate effectively and efficiently both in verbal and written form.

PO 11: An ability to develop confidence for self-education and understanding the value for life-long learning.

PO 12: Able to implement Electronic system projects for real world applications.

REGULATIONS 2023

CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Induction Programme – 2 weeks									**0**
Theory Courses									
1.	23SH11C	தமிழர்மரபு / Heritage of Tamils	HSMC	1	0	0	0	1	1
2.	23SH12C	Mathematical Foundations for Engineers	BSC	3	1	0	0	4	4
3.	23SH13C	Introduction to Engineering	ESC	1	0	0	0	1	1
Integrated Courses									
4.	23SH14C	Technical English	HSMC	1	0	2	0	3	2
5.	23SH15C	Engineering Physics	BSC	2	0	2	0	4	3
6.	23SH16C	Engineering Chemistry	BSC	2	0	2	0	4	3
7.	23CS11C	Problem Solving Techniques	ESC	3	0	2	0	5	4
8.	23EE12C	Electrical Engineering	ESC	3	0	2	0	5	4
			TOTAL	**16**	**01**	**10**	**0**	**27**	**22**

SEMESTER – II

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23SH21C	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	0	1	1
2.	23EC21C	Linear Algebra and Complex Analysis	BSC	3	1	0	0	4	4
3.	23EC22C /23EE22C	Materials Science	ESC	2	0	0	0	2	2
4.	23GN01C	Aptitude Essentials	EEC	1	0	0	0	1	1
5.	23MC02C	Environmental Science and Engineering	MC	2	-	-	-	2	0
Integrated Courses									
6.	23SH22C	Professional English	HSMC	1	0	2	0	3	2
7.	23ME11C	Engineering Graphics	ESC	2	0	4	0	6	4
8.	23EC23C	Circuit Analysis	PCC	2	1	2	0	5	4
9.	23CS24C	Object Oriented Programming using C++	ESC	2	0	2	2	6	4
Practical Courses									
10.	23GN02C	Innovation through Design Thinking	EEC	0	0	2	2	4	2
			TOTAL	**16**	**02**	**12**	**04**	**34**	**24**

SEMESTER – III

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23EC31C	Probability Random Process and Queuing Theory	BSC	3	1	0	0	4	4
2.	23EC32C	Signals and Systems	PCC	3	1	0	0	4	4
Integrated Courses									
3.	23EC33C	Electronic devices	PCC	3	0	2	0	5	4
4.	23EC34C	Digital Electronics	PCC	3	0	2	0	5	4
5.	23EC35C	Computer Networks	PCC	3	0	2	0	5	4
Practical Courses									
6.	23GN03C	Intellectual Property Rights Study	EEC	0	0	0	4	4	2
			TOTAL	**15**	**2**	**6**	**4**	**27**	**22**

SEMESTER – IV

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23GN04C	Aptitude Excellence	EEC	1	0	0	0	1	1
2.	23EC41C	Electromagnetic Waves	ESC	3	1	0	0	4	4
3.	-	Science Elective Course	BSC	3	0	0	0	3	3
Integrated Courses									
4.	23EC42C	Analog Circuits-I	PCC	3	0	2	0	5	4
5.	23EC43C	Communication Theory and Systems	PCC	3	0	2	0	5	4
6.	23EC44C	Digital signal processing	PCC	3	0	1	1	5	4
7.	23EC45C	Microprocessor and Microcontroller	PCC	3	0	0	2	5	4
Practical Courses									
8.	23EC46C	System Modeling	EEC	0	0	2	2	4	2
			TOTAL	**19**	**1**	**7**	**5**	**32**	**26**

SEMESTER – V

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	-	Program Elective Course I	PEC	3	0	0	0	3	3
2.	-	Open Elective Course I	OEC	3	0	0	0	3	3
3.	23GN05C	Professional Ethics and Human Values	HSMC	2	0	0	0	2	2
4.	23EC51C	Digital Communication	PCC	3	1	0	0	4	4
Integrated Courses									
5.	23EC52C	Analog Circuits II	PCC	3	0	2	0	5	4
6.	23EC53C	VLSI Design	PCC	3	0	2	0	5	4
7.	23EC54C	Antenna and Wave Propagation	PCC	3	0	0	2	5	4
Practical Courses									
8.	23EC55C	Simulation using Modern Tools	EEC	0	0	2	2	4	2
			TOTAL	**20**	**01**	**06**	**04**	**31**	**26**

SEMESTER – VI

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23MC01C	Constitution of India	MC	2	0	0	0	2	0
2.	23GN06C	Project Management and Finance	HSMC	2	0	0	0	2	2
3.	23EC61C	Wireless communication	PCC	3	0	0	0	3	3
4.	23EC62C	Control Systems	PCC	3	1	0	0	4	4
5.	-	Program Elective Course II	PEC	3	0	0	0	3	3
6.	-	Program Elective Course III	PEC	3	0	0	0	3	3
7.	-	Open Elective Course II	OEC	3	0	0	0	3	3
Integrated Courses									
8.	23EC63C	Artificial Intelligence and Machine Learning	PCC	3	0	2	0	5	4
Practical Courses									
9.	23EC64C	Product Development Practice	EEC	0	0	2	2	4	2
			TOTAL	**22**	**01**	**04**	**02**	**29**	**24**

SEMESTER – VII

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	-	Open Elective Course III	OEC	3	0	0	0	3	3
2.	-	Program Elective Course IV	PEC	3	0	0	0	3	3
3.	-	Program Elective Course V	PEC	3	0	0	0	3	3
4.	-	Program Elective Course VI	PEC	3	0	0	0	3	3
Practical Courses									
5.	23EC71C	Mini Project	EEC	0	0	0	6	6	3
6.	23EC72C	Internship	EEC	-	-	-	-	-	2
			TOTAL	**12**	**0**	**0**	**06**	**18**	**17**

SEMESTER – VIII

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Practical Course									
1.	23EC81C	Capstone Project/ Industry Practice	EEC	0	0	0	12	12	6
							TOTAL	**12**	**6**

TOTAL CREDITS: 167

Category	I - SEM	II - SEM	III - SEM	IV - SEM	V - SEM	VI - SEM	VII - SEM	VIII - SEM	Credits	Percentage Of Credits
HSMC	03	03			02	02			10	06
BSC	10	04	04	03					21	13
ESC	09	10		04					23	14
PCC		04	16	16	16	11			63	37
PEC					03	06	09		18	11
OEC					03	03	03		09	05
EEC		03	02	03	02	02	05	06	23	14
TOTAL	22	24	22	26	26	24	17	06	167	100

Course Code	**தமிழர் மரபு (HERITAGE OF TAMILS)**	**L**	**T**	**P**	**E**	**C**
23SH11C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**0**	**0**	**1**

COURSE OUTCOMES

இப்பாடம் முடிந்ததும் மாணவர்களிடம் வளரும் திறன்

CO1: தமிழ் மொழியின் இலக்கிய வளம், ஓவிய, சிற்பக் கலையின் பரிணாம வளர்ச்சி நாட்டுப்புறக் கலை மற்றும் வீர விளையாட்டுக்கள் பற்றிய அறிவு மற்றும் விளக்கும் திறன்

CO2: தமிழர்களின் திணை சார் கோட்பாடுகள் மற்றும் இந்திய பண்பாட்டில் தமிழர்களின் பங்கு பற்றிய அறிவு மற்றும் விளக்கும் திறன்

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: know and explain about Tamil literary resources, Dimensional growth of painting and sculpture arts, folk art and martial arts.

CO2: know and explain about Tamils Thinai concepts, contribution of Tamils in Indian National Movements and Indian Culture

CO1: தமிழ் மொழியின் இலக்கிய வளம், ஓவிய, சிற்பக் கலையின் பரிணாம வளர்ச்சி நாட்டுப்புறக்கலை மற்றும் வீர விளையாட்டுக்கள் பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:9**

இந்திய மொழிக்குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு - நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு - தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

CO1: know and explain about Tamil literary resources, Dimensional growth of painting and sculpture arts, folk art and martial arts.

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan - 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 - Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

CO2:தமிழர்களின் திணை சார் கோட்பாடுகள் மற்றும் இந்திய பண்பாட்டில் தமிழர்களின் பங்கு பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:6**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி - இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

CO2: know and explain about Tamils Thinai concepts, contribution of Tamils in Indian National Movements and Indian Culture

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas - Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

REFERENCES:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரீகம். (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 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) (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.

L: 15; TOTAL: 15 PERIODS

Course Code	MATHEMATICAL FOUNDATIONS FOR ENGINEERS	L	T	P	E	C
23SH12C	(Common to all B.E. / B.Tech. Degree Programmes)	**3**	**1**	**0**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: interpret the nature of quadratic form by orthogonal transformation.
CO2: identify the maxima and minima of functions.
CO3: solve ordinary differential equations.
CO4: find the solution of partial differential equations.
CO5: evaluate integrals of multivariate calculus.

Soft skill Component

CO6 : develop communication, problem solving and interpersonal skills

CO1: interpret the nature of quadratic form by orthogonal transformation. **L:9, T:3**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof) - Application: Stretching of a elastic membrane.

CO2: identify the maxima and minima of functions. **L:9, T:3**

Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series- Application : Linearization of Non Linear systems using Taylor Series - Maxima and minima - Method of Lagrange multipliers.

CO3: solve ordinary differential equations. **L:9, T:3**

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation. Application RCL – circuit and Mass Spring System.

CO4: find the solution of partial differential equations. **L:9, T:3**

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficient – Application - Shallow wave equations of first order PDE.

CO5 : evaluate integrals of multivariate calculus **L:9, T:3**

Double integration – Cartesian and polar coordinates - Change of order of integration - Change of variables - Cartesian to polar coordinates - Area as double integral - Triple integration - Cartesian and polar coordinates – Change of Variables- Cartesian to spherical and cylindrical coordinates. Application – Moments and centers of mass.

TEXT BOOKS:

1. Grewal.B.S., Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2021.
2. James E. Gentle, Matrix Algebra, Springer International Publishing, 2nd Edition, 2017
3. Shanker Rao.G., Linear Albebra, WileyIndia, 1st Edition , 2017

REFERENCES:

1. Bali.N.P. and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications Private Limited, 10th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, 10th Edition, 2017.
3. Kenneth B. Howell, Ordinary Differential Equations, CRC Press, 2020.
4. James Strewart, Daniel Clegg, Saleem Watson, Essential Calculus Early Trancendentals, Cengage Learning, 9th Edition, 2021.
5. Nanda Kumar A.K, P.S.Datti: Raju .K.George , Ordinary Differential Equations, Cambridge University press, 2017.

L: 45; T: 15; TOTAL: 60 PERIODS

Course Code	INTRODUCTION TO ENGINEERING	L	T	P	E	C
23SH13C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**0**	**0**	**1**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: articulate the importance of Engineering and its role in society through OBE framework
CO2: identify and describe academic pathways towards career settlement

CO1: articulate the importance of Engineering and its role in society through OBE framework **L:9**

Engineering – An introduction, Classification of different Engineering Disciplines, Role of Engineers in Society. Graduate Attributes (GA), Program Specific Criteria (PSC)- Program Educational Objectives (PEO), Program Outcomes (PO), Course Outcomes (CO), Choice Based Credit System (CBCS), course categories, teaching and learning process, active and passive learning, project / problem based learning, different assessments process.

CO2: identify and describe academic pathways towards career settlement **L:6**

Curriculum, cafeteria curriculum and self learning big picture of the Program and the significance of each course in the undergraduate Engineering Program, Discuss the different career paths for an engineering graduate. Career objective, competency requirement.

Case study: Each student has to interact with alumni mentors/seniors/faculty members/surf the internet and present a career path that inspires him/her at the end of the course

REFERENCES:

1. Quamrul H. Mazumder Introduction to Engineering, An Assessment and Problem Solving Approach, CRC Press, 1st Edition, 2016.
2. Saeed Moaveni, "Engineering Fundamentals an Introduction to Engineering", Cengage Learning, USA, 4th Edition, 2011.

L: 15; TOTAL: 15 PERIODS

Course Code	TECHNICAL ENGLISH	L	T	P	E	C
23SH14C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**2**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: apply the fundamental grammar rules in writing

CO2: utilizing phonetic transcription for pronunciation

Practical Component

CO3: apply the basic language skills in various aspects of communication

CO4: utilize technical terms and phrases in specific contexts

CO5: develop the pronunciation skill through various language components

CO6: distinguish different writing forms and interpret text through divergent thinking

CO7: develop effective reports with grammatical and language components

Soft skill Component

CO8: develop communication, team spirit, creativity and time management

CO1: apply the fundamental grammar rules in writing **L:13, P:26**

Parts of Speech - Word Formation using Prefix and Suffix - Sentence formation (Kinds of Sentences) - Tenses (Present, Past & Future tense) – Concord

CO3: apply the basic language skills in various aspects of communication

Diary Writing - Greeting and Self Introduction

CO4: utilize technical terms and phrases in specific contexts

Technical terms and extended definition - Essay Writing (Argumentative Essay and Analytical Essay) - Situational phrases & Conversation - Formal Letter Writing (Permission & Requisition letters)

CO6: distinguish different writing forms and interpret text through divergent thinking

Picture Description, Introduction to Reading Techniques (Skimming, scanning, inferring, predicting, Reading and Reviewing a book (Sci – Fi), E Mail Writing

CO7: develop effective reports with grammatical and language components
Listening and responding to general information (Business context) - Report Writing (Types, Structure, and Stages of report writing) - Checklist

CO2: utilizing phonetic transcription for pronunciation **L:2, P:4**

Phonetics (Vowels & Consonants)

CO5: develop the pronunciation skill through various language components

Word Transformation from one form to another - Letter Writing (Informal) - Listening and responding to general information (General context)

TEXT BOOKS:

1. Paul V. Anderson, Technical Communication: A Reader - Centered Approach, Cengage Learning, 9th Edition, 2017.
2. Ravindra Nath Tiwari, Technical English-II, Shashwat Publication, 1st Edition, 2020.
3. Stephen D. Krashen, Principles and Practice in Second Language Acquisition. Pergamon, 1987.
4. Lester Kaufman and Jane Straus, The Blue Book of Grammar and Punctuation: An Easy-to Use Guide with Clear Rules, Real-World Examples, and Reproducible Quizzes, Wiley, 2021.
5. Wells H. G., The Time Machine, Penguin Classics, 2012.

REFERENCES:

1. Michael McCarthy, English Grammar: The Basics, Taylor & Francis, 2021.
2. Peter Lucantoni and Lydia Kellas, Cambridge IGCSE(TM) English as a Second Language Workbook, Cambridge University Press, 6th Edition, 2022.

L: 15; P: 30; TOTAL: 45 PERIODS

Course Code	ENGINEERING PHYSICS	L	T	P	E	C
23SH15C	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**2**	**0**	**3**

COURSE OUTCOMES:

Upon successful completion of the course the students will be able to:

Theory Components:

CO1: identify the structural properties of crystalline materials
CO2: comprehend and apply the concepts of centre of mass and elasticity
CO3: explain thermodynamic parameters and fundamental laws and their application in various processes
CO4: illustrate the applications of different lasers and optical fibers
CO5: interpret the quantum concepts, to illustrate the quantization of energy, and computation

Practical Components:

CO6: compare the mechanical properties of the materials due to bending and torsion
CO7: analyze thermal conductivity of different bad conducting materials
CO8: explore the light-matter interaction by the phenomenon of interference and diffraction and photoelectric effect

Soft skill Component:

CO9: develop the team spirit and communication skill through group activities

CO1: identify the structural properties of crystalline materials **L:10**

Crystalline and amorphous materials - unit cell - primitive cell - crystal systems, Bravais lattices - Miller indices – interplanar distance – Characteristics of SC, BCC, FCC, HCP structures - Bragg's law - X-ray diffraction and its applications - Synthesis of crystalline materials

CO2: comprehend and apply the concepts of centre of mass and elasticity **L:6,**
CO6: compare the mechanical properties of the materials due to bending and torsion **P:10**

Multi-particle dynamics - Introduction - Center of mass (CM) – CM of continuous bodies -

Introduction to rigid bodies - translation - rotation – moment of inertia – theorems of moment of inertia – Torsional pendulum.

Elasticity – Stress - strain diagram and its applications - Moduli of elasticity and its relation - bending of beams - Bending moment – cantilever - theory and experiment - Uniform bending - theory and experiment – Non Uniform bending - I-shaped girders

CO3: explain thermodynamic parameters and fundamental laws and their application in various processes **L:6, P:8**

CO7: analyse thermal conductivity of different bad conducting materials.

Laws of thermodynamics – Thermo dynamical processes – Introduction to heat transfer – conduction - convection and radiation – thermal conductivity of good conductor –Radial flow of heat - Spherical shell method and cylindrical shell method – Thermal conductivity of poor conductor- Lee's disc method– Applications - heat exchangers - refrigerators and ovens

CO4: illustrate the applications of different lasers and optical fibers **L:6, P:6**

CO8: explore the light-matter interaction by the phenomenon of Interference and diffraction and photoelectric effect

Lasers: Interaction of light with matter - Einstein coefficients and their relations – characteristics of laser - components of laser – Lasing action – Pumping methods – Types of Laser - Nd-YAG laser -semiconductor laser- Applications

Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle – losses associated with optical fibers (Qualitative) – Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy

CO5: interpret the quantum concepts, to illustrate the quantization of energy, and computation **L:6, P:2**

CO8: explore the light-matter interaction by the phenomenon of interference and diffraction and photoelectric effect

Planck's radiation law - de-Broglie hypothesis – Matter waves - Heisenberg's uncertainty principle – elementary proof – applications – Schrödinger's time-dependent and time-independent wave equation – physical significance of wave function – Introduction to quantum tunneling - applications - particle in a one-dimensional box – tunneling microscope – quantum confinement in 0D, 1D, 2D systems - quantum computation

TEXT BOOKS:

1. Avadhanulu M. N., Kshirsagar P.G and Arun Murthy T.V.S, A Text book of Engineering Physics, S.Chand & Co, 11th Edition, 2018.
2. Kleppner D and Kolenkow R. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
3. Kenneth S Krane, Modern Physics, Wiley, 4th Edition, 2021.

REFERENCES:

7. Wolfson R., Essential University Physics, Volume 1 & 2, Pearson Education, 2nd Indian Edition, 2009.
8. Hitendra K. Malik, A.K.Singh, Engineering Physics, McGraw Hill Education, 2nd Edition, 2017.
9. Kyungwon An, Fundamentals of Laser Physics, World Scientific Publishing Company, 2023
10. Halliday D, Resnick R and Walker J, Principles of Physics, Wiley, 12th Edition, 2021.

L: 30; P: 30; TOTAL: 60 PERIODS

Course Code	**ENGINEERING CHEMISTRY**	**L**	**T**	**P**	**E**	**C**
23SH16C	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**2**	**0**	**3**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: explain the suitable water treatment technologies for domestic and industrial applications

CO2: apply the knowledge of corrosion to solve the industrial problems

CO3: describe the preparation, properties and their applications of smart materials in various sectors

CO4: describe the basic components and performance analysis of batteries

CO5: predict the mechanical, electrical and electronics properties of materials using various instrumentation techniques

Practical Component

CO6: estimate the amount of Ca^{2+}/ Mg^{2+}, alkalinity and Chloride ion present in the water sample.

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques

Soft skill Component

CO8: develop interpersonal, work ethics and communications skills for career settlement

CO1: explain the suitable water treatment technologies for domestic and industrial applications

CO6: estimate the amount of Ca^{2+}/ Mg^{2+}, alkalinity and Chloride ion present in the water sample.

Introduction, sources and impurities in water, potable water specifications (as per WHO and BIS) - hardness-types-estimation of $Ca^{2+}$and Mg^{2+} ion in water by EDTA method. Alkalinity-types-determination of alkalinity of water -chronic daily intake - incremental life time risk - hazard quotient, hazard index, contamination factor - determination of chloride ion in water using Argentometric method-municipal water treatment- physical methods and chemical methods. Disinfection-internal conditioning - calgon and carbonate conditioning. Desalination-types-Reverse Osmosis (RO) process- Forward osmosis (FO) - electro dialysis - demineralization. **L:6, P:12**

CO2: apply the knowledge of corrosion to solve the industrial problems.

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques

Corrosion – mechanism of dry and wet corrosion-forms of corrosion– galvanic corrosion and differential aeration corrosion, crevice corrosion, pitting corrosion, microbial corrosion-stress corrosion, intergranular corrosion - determination of rate of corrosion by weight loss method. **L:6, P:6**

Protection: cathodic protection, surface coatings, corrosion inhibitors. Corrosion of industrial components: corrosion and its control in power industries, automotive industries, chemical processing industries and marine industries.

CO3: describe the preparation,properties and their applications of smart materials in various sectors

Polymers: introduction - classification - functional polymers: electroluminescence polymer, biodegradable polymers, fire retardant polymer, thermo responsive polymer - piezo, ferro and pyroelectric polymer - nanocomposites: introduction, synthesis, properties & applications- synthesis of nanocomposites using sol -gel process **L:6**

CO4: describe the basic components and performance analysis of batteries

Introduction - components - operation principle - Lead acid – Nickel metal hydride batteries- Lithium ions batteries: Lithium polymer battery, Lithium sulphur battery - fabrication and performance evaluation- safety issues - battery management system - recycling of lithium batteries. **L:6**

CO5:predict the mechanical, electrical and electronics properties of materials using various instrumentation techniques

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques.

Spectroscopy methods: Beer-Lambert's law and its limitations– UV-visible spectroscopy and IR spectroscopy – principle - instrumentation– applications. Estimation of copper. Electro analytical methods: potentiometric titration - Estimation of Fe^{2+} ion by potentiotometric method. Conductometric method-estimation of HCl by conductometric titration- pH metric method-Estimation of HCl by pH metric titration- applications. Thermal analytical methods: Thermal Gravimetric Analysis (TGA) and Differential Thermal Analysis (DTA)- Thermo Mechanical Analysis (TMA) –principle - instrumentation - Thermo gravimetric analysis of $CuSO_4.5H_2O$- applications. **L:6, P:12**

TEXT BOOKS:

1. Jain P.C. and Jain M, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 17th Edition, 2021.
2. Dara S.S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.
3. Agarwal S, Engineering Chemistry, Cambridge Publishing Company, 2nd Edition, 2019

REFERENCES:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition, 2020.
4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towards Innovation, Publisher: Springer, 1st Edition, 2019.
5. Crouch S, Skoog D, Holler F, Principles of Instrumental Analysis, 2017.

L: 30; P: 30; TOTAL: 60 PERIODS

Course Code	PROBLEM SOLVING TECHNIQUES	L	T	P	E	C
23CS11C	(Common to all B.E. / B.Tech. Degree Programmes)	**3**	**0**	**2**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theroy Component

CO1:apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems

CO2:apply fundamental, sequential, conditional logic statements and arrays for solving basic problems

CO3: implement modular programming concept using user defined functions

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions

CO5: develop file processing application programs

Practical Component

CO6: develop programs for simple algorithms using sequential and Control structures

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

CO8: develop application programs using structures and files concept.

CO1: apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems **L:6**

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Algorithms - Building blocks of algorithms (statements, control flow, functions) - Notation (pseudo code, flow chart) – Problem solving aspect – Top down design – Implementation of algorithms – Program Verification – Efficiency of algorithms – Analysis of algorithm.

CO2: apply fundamental, sequential, conditional logic statements and arrays for solving basic problems **L:12, P:10**

Data Types - Constants – Variables - Keywords – Operators– Problem Solving using fundamental algorithms. Control Statements: Branching and Looping - Algorithms Using Selection and Repetition - Summation of a set of numbers, Reversing Digits of an Integer - Implementation of fundamental algorithms and factoring methods - Array Techniques - Array order reversal, Array Counting, Finding maximum and the minimum value in a set

CO6: develop programs for simple algorithms using sequential and Control structures

Solve problems using control statements (Decision making and Looping)

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Problem solving based on Array Handling(1D and 2D, Multi-dimensional arrays, traversal, rotation) - Solve problems to handle strings

CO3: implement modular programming concept using user defined functions **L:10, P:8**

Modular Programming approach: Modularization and recursion - Bubble Sort, Selection Sort, Linear Search, Binary Search, Implementation of sorting and searching

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Solve problems by using modular approach (Functions and Recursion)

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions **L:12, P:10**

Pointer Concept – add numbers using call by reference – finding maximum number from list of numbers - permutations of a given string using pointers – Implementation of function returns a pointer;

Structures & Union - finding the largest element of an array using Dynamic Memory Allocation – Implementation of Student database in structure using Dynamic Memory Allocation;

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Build efficient solutions to manage memory efficiently through Pointers.

CO8: develop application programs using structures and files concept.

Develop applications using Structures

CO5: Develop file processing application programs **L:5, P:2**

File Handling: Files - Introduction, Types of file processing: Sequential access, Random access – Implementation of word count, copy file, Voter's age validation, Marks range validation

CO8: Develop application programs using structures and files concept.

Develop appliactions using Files

TEXT BOOKS:

1. Maureen Sprankle and Jim Hubbard, Problem Solving and Programming Concepts, Prentice Hall, 9th Edition, 2012.
2. R.G Dromey, How to solve it by Compute, Pearson education, Delhi, 2nd Edition, 2021.

REFERENCES:

1. Behrouz A. Forouzan, Richard F.Gilberg, P.Golda Jeyasheeli, G.Priyanka, S.T.Veena , Problem solving Using C A Structured Programming Approach, Volume I & II, 1st Edition, Cengage Publication, 2022
2. Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, BCS Learning & Development Limited, 1st Edition, 2017.
3. Byron S. Gottfried, Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, New Delhi, 4th Edition, 2018.
4. Kernighan B.W., Ritchie D.M., C Programming Language (ANSI C), Prentice Hall of India Private Limited., New Delhi, 2nd Edition, 2010.
5. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, New Delhi, 2018.
6. Yashavant P. Kanetkar, Let Us C, BPB Publications,16th Edition, 2020
7. H. M.Deitel, P. J. Deitel, C How to Program, Pearson Education., New Delhi, 7th Edition, 2016.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	ELECTRICAL ENGINEERING	L	T	P	E	C
23EE12C		3	0	2	0	4

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Infer the significance and functionality of components in an electric circuit.
CO2: Illustrate the operation and selection of measuring instruments for circuit analysis.
CO3: Outline the electrical circuit wiring techniques for various applications.
CO4: Explain the construction, operations and speed control of various DC motors.
CO5: Describe the operation and characteristics of AC electrical machines.

Practical Component

CO6: Demonstrate electrical circuit wiring and the analysis of electric circuits.

CO7: Select appropriate instruments and protective devices during experiments for ensuing safety

CO8: Perform load test and infer the efficiency of various DC and AC motors

CO1: Infer the significance and functionality of components in an electric circuit **L:9, P:6**

Introduction to Electrical Components – RLC – Types of Sources: Fundamentals of DC and AC Sources -Voltage, current, and power– Ohm's law - Kirchhoff's Law– Electrical Appliances: Bulbs, Fans, and Heaters

CO6: Demonstrate electrical circuit wiring and the analysis of electric circuits.

1. Demonstration of bulbs, incandescent lamps, fans, heaters, Battery
2. Verification of Kirchoff's law and Ohm's Law

CO2: Illustrate the operation and selection of measuring instruments for circuit analysis **L:9, P:6**

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy. Electrical Installation: Components of LT Switchgear – Switch – Fuse – MCB – ELCB.

CO7: Select appropriate instruments and protective devices during experiments for ensuing safety

1. Measurement of Energy using Energy Meter for Single Phase System
2. Selection of protective devices.

CO3: Outline the electrical circuit wiring techniques for various applications. **L:9, P:6**

Introduction to Electrical Wiring: Types of Wires and Cables- Electrical Symbols - residential wiring –- Electrical Codes and Regulations - Wiring Methods - Earthing- GFCI and AFCI Protection – Uninterrupted Power supply – Types.

CO6: Demonstrate electrical circuit wiring and the analysis of electric circuits.

1. Residential House Wiring
2. Staircase Wiring

CO4: Explain the construction, operations and speed control of various DC motors. **L:9, P:6**

DC Machines: General Construction – Working Principles –Types of DC Machines – 3 point and 4 point Starters – Speed Control of DC Machines.

CO8: Perform load test and infer the efficiency of various DC and AC motors

1. Load test on DC shunt Motor
2. Load test on DC series Motor
3. Speed Control of DC shunt Motor

CO5: Describe the operation and characteristics of AC electrical machines **L:9, P:6**

Single Phase & three phase Induction Motor: Construction and operation - Starting and Speed Control of Induction Motors - Transformers: Construction and Working Principles – Auto Transformers.

CO8: Perform load test and infer the efficiency of various DC and AC motors

1. Load test on Single Phase Induction Motor
2. Load test on Three Phase Induction Motor
3. Load test of single Phase Transformers

TEXT BOOKS:

1. D.P. Kothari and I J Nagrath, "Basic Electrical and Electronics Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. P.S. Bimbhra, "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.

REFERENCES:

1. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, Revision 1st Edition, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. R.K.Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2017.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	தமிழரும் தொழில்நுட்பமும் (TAMILS AND TECHNOLOGY)	L	T	P	E	C
23SH21C	(Common to all B.E. / B.Tech. Degree Programmes)	1	0	0	0	1

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1: தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன்.

CO2: தமிழர்களின் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம், அறிவியல் தமிழ் மற்றும் கணினித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன்.

Upon the successful completion of the course, the student will be able to

CO1: Know and explain about Tamils weaving and Pottery technology, Design and construction Technology and Manufacturing Technology.

CO2: Know and explain about Tamils Agriculture and irrigation technology, Scientific Tamil and Tamil computing

CO1: தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் மற்றும் உற்பத்தித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:9**

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிகப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்- சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக்கலை- கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல் மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

CO1: KNOW AND EXPLAIN ABOUT WEAVING AND CERAMIC TECHNOLOGY, DESIGN AND CONSTRUCTION TECHNOLOGY, MANUFACTURING

TECHNOLOGY

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries - 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- 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 – Gemstone types described in Silappathikaram.

CO2: தமிழர்களின் வேளாண்மை, நீர்ப்பாசனத் தொழில்நுட்பம், அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் பற்றிய அறிவு மற்றும் விளக்கும் திறன். **L:6**

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்- அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

CO2: KNOW AND EXPLAIN ABOUT AGRICULTURE TECHNOLOGY, IRRIGATION TECHNOLOGY, SCIENTIFIC TAMIL & TAMIL COMPUTING

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- 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.

REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils(Dr.K.K.Pillay)A joint publication of TNTB & ESC and RMRL
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 TamilNadu (Dr.K.K.Pillay) (Published by: The Author)

L: 15; TOTAL: 15 PERIODS

Course Code	LINEAR ALGEBRA AND COMPLEX ANALYSIS	L	T	P	E	C
23EC21C		3	1	0	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: analyze concepts of vector spaces.
CO2: measure the similarity between different datasets using Inner product spaces.
CO3: decompose the matrix for computational convenience.
CO4: interpret analytic function in transformations.
CO5: evaluate complex integration over contour.

CO 1: analyze concepts of vector spaces

Vector spaces – Subspaces – Linear combinations – linear span - Linear independence and linear dependence – Bases and dimensions. **L:9,T:3**

CO2 : measure the similarity between different datasets using Inner product spaces

Linear transformation - Null spaces and ranges – Rank Nullity theorem - Matrix representation of a linear transformations - Inner product space - Norms - Orthonormal Vectors - Gram Schmidt orthogonalisation process**.** **L:9,T:3**

CO3 : decompose the matrix for computational convenience

Generalized eigenvector - QR decomposition- generalized inverse - Singular value decomposition and applications – Pseudo Inverse - Moore – Penrose Inverse – Least square approximations. **L:9,T:3**

CO4 : interpret analytic function in transformations

Analytic functions–Necessary and Sufficient conditions Harmonic and orthogonal properties of analytic functions –Harmonic conjugate –Construction of analytic functions – Conformal mapping: w= z+c, cz, 1/z and bilinear transformation. **L:9,T:3**

CO5 : evaluate complex integration over contour

Cauchy's integral theorem and Cauchy's integral formula – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour excluding poles on boundaries. **L:9,T:3**

TEXT BOOKS:

1. Grewal.B.S. Higher Engineering Mathematics, 44th Edition, Khanna Publications, Delhi, 2021
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India, 2017.
3. Bernard Kolman and David Hill, Elementary Linear Algebra with Application, 9th Edition

Pearson Modern Classic, 2019.

REFERENCES:

1. Bali.N.P. and Manish Goyal, A Textbook of Engineering Mathematics, 10th Edition, Laxmi Publications Private Limited, 2018.
2. Ramana B.V, Higher Engineering Mathematics, Tata Mc-Graw Hill Publishing Company, New Delhi, 2017.
3. Jain.R.K. and Iyengar.S.R.K., Advanced Engineering Mathematics, 5th Edition Narosa Publishing House Private Limited, 2016.
4. Seymour Lipschutz Marc Lipson., Linear Algebra, 6th Edition, Schaum's Out lines series 2017.
5. Gilbert Strang , Linear Algebra and its Applications,4th Edition , Wellesley-Cambridge Press 2011.
6. V.Sundara Pandian , Numerical Linear Algebra , PHI Learning Limited, 2014.

L: 45; T: 15; TOTAL: 60 PERIODS

23EC22C /	**MATERIALS SCIENCE**	**L**	**T**	**P**	**E**	**C**
23EE22C	(Common to ECE & EEE)	**2**	**0**	**0**	**0**	**2**

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

Theory Components:

CO1: explain the conductivity in metals using free electron theory.
CO2: describe the fundamental properties ofsemiconductors.
CO3: apply the magnetic and dielectric properties for relevant electrical and electronics engineering applications.
CO4: illustrate the optical properties and their applications to optical devices.
CO5: apply the concepts of nanomaterials for nano devices.

CO1: explain the conductivity in metals using free electron theory.

Conduction in metals - Classical free electron theory of metals – Mobility and electrical conductivity - Thermal conductivity of metals - Wiedemann – Franz law – Quantum free electron theory – merits and limitations of free electron theory (FET) - Fermi-Dirac Statistics - Density of States. **L:6**

CO2: describe the fundamental properties of semiconductors.

Energy band diagram - Direct and indirect band gap - Carrier concentration and Fermi level in anintrinsic semiconductor- Carrier concentration and Fermi level in N-type and P-type semiconductors - Carrier transport in Semiconductors: Drift, mobility, diffusion and carrierlifetime - Hall effect **L:6**

CO3: apply the magnetic and dielectric properties for relevant electrical and electronics engineering applications.

Magnetic materials – Classification – Hysteresis – Ferrites - $BaTiO_3$ – Application of Nd-Fe-B magnets. Electric polarization – Different types of polarization – Temperature and frequency dependence –Dielectric loss and dielectric breakdown – dielectric materials **L:6**

applications - capacitors and transformers.

CO4: illustrate the optical properties and their applications to optical devices.

Light waves in a homogeneous medium – Refractive index – Dispersion – Classification of Optical materials – Luminescence - Fluorescence– Phosphors – Photoconductivity – Display devices - Principle and working of LED, OLED, LCD - Laser diode – Photodiode (CdS and CdSe)- Optical Amplifiers. **L:6**

CO5: apply the concepts of nanomaterials for nano devices.

Nanomaterials - synthesis - properties - Band gap of nanomaterials – Quantum Tunneling – Quantum cascade lasers -Nano magnets - GMR - Conductivity of metallic nanowires – Carbonnanotubes: Properties and applications - QLED – Spintronics and its device application. **L:6**

TEXTBOOKS:

1. Dr. M. Arumugam, Materials Science, Anuradha Publications, 2018
2. S. M. Sze and M. K. Lee, Semiconductor Physics and Devices, Wiley, 2021.
3. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw-Hill Education, 2017.
4. Hilmi Unlu and Norman J. M. Horing, Progress in Nanoscale and Low-Dimensional Materials and Devices, Springer Link, 2022.

REFERENCES:

1. S.O Pillai, Solid State Physics, 10th edition, NEW AGE International Publishers, 2022
2. W.D.Callitser and D.G. Rethwish. Materials Science and Engineering, John Wiley & Sons, 2014.
3. Juan Martinez-Vega, Dielectric Materials for Electrical Engineering, Wiley, 2013
4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education, 2009.
5. J. Wilson and J.F.B. Hawkes, Optoelectronics, Pearson Education, 2018.

L : 30; TOTAL : 30 PERIODS

Course Code	**APTITUDE ESSENTIALS**	**L**	**T**	**P**	**E**	**C**
23GN01C		1	0	0	0	1

COURSE OUTCOMES

Upon the completion of the course the students will be able to

CO1: Recall the fundamentals in quantitative techniques and solve Number series problems quickly

CO2: Develop problem solving skills on Numbers and enhance arithmetic ability

CO3: Infer appropriate comparison and distribution methods using ratio and to form equations

CO4: Improve quantitative skills and solve problems on percentages and profit loss

CO5: Calculate data interpretation and data sufficiency in quantitative aptitude

CO1: Recall the fundamentals in quantitative techniques and solve Number series **3**

problems quickly

Numeric series – Finding missing numbers – Odd number out series - Letter series – Symbol series - Alphanumeric series

CO2: Develop problem solving skills on Numbers and enhance arithmetic ability **3**

Number Types - HCF & LCM – Square root- Cubic root - divisibility criteria- Unit digit calculation- Prime factors

CO3: Infer appropriate comparison and distribution methods using ratio and to form equations **3**

Ratio & Proportion: Comparison of Ratios - Variations: Direct and indirect proportion Ages: Present Age, Past Age & Future calculation

CO4: Improve quantitative skills and solve problems on percentage and profit loss **3**

Concept of Percentage – Percentage calculation - Calculation of Percentage on Population Results on Depreciation .Profit and Loss –Percentage of Profit and Loss – Discount

CO5: Calculate data interpretation and data sufficiency in quantitative aptitude **3**

Data Interpretation – Pie Chart – Bar Chart – Table Chart .Data Sufficiency in Logical Reasoning : Numbers, Ratio, Ages, Percentage and Profit Loss

REFERENCE BOOKS:

1. Dr.R.Aggarwal, " Quantitative Aptitude", S Chand Publishing, Revised Edition 2017
2. R.V.Praveen, "Quantitative Aptitude and Reasoning", 3rd Edition, Eastern Economy Edition, PHI Learning, 2016

L:15; TOTAL : 15 PERIODS

Course code	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
23MC02C		2	0	0	0

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: explain the structure and functions of an ecosystem and the importance of biodiversity.

CO2: interpret the causes, effects of air and water pollution.

CO3: comprehend the causes, impacts and management of e-waste and municipal waste.

CO4: apply the knowledge of sustainability practices in the environment.

CO1: explain the structure and functions of an ecosystem and the importance of biodiversity. **L-6**

Introduction to Environment**,** scope and importance of environment – need for public awareness. Eco-system: structure and function. Biodiversity: Introduction - types – values 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 - Biodiversity index calculation (Simpson and Shannon diversity Index,

Sorenson coefficient)

CO2: interpret the causes, effects of air and water pollution. **L-6**

Air pollution - Classification of air pollutants – sources – Effects - Measurements: dust monitor – gas analyzer, particle size analyzer. Water pollution – Classification – health hazards – sampling and analysis of water. Waste water treatment – different industrial effluents and their treatment – Measurement: BOD and COD – atomic absorption spectrometer. Case study (Okhla sewage water treatment plant)

CO3: comprehend the causes, impacts and management of e-waste and municipal waste. **L-12**

Integrated Waste Management: Introduction – Generation and types of solid waste – Swachh Bharat Mission – Solid waste management: collection, transportation, segregation and processing – Disposal: landfill – biochemical processes and energy recovery - Municipal solid waste management rules 2016.

e-Waste Management: Introduction – Composition - Types – Generation – Environmental and health hazards of e-waste – Recycling - Recovery of metals: pyrometallurgical, hydrometallurgical, and biometallurgical process – e-waste management and handling rules 2016 – e-waste management companies in India.

CO4: apply the knowledge of sustainability practices in the environment. **L-6**

Sustainability and Management**:** Introduction - concept, needs and challenges –economic and social aspects of sustainability – 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 – Zero waste and R concept – Circular economy – ISO 14000 Series – Material Life cycle assessment.

TEXT BOOKS:

1. Miller. G.T and Spoolman. S, 'Environmental Science', 16th Edition, Brooks/Cole Publishing Co., 2018.
2. Peavy. H.S, Rowe. D.R and Tchobanoglous. G, "Environmental Engineering", 2nd Edition, McGraw Hill Education, 2020.
3. Benny Joseph, 'Environmental Engineering', Tata-Mc-Graw Hill, New Delhi, 2016.
4. Gilbert M. Masters, 'Introduction to Environmental Science and Engineering', 2nd Edition, Pearson Education, 2016.

REFERENCES:

1. Kaushik. A and Kaushik. C.P, 'Environmental Science and Engineering', 6th Edition, New Age International Publishers, 2018.
2. Weller. K, 'Environmental Science and Biological Engineering', 1st Edition, WIT Press, 2015.

L:30; TOTAL : 30 PERIODS

Course Code	PROFESSIONAL ENGLISH	L	T	P	E	C
23SH22C	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**2**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: extend the primary language skills to develop critical thinking

CO2: build the secondary language skills for professional competence

Practical Component

CO3: apply the vital sub-functions of listening in particular context

CO4: take part in propagating ideas through effective oral communication

CO5: inferring information using various reading techniques

CO6: construct professional content via distinct methods of writing

Soft skill Component

CO7: develop interpersonal, communicational and behavioral attributes

CO1:extend the primary language skills to develop critical thinking

CO3: apply the vital sub-functions of listening in particular context **L:6,P:16**

CO4: take part in propagating ideas through effective oral communication

If Conditionals – Standard Abbreviations –Types of Listening (Comprehensive, Informational, Critical Listening) –One Word Substitution, Components of Speaking

Listening for Specific Information –Listening to Speech (Oxford Union Society) – Listening to Science Talks or Theories

Product Description – Chart Description – Process Description – Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples – Demo)

CO2:build the secondary language skills for professional competence **L:5, P:18**

CO5: inferring information using various reading techniques

CO6: construct professional content via distinct methods of writing

Synonyms – Intensive and Extensive Reading –Error Spotting (Based on Concord, Pronoun, Articles & Adverb Placement)– Writing Style (Persuasive, Expository & Descriptive)

Newspaper Reading – Reading Comprehension (Fiction & NonFiction)

Business Letters for Quotations and Clarification, Placing Orders and Making Complaints – Proposal Writing – Job Application Letter & Resume Preparation – Paragraph Writing – Content Writing

TEXT BOOKS

1. Lucantoni, Peter & Lydia Kellas, "English as a Second Language Workbook", 6th Edition, Cambridge University Press, 2022.
2. Twain, Mark. "The Adventures of Tom Sawyer", 1st Edition, Pegasus, 2012.
3. Clear, James. "Atomic Habits", 1st Edition, Dreamliners, 2022.
4. Garcia, Hector & Francesc Miralles. Ikigai: The Japanese Secret to a long and Happy Life. 1st Edition, Tuttle Publishing, 2021.
5. Elbow, Peter, "Writing with Power" 2nd Edition, Oxford University Press, 1998.

REFERENCES

1. Butterfield, Jeff. "Soft Skills for Everyone". 2nd Edition, Cengage, 2020
2. Raman, Meenashi & Sangeetha Sharma. Professional English. 1st Edition, Oxford University Press, 2018

L: 11; P: 34; TOTAL: 45 PERIODS

Course Code	ENGINEERING GRAPHICS	L	T	P	E	C
23ME11C	(Common to MECH, CIVIL, AIDS, EEE, ECE, IT)	**2**	**0**	**4**	**0**	**4**

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to
CO1: Construct the Engineering Curves and Perform Freehand Sketching.
CO2: Construct the Orthographic Projections of Points, Straight Lines and Lamina
CO3: Draw the Projections of Simple Solids in Different Positions.
CO4: Visualize the Sectional Views and Surface of Various Solids.
CO5: Draw the Isometric and Perspective Projections of Various Solids.

CO1: Construct the Engineering Curves and Perform Freehand Sketching. L:6, P:12

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

CO2: Construct the Orthographic Projections of Points, Straight Lines and Lamina L:6, P:12

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

CO3: Draw the Projections of Simple Solids in Different Positions. L:6, P:12

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

CO4: Visualize the Sectional Views and Surface of Various Solids. L:6, P:12

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section. Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

CO5: Draw the Isometric and Perspective Projections of Various Solids. **L:6, P:12**

Principles of isometric projection – Isometric scale – Isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Perspective projections of simple solids by visual-ray method

TEXT BOOKS:

1. Bhatt N.D, "Engineering Drawing", 54th Edition, Charotar Publishing House, 2023.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

REFERENCES:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Agrawal B. & Agrawal C.M., "Engineering Graphics", TMH Publication, 2nd Edition, 2013
3. Narayana K.L. & Kannaiah P, "Text book on Engineering Drawing", Scitech Publishers, 2011.
4. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32nd Edition, 2017.

L: 30; P: 60; TOTAL: 90 PERIODS

Course Code	CIRCUIT ANALYSIS	L	T	P	E	C
23EC23C		2	1	2	0	4

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

Theory Components:

CO1: Apply the knowledge of various network theorems to analyze the electrical circuit.
CO2: Analyze the transient response of RL, RC and RLC circuits in time domain.
CO3: Analyze the frequency domain response of resonant circuits
CO4: Apply Laplace transform for analysis of network.
CO5: Determine the parameters of two port networks.

Practical Components:

CO6: Demonstrate the analysis of circuits using Network theorems.
CO7: Perform simulation of transient and steady state response of first order RL and RC circuits.
CO8: Demonstrate the frequency response of series and parallel RLC circuits.
CO9: Verification of network stability using simulation
CO10: Demonstrate the determination of Two Port Network parameters.

Soft Skill Components:

CO11: Develop the team spirit and communication skill through group activities.

CO1: Apply the knowledge of various network theorems to analyze the electrical circuit **L:6, T:3,**
CO6: Demonstrate the analysis of circuits using Network theorems **P:6**

Node voltage and Mesh current analysis, Theoretical study and experimental verification of

Network Theorems: Source Transformation, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem.

CO2:Analyze the transient response of RL, RC and RLC circuits in time domain **L:6,**
CO7: Perform simulation of transient and steady state response of first order RL and RC circuits. **T:3, P:6**

Step response and sinusoidal response of first order (series RL and series RC) and second order circuits (Series RLC), sinusoidal steady state analysis-Simulation of transient and steady state response of first order RL and RC circuits.

CO3: Analyze the frequency response of resonant circuits **L:6,**
CO8: Demonstrate the frequency response of series and parallel RLC circuits **T:3,**
Series resonance, Parallel resonance, Bandwidth, Quality factor, Selectivity, Experimental verification of frequency response of series and parallel resonant circuit. **P:6**

CO4:Apply Laplace transform for analysis of network **L:6,**
CO9: Verification of network stability using simulation **T:3,**
Application of Laplace transforms–Circuit Element models, circuit analysis, transfer function –Network stability-Poles and Zeros - Verification of network stability using MATLAB simulation. **P:6**

CO5: Determine the parameters of two port networks **L:6,**
CO10: Demonstrate the determination of Two Port Network parameters **T:3,**
Theoretical study and experimental verification of Impedance parameters, Admittance parameters, Hybrid parameters, Transmission parameters, Relationships between parameters, Interconnection of two port networks **P:6**

TEXTBOOKS

1. Robert L.Boylestad, "Introductory circuit analysis", 14th Edition, Pearson, 2023.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, Mc-Graw Hill, 2022.

REFERENCES

1. John Bird, "Electrical Circuit Theory and Technology", 7th Edition, Newness Publication, 2021.
2. William H.Hayt, Jack, E.Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 9th Edition, Tata Mc-Graw Hill, 2020.
3. Joseph A.Edminister, Mahmood, Nahvi, "Electric Circuits", Schaum's Series, 7th Edition, Tata Mc-Graw Hill, 2017.

L: 30;T:15; P:30;TOTAL:75 PERIODS

Course Code	OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	E	C
23CS24C	(Common to CSE, IT & ECE)	**2**	**0**	**2**	**2**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: apply the object oriented programming constructs to solve known applications

CO2: design effective application with inheritance, compile time and run time polymorphism

CO3: develop real-world applications by using files, streams, and exceptions

CO4: construct well-defined, efficient data handling strategies using templates and STL

Practical Component

CO5: demonstrate the basic OO principles such as class, objects, and constructors

CO6: implement code reusability through overloading, inheritance and polymorphism

CO7: solve problems using files and exception handling

CO8: employ problem solving skill using templates and STL

Experiential Component

CO9: create efficient solutions for solving real-world OOP applications

Soft Skill Component

CO10: demonstrate diversity and inclusive attitude while practicing project component as a team

CO1: apply the object oriented programming constructs to solve known applications **L:8;**
CO5: demonstrate the basic OO principles such as class, objects, and constructors **P:8;**
Introduction- Comparison between procedural programming paradigm and object-oriented programming paradigm. Features of object-oriented programming. Functions - Inline functions- Friend functions. Arrays -Array of objects. Pointer - Function pointer. Memory management: New and Delete. Classes and Objects - Access specifiers, Types of classes- Constructor and destructor - Types of constructor - Static members **E:8**

CO2:design effective application with inheritance, compile time and run time polymorphism **L:8;**
P:8;
CO6:implement code reusability through overloading, inheritance and polymorphism **E:10**
Function Overloading, Overloading Constructors, Ambiguity in Overloading. Operator overloading - Overloading Using Friend Function- Overloading New and Delete- Overloading Special Operators. Inheritance – Types of Inheritance - Typing Conversions and Visibility – Code Reuse- Aggregation. Polymorphism- Virtual Functions – Pure Virtual Functions – Early vs. Late Binding. Run-Time Type ID and Casting Operators: RTTI – Casting Operators – Dynamic Cast.

CO3: develop real-world applications by using files, streams, and exceptions **L:7;**
CO7: solve problems using files and exception handling **P:6;**
Streams and Files: Streams classes - Sequential Input and Output operations – Random Access - File pointers - Error handling in file I/O with member function - command line arguments. Exception handling – expected and unexpected exceptions - uncaught exception - resource captures and release. Case study with real time applications. **E:4**

CO4:construct well-defined, efficient data handling strategies using templates and STL **L:7;**
P:8;
CO8: employ problem solving skill using templates and STL **E:8**

Templates- Generic programming - variadic templates – template compilation model – Generic Classes. Standard Template Library: Iterators – Auxiliary Iterator function – Algorithms – Non-modifying sequence operations – mutating sequence operations – Containers: Sequence and associative containers - Algorithms, string class – explicit, mutable and operator keywords. Namespaces: user defined namespaces, namespaces provided by library

TEXT BOOKS

1. Bjarne Stroustrup, "A Tour of C++", 3rd Edition, Pearson Education, April 2023.
2. Herbert Schildt, "C++: The Complete Reference", 4th Edition, Tata McGraw–Hill Publishers, 2017.

REFERENCE BOOKS

1. Reema Thareja, "Object oriented programming with C++", Revised 1st Edition, Oxford University Press, 2018.
2. E.Balagurusamy, "Object oriented programming with C++", 8th Edition, McGraw Hill Education (India) Private Limited, September 2020.
3. Ivor Horton, Peter van, "Beginning C++ 20 from novice to professional", 6th Edition, APRESS media, 2020.
4. Bjorin Andrist, Viktor Sehr, "C++ High Performance: Master the art of optimizing the functioning of your C++ code", 2nd Edition, Packt Publishing Limited, December 2020.
5. Nicoloai. MJosuttis and Doug Gregor, "C++Templates: The complete guide", 1st Edition, Addison Wesley, 2020

ONLINE COURSES

1. https://onlinecourses.nptel.ac.in/noc23_cs78/preview
2. https://www.udemy.com/course/oops-and-c-from-basic-to-advanced
3. https://www.udemy.com/course/crash-course-on-cpp-stl/
4. https://www.coursera.org/lecture/c-plus-plus-b/1-3-standard-template-library-o3v9K
5. https://www.coursera.org/learn/object-oriented-cpp

L:30; P:30; E:30; TOTAL: 90 PERIODS

Course Code	**INNOVATION THROUGH DESIGN THINKING**	**L**	**T**	**P**	**E**	**C**
23GN02C	(Common to all B.E. / B.Tech. Degree Programmes)	**0**	**0**	**0**	**4**	**2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

Experiential Component

CO1: Analyse the impact of design thinking process.

CO2: Practice design thinking process through real world problems.

Soft skill Component

CO3: Present survey conclusions on selected real-world problems.

CO1: Analyse the impact of design thinking process **30**

Design thinking process: history and phases -Ideation tools: brainstorming, mind mapping, scrambler method, six thinking hats -case studies.

CO2: Practice design thinking process through real world problems **30**

Real world problem selection-Practicing the preliminary stages of design thinking process - work presentation.

TEXT BOOKS

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", WS Professional, 2020
2. PavanSoni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving", Penguin Random House, 2020

REFERENCES

1. Michael Lewrick, "The Design Thinking Playbook", Wiley, 2019
2. Kathryn Christopher, "Design Thinking in Engineering", Kendall Hunt Publishing Company,2019
3. Robert Curedale, "Design Thinking Process & Methods" Design Community College Inc, 5th Edition, 2019
4. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018
5. Jimmy Jain, "Design Thinking for Startups", Notion Press, 2018
6. Monika Hestad Silvia Rigoni Anders Grnli, "The Little Booklet on Design Thinking: An Introduction", Zaccheus Entertainment, 2nd Edition, 2017
7. Scott Swan, Michael G.Luchs and Abbie Griffin, "Design Thinking: New Product Development Essentials", Wiley-Blackwell, 2016
8. D.M. Arvind Mallik, "Design Thinking for Educators", Notion Press, 2019

E:60; TOTAL:60 PERIODS

Course Code	PROBABILITY, RANDOM PROCESS AND	L	T	P	E	C
23EC31C	QUEUEING THEORY	3	1	0	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: grasp basic probability concepts and standard distributions
CO2: find the correlation and regression of two dimensional random variables
CO3: interpret the basic characteristic features of Random processes
CO4: evaluate spectral densities of functions.
CO5: interpret the basic characteristic features of markovian queues.

CO 1: grasp basic probability concepts and standard distributions

Discrete and continuous random variables - Moments - Moment generating functions and their properties. Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, and Normal distributions - *Compute probabilities and moments of discrete and continuous random variables - Case Study through software* **L:9,T:3**

CO2 : find the correlation and regression of two dimensional random variables

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables. **L:9,T:3**

CO3 : interpret the basic characteristic features of Random processes

Classification - Stationary process - Markov process - Markov chains – Transition probabilities - Limiting distributions - Poisson process. **L:9,T:3**

CO4 : evaluate spectral densities of functions

Auto correlation - Cross correlation – Power spectral density–Cross spectral density-Properties–Wiener – Khintchine theorem (without proof)–Relationship between cross power spectrum and cross correlation function - *Carry out performance study on power spectrum analysis of time-domain signals using Fourier transform – Activity through programming* **L:9,T:3**

CO5: interpret the basic characteristic features of Markovian queues

Markovian models – Birth and Death Queuing models- Steady state results: Single and multiple server queuing models- queues with finite waiting rooms- Finite source models- Little's Formula. **L:9,T:3**

TEXT BOOKS:

1. Oliver C. Ibe, "Fundamentals of Applied Probability and Random processes", Academic Press, 2nd Edition, 2014.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes, Tata McGraw-Hill, 3rd Edition, New Delhi, 2017
3. D. Gross and C.M. Harris, "Fundamentals of Queueing Theory", Wiley and Sons Publication Limited, 5th Edition, 2018

REFERENCES:

1. Miller.S.L and Childers, S.L, Probability and Random Processes with applications to Signal Processing and Communications, Elsevier Inc., 2nd Edition, 2012.
2. Yates and D.J. Goodman, Probability and Stochastic Processes, 3rd Edition, John Wiley and Sons, 2014.
3. Peyton. Z. Peebles Jr., Probability Random Variables and Random Signal Principles, 4th Edition, Tata McGraw-Hill Publishers, New Delhi, 2017.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India, 2017

L: 45; T: 15; TOTAL: 60 PERIODS

23EC32C	**SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**E**	**C**
		3	**1**	**0**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Classify and analyze the types of signals and systems using properties.

CO2: Analyze any continuous time signals using Fourier Series, Fourier transform and Laplace transform and also understand their properties.

CO3: Analyze the continuous time systems using Fourier transform and Laplace transform and to calculate the frequency response of CT- LTI systems.

CO4: Analyze the sampling concepts and aliasing effect, discrete time signals using DTFT and Z transform

CO5: Analyze the discrete time systems using DTFT and Z- transform and to calculate the frequency response of DT-LTI systems.

CO1: Classify and Analyze the Types Of Signals And Systems Using Properties. L:9;T:3

Standard signals-Step .Ramp, Pulse, Impulse, Real , Complex Exponential and Sinusoids.

Classification and Simulation of Continuous time signals and Discrete time signals - periodic and aperiodic signals, Deterministic and Random signals, Energy and Power Signals.

Classification of CT systems and DT systems- Linear and Non Linear, Time Variant and Time Invariant, Causal and Non Causal, Stable and Unstable.

CO2: Analyze any continuous time signals using Fourier Series, Fourier transform and Laplace transform and also understand their properties L:9;T:3

Fourier series analysis, Fourier Transform -signal analysis and simulation using MATLAB, Properties. Laplace Transform- signal analysis, Properties.

CO3: Analyze the continuous time systems using Fourier transform and Laplace transform and to calculate the frequency response of CT- LTI systems. L:9; T:3

Representation of CT-LTI system - Differential equation, Block diagram representation, Impulse response and transfer function, Convolution integral, frequency response, LTI systems analysis and MATLAB simulation using Fourier and Laplace transforms.

CO4: Analyze the sampling concepts and aliasing effect, discrete time signals using DTFT and Z transform L:9; T:3

Theoretical study and MATLAB simulation of Sampling and aliasing effects, DTFT (Discrete Time Fourier Transform) - signal analysis, Properties, Z Transform- signal analysis, Properties.

CO5: Analyze the discrete time systems using DTFT and Z- transform and to calculate the frequency response of DT-LTI systems. L:9;T:3

Representation of DT-LTI system, Difference equation, Block diagram representation, Impulse response and transfer function, Convolution sum, Frequency Response, LTI systems analysis and MATLAB simulation using DTFT and Z-transforms.

L: 45; T:15;TOTAL: 60 PERIODS

TEXT BOOKS

1. Alan V.Oppenheim, Alan S.Willsky and S.H.Nawab, “Signals and Systems”, Pearson Education, 2nd Edition, 2015.
2. Edward W Kamen and Bonnie S. Heck, “Fundamentals of Signals and Systems using the Web and MATLAB”, Pearson Education, 3rd Edition, 2013.

REFERENCES

1. Rodger E.Ziemer, William H.Tranter and D.Ronald Fannin, "Signals & Systems continuous and discrete", Pearson Education, 4th Edition, 2014.
2. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, Willey Publication, 2010.
3. Hwei P. Hsu, "Signals and Systems- Schaum's Outline Series", Tata McGraw Hill, 3rd Edition, 2013.
4. M.J.Roberts, "Signals and systems Analysis using transform methods and MATLAB", Tata McGraw Hill, 2nd Edition, 2011.

Course Code	ELECTRONIC DEVICES	L	T	P	E	C
23EC33C		3	0	2	0	4

COURSE OUTCOMES

On the successful completion of the course, students will be able to

Theory Component

CO1: Analyze the diode characteristics and its applications.
CO2: Describe the operation and characteristics of Bipolar Junction Transistors.
CO3: Describe the operation and characteristics of Field Effect transistors.
CO4: Analyze various biasing circuits for a transistor
CO5: Gain knowledge and aware of the special semiconductor devices and latest technological changes.

Practical Component

CO6: Analyze the characteristics and the applications of PN junction diode, Zener diode
CO7: Analyze the characteristics of BJT and FETs.
CO8: Design and demonstrate various biasing circuits of a transistor

Soft skill Component

CO9: Improve teamwork, communication, and develop problem-solving skills to solve complex Electronics problems.

CO1: Analyze the diode characteristics and its applications. **L:9, P:6**

CO6: Analyze the characteristics and the applications of PN junction diode, Zener diode

PN junction diode, Current equations, Energy Band diagram of PN Junction, Diffusion and drift current densities, Experimental verification of forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Experimental verification of applications of diode as a rectifier.

CO2: Describe the operation and characteristics of Bipolar Junction Transistors. **L:9, P:6**

CO7: Analyze the characteristics of BJT and FETs.

Bipolar Junction Transistor- NPN -PNP -Operations-Early Effect-Current equations — Experimental verification of Input and Output characteristics of Common Emitter, Common Base and Common Collector.

CO3: Describe the operation and characteristics of Field Effect transistors. **L:9, P:6**

CO7: Analyze the characteristics of BJT and FETs.

JFETs — Experimental verification of Drain and Transfer characteristics -Current Equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics — Comparison of MOSFET with JFET.

CO4: Analyze various biasing circuits for a transistor. **L:9, P:6**

CO8: Design and demonstrate various biasing circuits of a transistor.

BJT biasing – DC Load line and AC Load line, Quiescent point – Different Types of biasing circuits: Experimental verification of Fixed Bias Circuit, Collector to base bias, Voltage divider bias– Stability Factors – Bias compensation: Diode, Thermistor and Sensistor compensations – Biasing circuits for JFET and MOSFET.

CO5: Gain knowledge and aware of the special semiconductor devices and latest technological changes. **L:9, P:6**

CO6: Analyze the characteristics and the applications of PN junction diode, Zener diode.

Zener diode- Experimental verification of characteristics and applications, Schottky diode, Tunnel diode, SCR, DIAC, TRIAC, UJT, Advanced MOS devices- Multi gate MOSFETs.

TEXT BOOKS

1. G.Streetman and S.K.Banerjee, “Solid State Electronic Devices,” 7th Edition, Pearson, 2015.
2. D.Neamen, D.Biswas "Semiconductor Physics and Devices," McGraw-Hill Education. 2018.
3. Millman.J and Halkias.C, “Electronic Devices and Circuits”, TMH, 2015.

REFERENCES

1. S.M.Sze and K.N.Kwok, “Physics of Semiconductor Devices,” 3rd Edition, John Wiley & Sons, 2006.
2. Y.Tsividis and M.Colin, “Operation and Modeling of the MOS Transistor”, Oxford Univ. Press, 2011.
3. J.P. Colinge, FinFETs and Other Multi-Gate Transistors, Springer 2008.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	**DIGITAL ELECTRONICS**	**L**	**T**	**P**	**E**	**C**
23EC34C		**3**	**0**	**2**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to:

Theory Components:

CO1: Analyze the concept of Boolean Logic function and simplify it.

CO2: Design and implement combinational logic circuits. .

CO3: Design and implement sequential logic circuits. .

CO4: Design and analyze synchronous and asynchronous sequential circuits. .

CO5: Illustrate the operation of Logic families, Memory architecture and Programmable Logic devices.

Practical Components:

CO6: Realize the Boolean functions using basic gates and universal gates.

CO7: Demonstrate the combinational logic circuits using digital IC's and verilog HDL.

CO8: Demonstrate the sequential logic circuits using digital IC's and verilog HDL.

CO9: Design and simulate the finite state machine for the given specification.

CO10: Simulate the logic families and memory architecture circuits.

Soft skill Component:

CO11: Develop the team spirit and communication skill through group activities.

CO1: Analyze the concept of Boolean Logic function and simplify it. **L:9, P:6**

CO6: Realize the Boolean function using basic gates and universal gates.

Boolean algebra, Number systems, De Morgan's theorem, Demonstration of the Boolean function using Logic Gates & Universal gates, Binary arithmetic, SOP, POS, Canonical forms, NAND and NOR implementation, Binary codes - Binary code, gray code, Binary coded decimal, ASCII, Code conversions, Boolean expression simplification using Karnaugh Maps.

CO2: Design and implement combinational logic circuits. **L:9, P:6**

CO7: Demonstrate the combinational logic circuits using digital IC's and verilog HDL.

Implementation of Adder & Subtractor, Parallel adder, BCD Adder, Carry Look Ahead adder, Decoder, Implementation of Encoder & Multiplexer, Function realization using Multiplexer & Decoder, Comparator, Parity generator & checker, Driver and Multiplexed display.

CO3: Design and implement sequential logic circuits. **L:9, P:6**

CO8: Demonstrate the sequential logic circuits using digital IC's and verilog HDL.

CO11: **Develop the team spirit and communication skill through group activities.**

Latches, Flipflops - SR, JK, D & T, Master-slave FFs, Implementation of Shift registers and Asynchronous Counter – Up/Down Counter & Synchronous counter- Up/Down Counter, Modulus Counters, Ring Counter, Johnson Counter. Demonstration of shift register and ripple counters.

CO4: Design and analyze synchronous and asynchronous sequential circuits. **L:9, P:6**

CO9: Design and simulate the finite state machine for the given specification.

Design of synchronous sequential circuits- Moore, Mealy, Serial Adder Design, Synchronous FSM: State machine analysis: State diagram, state assignment, state minimization, Asynchronous sequential design- Hazards, Races. Verilog HDL programming for sequence detector.

CO5: Illustrate the operation of Logic families, Memory architecture and Programmable Logic devices. **L:9, P:6**

CO10: Simulate the circuits of various logic families.

TTL specifications, TTL, ECL, CMOS Logic Family and its Interfacing, Characteristics, Memory Elements – static RAM, dynamic RAM, ROM, EPROM, FPGA, Programmable Logic devices – PLA, PAL, PLD. Verilog HDL programming for TTL and CMOS circuits.

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design with an introduction to Verilog HDL", PHI, 6th Edition, 2018 Pearson Education, 2nd Edition, 2015.
2. Charles Roth, L.K.John, B.K.Lee, "Digital System Design using Verilog", Cengage, 1st Edition, 2016.

REFERENCES:

1. R.P. Jain, "Modern digital Electronics", Tata Mc-Graw Hill, 4th Edition, 2010.
2. Donald P.Leach, A.P.Malvino, Goutam Saha, "Digital Principles and Applications", Tata Mc-Graw Hill, 8th Edition, 2014.
3. James E. Palmer, David E. Perlman, "Schuams Outlines-Introduction to Digital Systems", Tata Mc-Graw Hill, Reprise Edition, 2020.
4. Thomas L.Floyd, "Digital Fundamentals", PHI, 11th Edition, 2017.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	COMPUTER NETWORKS	L	T	P	E	C
23EC35C		3	0	2	0	4

COURSE OUTCOMES

Upon the successful completion of the course, students will be able to

Theory Component

CO1: Demonstrate simple network model with physical layer concepts.
CO2: Design error free transmission of data and analyze data collision with various protocols.
CO3: Demonstrate various network layer protocols.
CO4: Implement and demonstrate TCP, UDP Protocols.
CO5: Demonstrate the real time applications of networks and SDN.

Practical Component

CO6: Design and validate a simple network
CO7: Analyze various Error Detection algorithms.
CO8: Analyze the protocols of network layer and transport Layer.
CO9: Analyze the protocols of Application layer.

Soft skill Component

CO10: Improve teamwork, communication, and develop problem-solving skills to solve complex Networking problems.

CO1: Demonstrate simple network model with physical layer concepts. **L:9, P:6**

CO6: Design and validate a simple network

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – Addressing – Types of Transmission Media, Switching in networks: Classification and requirements of switches, a generic switch, Crossbar switch and evaluation of blocking probability, Circuit switched networks – Packet switched networks. Experimentation and validation of simple network.

CO2: Recognize error free transmission of data and analyze data collision with various protocols. **L:9, P:6**

CO7: Analyze various Error Detection algorithms.

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – Experimentation and validation. Error Detection: Parity, LRC, VRC, CRC – Multiple Accesses: Random access – Controlled access. Wired LANS: IEEE standards – standard Ethernet – changes in the standard. Wireless LANS: IEEE 802.11: Architecture, MAC Sub layer, Addressing Mechanism - Experimentation and validation of MAC layer, Networking Commands.

CO3: Describe the various network layer protocols. **L:9, P:6**

CO8: Analyze the protocols in network layer and transport Layer.

Logical addressing: IPv4, IPv6 addresses - Internet Protocol: Internet working – IPv4, Ipv6 – Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, Delivery - Forwarding - Routing protocols – DSDV, OSPF – Experimentation and verification of protocols.

CO4: Implement and demonstrate TCP, UDP Protocols. **L:9, P:6**

CO8: Analyze the protocols in network layer and transport Layer.

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP)/ Internet Protocol (IP) Suite – Experimentation and verification of UDP/TCP/IP Suite. Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

CO5: Demonstrate the real time applications of networks and SDN. **L:9, P:6**

CO9: Analyze the protocols in Application layer.

Domain Name System (DNS) – E-mail – HTTP – FTP – WWW – Experimentation and validation of protocols. Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Evolution of SDN –SDN operations.

TEXT BOOKS

1. Larry Peterson Bruce Davie, "Computer Networks: A system Approach, 5th Edition, The Morgan Kaufmann Series in Networking Publisher, 2011.
2. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 4th Edition, 2011.

REFERENCES

1. Paul Goransson and Chuck Black, "Software Defined Networks: A comprehensive Approach", 1st Edition, Morgan Kaufmann, 2014.

2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
3. William Stallings, "Wireless Communication & Networking", Pearson Education Asia, 2009.

L: 45; P: 30; TOTAL: 75 PERIODS

23GN03C	**INTELLECTUAL PROPERTY RIGHTS STUDY**	**L**	**T**	**P**	**E**	**C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**0**	**0**	**0**	**4**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Experiential Component

CO1: Survey and practice the basic elements of existing patents.

CO2: Investigate and present the state of art technologies through effectual IP search.

Soft Skill Component

CO3: Present patent survey conclusions

CO1 Survey and practice basic elements of existing patents **30**

Basic elements of IPR – claims – infringements – Patent examination and Report - Case studies: patent survey.

CO2 Investigate and present the state of art technologies through effectual IP search **30**

Importance of IP search-factors to be considered for effective IP search-Hands-on Practice

REFERENCES

1. D.P. Mittal, "Indian Patents Law and Procedure", Taxman Publication, 2002
2. B.L. Wadera, "Patents, trademarks, copyright, Designs and Geographical Judications", 2010
3. P. Narayanan, "Intellectual Property Law", Eastern Law House, 2022
4. N.S. Gopalakrishnan & T.G.Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.

E:60 TOTAL:60 PERIODS