

# PANIMALAR ENGINEERING COLLEGE

An Autonomous Institution

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai



## CURRICULUM & SYLLABUS

### REGULATION 2023

for the students admitted during 2024-25

**B.TECH - ARTIFICIAL INTELLIGENCE AND  
MACHINE LEARNING**

[www.panimalar.ac.in](http://www.panimalar.ac.in)

# PANIMALAR ENGINEERING COLLEGE

An Autonomous Institution, Affiliated to Anna University, Chennai

(JAISAKTHI EDUCATIONAL TRUST)

*Bangalore Trunk Road, Varadharajapuram,  
Poonamallee, Chennai – 600 123.*



**B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**CURRICULUM AND SYLLABUS**

**REGULATION-2023**

(For the Students admitted during 2024-25)

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

### VISION

- To be a center of excellence in the field of Artificial Intelligence and Machine Learning applications through appropriate use and diffusion of emerging techniques

### MISSION

- To develop students with strong capabilities in Artificial Intelligence by continuously enhancing teaching and learning with state-of-the-art technologies.
- To provide high-quality, value-based education to gain competence in Artificial Intelligence and Machine learning in terms of research and innovation activities.
- To implement engineering solutions for the benefit of society by the use of AI and ML.



## PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

**PEO 1:** To perform well in their professional career by acquiring enough knowledge in the domain of Artificial Intelligence and Machine Learning.

**PEO 2:** To enable graduates to research, design and implement AI/ML products and services with effective Communication and Entrepreneurial Skills.

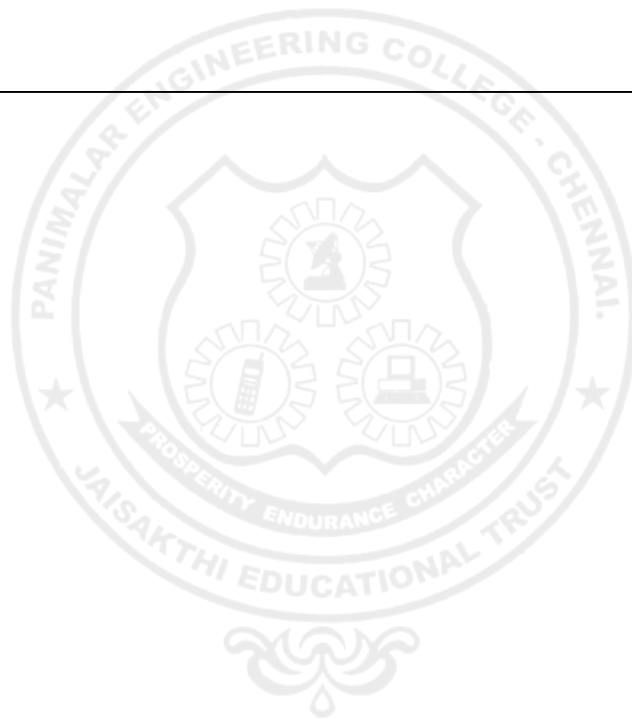
**PEO 3:** To modernize the students with evolving technology and use it for career Advancement.

## PROGRAM OUTCOMES (PO)

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

## PROGRAMME SPECIFIC OUTCOMES (PSO)

- PSO1:** Develop models in Data Science, Machine learning, Deep learning and Big data technologies, using AI and modern tools.
- PSO2:** Create solutions for interdisciplinary AI problems through acquired programming knowledge in the respective domains fulfilling with real- time constraints.



**B.Tech. - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING****CHOICE BASED CREDIT SYSTEM (CBCS)****I - VIII SEMESTERS CURRICULUM AND SYLLABI (REGULATION 2023)**

(For the Students admitted during 2024-25)

<b>Semester I</b>							
<b>S. No</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>Category</b>	<b>L/T/P</b>	<b>Contact Hours</b>	<b>Credit</b>	<b>Ext / Int Weightage</b>
<b>Theory Courses</b>							
1.	23MA1101	Matrices and Calculus	BS	3/1/0	4	4	60/40
2.	23ES1106	Programming in C	ES	3/0/0	3	3	60/40
<b>Theory Cum Practical Courses</b>							
3.	23HS1103	Communicative English and Language Skills I	HS	2/0/2	4	3	50/50
4.	23PH1103	Engineering Physics	BS	2/0/2	4	3	50/50
5.	23ES1102	Basic Electrical and Electronics Engineering	ES	3/0/2	5	4	50/50
<b>Laboratory Courses</b>							
6.	23ES1113	Programming in C Laboratory	ES	0/0/4	4	2	40/60
7.	23ES1114	Innovative Thinking and Prototype Development Laboratory	ES	0/0/4	4	2	40/60
<b>Mandatory Course</b>							
8.	23TA1101	தமிழர் மரபு / Heritage of Tamils	HS	1/0/0	1	1	60/40
9.	23HS1104	Interpersonal Communication skills I	EEC	0/0/2	2	0	0/100
10.	23HS1105	Quantitative Aptitude Practices I	EEC	0/0/1	1	0	0/100
<b>TOTAL</b>					<b>32</b>	<b>22</b>	

Semester II							
S. No	COURSE CODE	COURSE TITLE	Category	L/T/P	Contact Hours	Credit	Ext / Int Weightage
<b>Theory Courses</b>							
1.	23MA1203	Transforms and Vector Calculus	BS	3/1/0	4	4	60/40
2.	23AD1202	Data Structures and Analysis of Algorithms	PC	3/0/0	3	3	60/40
3.	23ES1206	Programming in Python	ES	3/0/0	3	3	60/40
<b>Theory Cum Practical Courses</b>							
4.	23HS1203	Communicative English and Language Skills II	HS	2/0/2	4	3	50/50
<b>Laboratory Courses</b>							
5.	23ES1212	Technical Skill Practices I	EEC	0/0/2	2	1	40/60
6.	23AD1212	Data Structures and Analysis of algorithms Laboratory	PC	0/0/4	4	2	40/60
7.	23ES1215	Programming in Python Laboratory	ES	0/0/4	4	2	40/60
<b>Mandatory Course</b>							
8.	23TA1201	தமிழரும் தொழில்நுட்பமும்/ Tamil and Technology	HS	1/0/0	1	1	60/40
9.		Mandatory Course I	MC	2/0/0	2	0	0/100
10.	23HS1204	Interpersonal Communication skills II	EEC	0/0/2	2	0	0/100
11.	23HS1205	Quantitative Aptitude Practice II	EEC	0/0/1	1	0	0/100
<b>TOTAL</b>					<b>30</b>	<b>19</b>	

## SEMESTER-I

23MA1101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

### COURSE OBJECTIVE:

- Matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view
- To introduce the concepts of limits, continuity, derivatives and maxima and Minima
- To familiarize the functions of two variables and finding its extreme points
- To provide understanding of various techniques of integration
- To introduce integral ideas in solving areas, volumes and other practical problems

### UNIT I

### MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix - Characteristic equation -Properties of Eigenvalues and Eigenvectors -Cayley Hamilton theorem -Diagonalization of matrices-Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

### UNIT II

### DIFFERENTIAL CALCULUS

9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) - Maxima and Minima of functions of one variable and its applications.

### UNIT III

### FUNCTIONS OF SEVERAL VARIABLES

9+3

Partial differentiation - Total derivative - Change of variables –Jacobian's- Taylor's series for functions of two variables - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers

### UNIT IV

### INTEGRAL CALCULUS

9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts - Bernoulli's formula- Integration of rational functions by partial fraction - Improper integrals.

### UNIT V

### MULTIPLE INTEGRALS

9+3

Double integrals in Cartesian and polar coordinates - Change of order of integration in Cartesian coordinates - Area enclosed by plane curves - Change of variables in double integrals -Triple integrals - Volume of Solids.

**TOTAL :60 PERIODS**

### COURSE OUTCOME

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

- CO1** Find Eigen values and Eigen vectors, diagonalization of a matrix, symmetric matrices, positive definite matrices.
- CO2** Apply limit definition and rules of differentiation to differentiate functions.
- CO3** Understand familiarity in the knowledge of Maxima and Minima, Jacobian, Taylor series and apply the problems involving Science and Engineering.





Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
40%				60 %





**TOTAL : 45 PERIODS**

**COURSE OUTCOME(S):**

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

- CO1** Learn the syntax for C programming
- CO2** Develop simple applications in C using basic constructs
- CO3** Design and implement applications using arrays and strings
- CO4** Develop and implement applications in C using functions and pointers.
- CO5** Develop applications in C using structures and union.
- CO6** Design applications using sequential and random access file processing

**TEXT BOOKS:**

1. Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016
2. Kernighan, B.W and Ritchie, D.M, —The C Programming language, Second Edition, Pearson Education, 2006.

**REFERENCE BOOKS:**

1. Paul Deitel and Harvey Deitel, — C How to Program, Seventh edition, Pearson Publication, 2015
2. Juneja, B. L and Anita Seth, —Programming in C, CENGAGE Learning India Pvt. Ltd.,2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011
5. Byron S. Gottfried, "Schism"s Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996

**WEB REFERENCES:**

1. <https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf>
2. <https://freecomputerbooks.com/langCBooks.html>

**ONLINE COURSES / RESOURCES:**

1. <https://www.programiz.com/c-programming>
2. <https://www.tutorialspoint.com/cprogramming/index.htm>
3. <https://www.javatpoint.com/c-programming-language-tutorial>
4. <https://www.geeksforgeeks.org/c-programming-language/>
5. [https://en.wikibooks.org/wiki/C\\_Programming](https://en.wikibooks.org/wiki/C_Programming)
6. <https://www.cprogramming.com/tutorial/c-tutorial.html?inl=hp>

## CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1		1						
CO2	2	1	1	1	2	1						
CO3	3	2	2	1	3	1						
CO4	3	2	2	1	3	1						
CO5	2	1	1	1	2	1						
CO6	2	1	1	1	2	1						

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				<b>60 %</b>



Listening: Listening for specific information. Speaking: Giving Short Talks on a given Topic. Reading: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open-Ended and Closed Questions). Writing: Writing Permission Letters/Editor, Complaint, and Invitation. Emails and Review Writing-Books, Films. Grammar: Adverb, Prepositions & Conjunctions. Vocabulary Development: Collocations —Fixed Expressions.

**ACTIVITY:** Preparing Permission letters and short talks and presentation on various topics related to professions.

#### **UNIT IV COMMUNICATION AT WORK PLACE 6**

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making .Speaking: Small Group Discussion, Giving Recommendations. Reading: Reading Problem —Solution Articles/Essays Drawn from Various Sources .Writing: Making Recommendations. Grammar: Subject-Verb Agreement, Framing Questions. Vocabulary Development: Infinitives and Gerunds, Reference Words, Technical Vocabulary.

**ACTIVITY:** Listening to Group Discussion and sharing recommendation.

#### **UNIT V DEFINITIONS AND PRODUCT DESCRIPTION 6**

Listening: Listening to a Product Description (labeling and Gap Filling) Exercises. Speaking: Describing a Product and Comparing and contrasting it with Other Products. Reading: Reading Graphical Material for Comparison (Advertisements). Writing: Essay Writing. Compare and Contrast Paragraphs, Essay writing. Grammar: Phrasal Verbs – Cause and Effect Sentences –Compound Nouns and Definitions. Vocabulary Development: Use of Discourse Markers.

**ACTIVITY:** Reading about the modern gadgets and describing them.

**TOTAL :30 PERIODS**

#### **COURSE OUTCOME**

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

- CO1** Comprehend conversation and short talks delivered in English.
- CO2** Participate effectively in informal conversation; introduce themselves and their friends and express opinions English.
- CO3** Read articles of a general kind in magazines and newspaper.
- CO4** Write short essays of a general kind and personal letters and emails in English.
- CO5** Recognize the use of grammar in speech and writing.

#### **TEXT BOOKS:**

1. N P Sudharshana & C Savitha. English for Technical Communication Delhi: CUP, 2019.
2. Board of Editors. English for Engineers and Technologists Volume 1 Orient Black Swan Limited, 2020

## REFERENCE BOOKS:

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black Swan Limited, 2017
2. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
4. Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA:2007
5. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005.

## WEB REFERENCES:

1. <https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/wordformation>
2. [https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316\\_21.pdf](https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316_21.pdf)
3. <http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm>
4. <https://www.edudose.com/english/grammar-degree-of-comparison-rules/>

## ONLINE COURSES / RESOURCES:

1. <https://basicenglishspeaking.com/wh-questions/>
2. <https://agendaweb.org/verbs/modals-exercises.html>
3. <https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf>
4. <https://www.ego4u.com/en/cram-up/grammar/prepositions>

**LANGUAGE SKILLS LAB**

**30 Hours**

**LIST OF EXPERIMENTS**



1. Listen to lectures- articulate a complete idea as opposed to producing fragmented utterances- Tedtalks, Science Fiction- My Fair Lady
2. Listening – following, responding to explanations, giving directions and instructions in academic and business contexts- IELTS, TOEFL.
3. Listening to transcripts and answer to the questions.
4. Listening for specific information: accuracy and fluency – BEC.
5. Reading: Different Text Type.
6. Reading: Predicting Content using pictures and titles.
7. Reading: Use of Graphic Organizers to review.
8. Reading: Aid Comprehension.
9. Reading: Speed Reading Techniques.
10. Reading and Comprehending the passages in the competitive exams like GATE, TOEFL, GRE, IELTS, and other exams conducted by Central and state governments.

#### REFERENCE:

1. Suresh Kumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Blackswan: Hyderabad,2012
2. Davis, Jason and Rhonda Liss. Effective Academic Writing (level 3) Oxford University Press: Oxford,2006
3. Withrow, Jeans and et al. Inspired to write. Reading and Tasks to develop writing skills. Cambridge University Press: Cambridge,2004

#### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2									3	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2
CO6									3	3		2

<b>Assessment</b> (40% weightage) (Theory Component)		<b>Assessment</b> (60% weightage) (Laboratory Component)		<b>End Semester Examination</b>
<b>Individual Assignment / Case Study / Seminar / Mini Project</b>	<b>Written Test</b>	<b>Evaluation of Laboratory Observation, Record</b>	<b>Test</b>	<b>Written Examination</b>
<b>40</b>	<b>60</b>	<b>75</b>	<b>25</b>	
<b>100</b>				<b>100</b>
<b>50 %</b>				<b>50 %</b>





Divergence – curl – integral calculus – Gauss divergence theorem – Stoke's theorem – equation of continuity – displacement current – Maxwell's equations – Gauss's laws – Faraday's law – Ampere-Maxwell law – Hertz observation – production and detection of electromagnetic wave – mechanism of electromagnetic wave propagation – properties of electromagnetic waves

**TOTAL : 30 PERIODS**

### **COURSE OUTCOME**

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

- CO1** Understand the basics properties of materials, especially elastic and thermal properties of materials.
- CO2** Have adequate knowledge on the concepts of semiconducting and magnetic materials and their applications in memory storage.
- CO3** Acquire the knowledge on the concepts of lasers, fiber optics and their technological applications.
- CO4** Get knowledge on fundamental concepts of quantum theory, nanoscience its applications.
- CO5** Gain knowledge on the basics of electromagnetic waves and its properties.

### **TEXT BOOKS:**

1. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
3. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017
4. Karl.F.Reck, Basics of laser physics: for students of science and engineering, Second edition, Springer Publications

### **REFERENCE BOOKS:**

1. Halliday, D., Resnick, R. & Walker, J.—Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. — Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
3. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016), ISBN 978-93-80386-86-7

## LIST OF EXPERIEMENTS

1. Determination of Moment of Inertia of the disc and Rigidity Modulus of the material of the wire – Torsional Pendulum
2. Determination of Young’s Modulus – Non - Uniform Bending
3. Determination of Thermal Conductivity of the Bad Conductor – Lee’s Disc Method
4. Determination of thickness of a thin wire – Air wedge method
5. (i) Determination of wavelength of Laser using Grating and Particle size determination  
(ii) Determination of Numerical Aperture and Acceptance angle of an Optical Fibre
6. Determination of Velocity of ultrasonic waves in a liquid and compressibility of the liquid – Ultrasonic Interferometer
7. Determination of wavelength of Hg source using Grating by normal incidence method using spectrometer
8. Determine the energy band gap of a semiconductor

**30 HOURS**

### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1						
CO2	3	3	2	1	2	1						
CO3	3	3	2	2	2	1						1
CO4	3	3	1	1	2	1						
CO5	3	3	1	1	2	1						

<b>Assessment</b> (40% weightage) (Theory Component)		<b>Assessment</b> (60% weightage) (Laboratory Component)		<b>End Semester Examination</b>
<b>Individual Assignment / Case Study / Seminar / Mini Project</b>	<b>Written Test</b>	<b>Evaluation of Laboratory Observation, Record</b>	<b>Test</b>	<b>Written Examination</b>
<b>40</b>	<b>60</b>	<b>75</b>	<b>25</b>	
<b>100</b>				<b>100</b>
<b>50 %</b>				<b>50 %</b>



23ES1102	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

### COURSE OBJECTIVE:

- To learn the concepts related with Electrical circuits and Wiring
- To study the concept of electrical machines
- To understand basics of Semiconductor Devices
- To understand the basics of Sensors and Actuators
- To develop IOT infrastructure for Real time applications

### UNIT I BASIC ELECTRICAL CIRCUITS AND HOUSE WIRING 9

Electrical Quantities — Ohms Law — Kirchhoff's Law — Series and Parallel Connections —Earthing and its Types- basic house wiring - tools and components, different types of wiring, safety measures at home and industry. **Case Study** -staircase Wiring and ceiling fan Wiring.

### UNIT II ELECTRICAL MACHINES 9

Construction, Working Principle of Dc motors, Brushless dc motor, Permanent magnet DC Motor, stepper motor, Servo Motor(No Problems). -Application of motor in Industrial automation

### UNIT III SEMICONDUCTOR DEVICES AND CIRCUITS 9

PN junction diode -Zener diode — Half wave and Full wave rectifier, - BJT, MOSFET,IGBT- Characteristics- **Case Study**: SMPS in computer and UPS in Residential Application

### UNIT IV SENSORS AND ACTUATORS 9

Sensors: Temperature Sensor- Pressure Sensor-Proximity Sensor, Ultrasonic sensors. Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals. **Case Study**: Integrated sensor and actuator systems in automation

### UNIT V EMERGING TECHNOLOGIES 9

Solar PV system- solar and battery powered Electric Vehicle - IOT Concept and its Functional blocks- Introduction to Arduino Uno. Case Study: Smart and Connected Cities: Smart Lighting- Smart Parking Architecture - Smart Traffic Control

**TOTAL :45 PERIODS**

### COURSE OUTCOME

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

- CO1** Acquire basic knowledge on Basic Electrical circuits and House Wiring
- CO2** Understand the construction, working principle and applications of DC and AC Machines
- CO3** Acquire basic knowledge on semiconductor devices and their applications
- CO4** Illustrate the concepts of Sensors and Actuators

**CO5** Identify and analyse Various Emerging Technologies

**CO6** Analyse the applications of IOT in real time scenario

**TEXT BOOKS:**

1. Hughes revised by Mckenzie Smith with John Hilcy and Keith Brown, Electrical and Electronics Technology, 8th Edition, Pearson, 2012.
2. R.J. Smith, R.C. Dorf, Circuits Devices and Systems, 5th Edition, John Wiley and sons, 2001
3. P. S. Dhogal, Basic Electrical Engineering – Vol. I & II, 42nd Reprint, McGraw Hill, 2012.
4. Clarence W. de Silva, “Sensors and Actuators: Engineering System Instrumentation”, 2nd Edition, CRC Press, 2015
5. David Hanes, Gonzalo Salgueiro, Patrick Grossetete. Rob Barton and Jerome Henry, "IOT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

**REFERENCE BOOKS:**

1. Del Toro, "Electrical Engineering Fundamentals" Pearson Education, New Delhi, 2007
2. Smarjit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2<sup>nd</sup> Edition 2007
3. Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things – Key applications and Protocols II, Wiley, 2012

**WEB REFERENCES:**

1. <https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/basic-course>
2. <https://www.infoq.com/articles/internet-of-things-reference-architecture/>

**ONLINE COURSES / RESOURCES:**

1. <https://archive.nptel.ac.in/courses/117/106/117106108/>
2. <https://archive.nptel.ac.in/courses/108/105/108105155/>
3. [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

**LANGUAGE SKILLS LAB**

**30 Hours**

**LIST OF EXPERIMENTS**



1. (i) Study of Electronic components and equipment"s – Resistor, colour coding (ii) Soldering practice – Components Devices and Circuits–Using general purpose PCB
2. Electrical House Wiring:
  - (i)Residential house wiring using switches, fuse, indicator, lamp and energy meter. (ii)Fluorescent lamp wiring
  - (iii)Stair case wiring
  - (iv)Study of Home Appliances- wiring and assembly
3. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
4. Design of Half wave Rectifier & Full wave Rectifier
5. Simulation of following circuits using suitable software (i)Seven segment LED display (ii)Stepper Motor control (iii)Traffic Light Control
6. 2D & 3D Electrical wiring Model using suitable Software.

**SOFTWARE REQUIRED: Keil/Proteus/Fusion 360**

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1		1					1
CO2	3	2	2	2	1		1					1
CO3	3	2	2	2	1		1					1
CO4	3	2	2	2	1		1					1
CO5	3	2	2	2	1		1					1
CO6	3	2	3	3	3		1					1

<b>Assessment</b> (40% weightage) (Theory Component)		<b>Assessment</b> (60% weightage) (Laboratory Component)		<b>End Semester Examination</b>
<b>Individual Assignment / Case Study / Seminar / Mini Project</b>	<b>Written Test</b>	<b>Evaluation of Laboratory Observation, Record</b>	<b>Test</b>	<b>Written Examination</b>
<b>40</b>	<b>60</b>	<b>75</b>	<b>25</b>	
<b>100</b>				<b>100</b>
<b>50 %</b>				<b>50 %</b>



23ES1113	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

## COURSE OBJECTIVE

To impart Knowledge on the following topics:

- Write, test, and debug simple C programs
- Implement C programs with conditional and looping statement
- Develop applications in C using strings, pointers, functions
- Implement C programs with structures and union
- Develop applications in C using file processing
- Develop an application in real time situation

## LIST OF EXPERIMENTS

1. Programs using I/O statements and expressions
2. Programs using decision-making constructs
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number
5. Check whether a given number is Armstrong number or not?  
Given a set of numbers like <10, 36, 54, 89, 12, 27>,  
find sum of weights based on the following conditions
6.
  - a) if it is a perfect cube
  - b) if it is a multiple of 4 and divisible by 6
  - c) if it is a prime number
  - d) Sort the numbers based on the weight in the increasing order as shown below <10,its weight>,<36,its weight><89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. Given a string —a\$bcd./fgll find its reverse without changing the position of special characters. (Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using userdefined functions
10. From a given paragraph perform the following using built-in functions:
  - a) Find the total number of words.
  - b) Capitalize the first word of each sentence.
  - c) Replace a given word with another word
11.
  - a) Sort the list of numbers using Selection sort and insertion sort
  - b) Sort the list of numbers using pass by reference
12. Search an element from an unsorted array using linear search Search an element in an array using Binary search recursion call

13. Generate salary slip of employees using structures and pointers  
Programs using Pointers
  - a. Pointer demonstration the use of & and \*
  - b. Access Elements of an Array Using Pointer
  - c. Perform the string operations like Length of the String ,
  - d. Concatenation of string and compare the string using Pointer
14.
  - e. Count number of words, digits, vowels using pointers
  - f. Add two matrices using Multidimensional Arrays with pointers
  - g. Multiply two matrices using pointers
  - h. Multiply two numbers using Function Pointers
15. Compute internal marks of students for five different subjects using structures and functions
16. Program to demonstrate the difference between unions and structures
17. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file
18. Count the number of account holders whose balance is less than the minimum balance using sequential access file

#### **MINI PROJECT**

Create a Railway reservation system with the following modules

19.
  - a. Booking
  - b. Availability checking
  - c. Cancellation
  - d. Prepare chart

**TOTAL: 60 PERIODS**

#### **COURSE OUTCOMES**

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

- CO1** Write, test, and debug simple C programs
- CO2** Implement C programs with conditionals and loops
- CO3** Develop C programs for simple applications making use arrays and strings
- CO4** Develop C programs involving functions, recursion, pointers, and structures and union
- CO5** Design applications using sequential and random access file processing
- CO6** Perform task as an individual and / or team member to manage the task in time

#### **WEB REFERENCES**

1. <https://www.programiz.com/c-programming/examples>
2. <https://beginnersbook.com/2015/02/simple-c-programs/>
3. <https://www.programmingsimplified.com/c-program-examples>
4. <https://www.tutorialgateway.org/c-programming-examples/>
5. <https://www.javatpoint.com/c-programs>
6. [https://www.tutorialspoint.com/learn\\_c\\_by\\_examples/simple\\_programs\\_in\\_c.htm](https://www.tutorialspoint.com/learn_c_by_examples/simple_programs_in_c.htm)

### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2								
CO2	3	2	2	1	3							
CO3	3	3	3	2	3							
CO4	3	2	2	1	3							
CO5	3	3	3	2	3							
CO6	3	2	2	1	3							

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23ES1114

**INNOVATIVE THINKING AND PROTOTYPE  
DEVELOPMENT LABORATORY**

L	T	P	C
0	0	4	2

**COURSE OBJECTIVE:**

To impart Knowledge on the following topics:

- To demonstrate the essence of agile development methods and create a GitHub repository.
- To acquire practical knowledge for Designing using Adobe Photoshop, COREL Draw.
- To Gain Knowledge, in CANVA Tools.
- Apply the basic knowledge of design thinking in project work.
- Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects.

**LIST OF EXPERIMENTS**

1. Introduction to GIT Setting a GIT repository. Create a repository in a GitHub for a team.
2. Design your college Logo using COREL Draw tools.
3. Design a visiting card using COREL Draw tools.
4. Adobe Photo Shop Tools – Magnetic Lasso Tool –image, Patch Tool – Smudge Tool, Blur-Filter Tool.
  - a. Make Selections with the Magnetic Lasso Tool
  - b. Replace unwanted content with the patch tool and Apply filter to it
  - c. Work with the smudge tool to smooth and blend colors.
  - d. Blur areas in an image with Blur tool.
5. Timeline & Trimming adding, arranging, and trimming video clips, images, and audio tracks. Using CANVA Tools.
6. Learn basic CHAT GPT tools and perform Provide the text to ChatGPT and tell it what you're looking for/what you want it to find.
7. Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of England?"
8. Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate

the rest of the content. This can be a fun way to brainstorm creative ideas.

Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

9. Design of 3D printing using Fusion 360 and product development.
10. Write CNC programming for CNC Lathe and Milling.
11. Create design for CNC router for ART cam software.
12. Create a PCB design for product Development
13. Develop The Mini Project Using Idea Lab.

**TOTAL:60 PERIODS**

### **COURSE OUTCOME(S):**

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

- CO 1** Define agile development methods in software development practices
- CO 2** Identify the various tools used to Edit Videos using CANVA tools.
- CO 3** Apply the Knowledge for Designing using Photo Shop ,COREL draw
- CO 4** Implement the usage of ChatGPT and its tools.
- CO 5** Design thinking using 3D Printer
- CO 6** Develop a simple PCB boards using etching and milling Process

### **TEXT BOOKS:**

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Ninth Edition, 2020.
2. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
3. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
4. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017

**WEB REFERENCES:**

1. <https://www.raypcb.com/video-electronics-pcb>
2. <https://www.coursera.org/courses?query=3d%20printing>
3. <https://www.coursera.org/courses?query=photoshop>

**CO - PO & PSO MAPPING**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	3		3						3		3		
<b>CO2</b>	3	3	3		3						3		2		
<b>CO3</b>	3	3	3		3						2		3		
<b>CO4</b>	3	3	3		3						2		3		
<b>CO5</b>	2	3	3							3	3		2		
<b>CO6</b>	2	3	3							3	3		3		

<b>Internal Assessment</b>		<b>End Semester Examination</b>	
<b>Evaluation of Laboratory Observation, Record</b>	<b>Test</b>	<b>Practical</b>	
<b>75</b>	<b>25</b>	<b>100</b>	
<b>60 %</b>		<b>40%</b>	



23TA1101	HERITAGE OF TAMIL	L	T	P	C
		1	0	0	1

**UNIT – I LANGUAGE AND LITERATURE 3**

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.

**UNIT – II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – 3  
SCULPTURE**

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

**UNIT – III FOLK AND MARTIAL ARTS 3**

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

**UNIT –IV THINAI CONCEPT OF TAMILS 3**

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

**UNIT –V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL 3  
MOVEMENT AND INDIAN CULTURE**

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

**Total : 15 PERIODS**

**TEXT-CUM 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)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published 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 by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (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

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
40%				60 %



23TA1101	தமிழர் மரபு	L	T	P	C
		1	0	0	1

**UNIT – I**

**மொழி மற்றும் இலக்கியம்**

**3**

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

**UNIT – II**

**மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை**

**3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**UNIT – III**

**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**

**3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**UNIT –IV**

**தமிழர்களின் திணைக் கோட்பாடுகள்**

**3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT -V

**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**

3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்புகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**Total : 15 PERIODS**

**TEXT-CUM 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)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published 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 by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	100
40%				60 %

23HS1104	INTERPERSONAL COMMUNICATION SKILLS I	L	T	P	C
		0	0	2	0

## COURSE OBJECTIVES

- To induce the basic reading and writing skills among the first year engineering and technology students.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications
- To succor the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments
- To improve your English communication skills in a professional setting

## CONTENTS

**Listening:** Listening to Specific Information – About various Professions, Professionals, Work Cultures, Demands of industry and expectation

**Speaking:** Sharing information with friends/colleagues/teachers/employers

**Reading:** Reading Comprehension – About the famous and leading personalities in the industry and various fields as motivation

**Writing:** Writing about personalities in one's own words

**TOTAL : 30 PERIODS**

## TEXT BOOKS

1. Crucial Conversations: Tools for Talking When Stakes Are High by Kerry Patterson, Joseph Grenny, Ron McMillan, and Al Switzler, 2014
2. 2. Simply Said: Communicating Better at Work and Beyond by Jay Sullivan, 2016

## REFERENCE BOOKS

1. Words That Work: It's Not What You Say, It's What People Hear by Dr. Frank Luntz, 2011.
2. The Fine Art of Small Talk: How To Start a Conversation, Keep It Going, Build Networking Skills — and Leave a Positive Impression! By Debra Fine

## WEB REFERENCES

1. <https://teambuilding.com/blog/communication-books>
2. <https://unacademy.com/content/upsc/study-material/science-and-technology/famous-personalities-in-science/>

### **ONLINE COURSES / RESOURCES**

1. <https://www.krisamerikos.com/blog/phone-conversation-in-english>
2. <https://blog.hubspot.com/service/phone-etiquette>

### **COURSE OUTCOME**

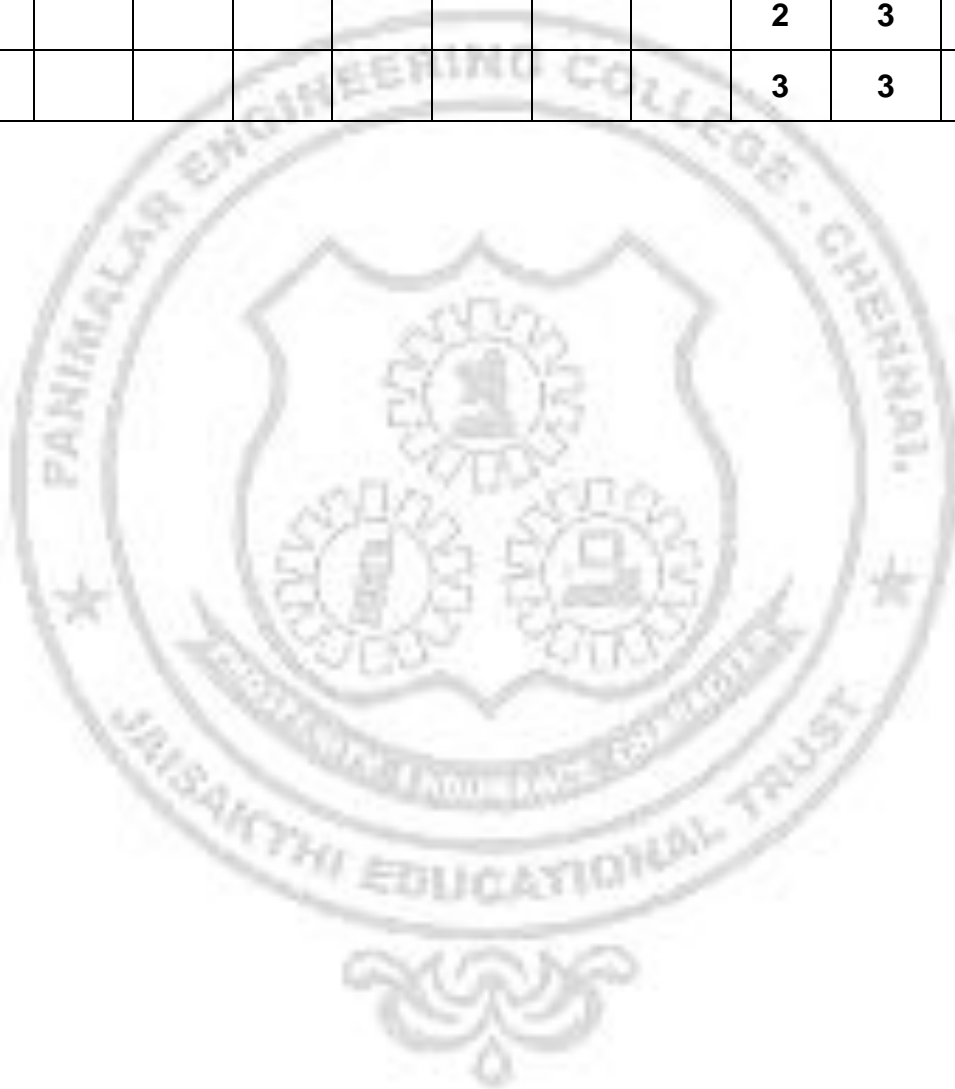
Upon completion of the course, students will be able to:

- CO1** Comprehend conversation and short talks delivered in English.
- CO2** Participate effectively in informal conversation; introduce themselves and their friends and express opinions in English.
- CO3** Read articles of a general kind in magazines and newspapers.
- CO4** Write short essays of a general kind and personal letters and emails in English.
- CO5** Gain understanding of basic grammatical structures and use them in the right context.
- CO6** Use appropriate words in a professional context.



### CO&PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2									3	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2
CO6									3	3		2



23HS1105	QUANTITATIVE APTITUDE PRACTICES I	L	T	P	C
		0	0	1	0

**COURSE OBJECTIVE:**

- To strengthen students understanding of number systems, algebra and assist them in developing their problem-solving skills.
- To get the abilities needed to address challenges with quantitative aptitude.

**Module 1 Number system**

**3**

Numbers - HCF and LCM- simplification - square root - cube root.

**Module 2 Algebra**

**3**

Algebra - decimal fraction - arithmetic progression - geometric progression.

**Module 3 Blood relations**

**3**

Blood relations - pattern sequence - alphabet test question – clocks-calenders.

**Module 4 Data Interpretation**

**3**

Table chart- pie chart - bar chart - line charts

**TOTAL : 12 PERIODS**

**COURSE OUTCOME:**

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

- CO1** Demonstrate solid understanding to address number system and algebraic problems.
- CO2** Handle problems with the blood relations and data interpretation.

**TEXT BOOKS:**

1. Aggarwal R.S.(2017).Quantitative Aptitude for Competitive Examinations 3rd edition New Delhi: S.Chand Publishing.
2. Abhijit guha(2016). Quantitative Aptitude for All Competitive Examinations, 6th edition. Noida : McGraw Hill Education Pvt. Ltd.
3. FACE.(2016). Aptipedia Aptitude Encyclopedia1(Ed.).New Delhi: Wiley Publications.

**REFERENCE BOOK:**

1. Sharma arun. (2016).Quantitative aptitude, 7<sup>th</sup> (Ed.).Noida : McGraw Hill Education Pvt. Ltd.
2. Praveen. R.V 3<sup>rd</sup> edition, Quantitative aptitude and reasoning, PHI learning publication.

**WEB REFERENCES:**

[https:// www.indiabix.com](https://www.indiabix.com)

**Mode of Evaluation: Online Test**

## SEMESTER – II

23MA1203	TRANSFORMS AND VECTOR CALCULUS	L	T	P	C
		3	1	0	4

### COURSE OBJECTIVE:

- To acquaint the student with the concepts of vector calculus needed for problems in AI&DS discipline.
- Introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- To develop Z transform techniques for discrete time systems

### UNIT - I **VECTOR CALCULUS** **9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vectorfields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem(excluding proofs) – Simple applications involving cubes and rectangular parallelepiped.

### UNIT - II **FOURIER SERIES** **9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Harmonic analysis.

### UNIT - III **FOURIER TRANSFORMS** **9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

### UNIT - IV **LAPLACE TRANSFORM** **9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions– Basicproperties – Transforms of derivatives and integrals of functions - Derivatives and integralsoftransforms - Transforms of unit step function and impulse functions – Transform of periodic functions.Inverse Laplace transforms -Statement of Convolution theorem – Initial and final value theorems.

### UNIT - V **Z-TRANSFORMS AND DIFFERENCE EQUATIONS** **9+3**

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z – transform.

**TOTAL : 60 PERIODS**

### **COURSE OUTCOME(S):**

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

- CO1** Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- CO2** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- CO3** Determine the Fourier transforms for a function and evaluates special integrals.
- CO4** To find out Laplace transform for a function using the properties
- CO5** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

### **TEXT BOOKS:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
3. Narayanan.S, Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics For Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

### **REFERENCE BOOKS:**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics", Sixth Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.
7. Nagarajan. G and Sundar Raj. M, "Transforms and Partial Differential Equations" 5<sup>th</sup> Edition, Sree Kamalamani Publications, Chennai, 2020.

### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									1
CO2	3	3	3									1
CO3	3	3	3									1
CO4	3	3	3									1
CO5	3	3	3									1

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				

23AD1202	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

**COURSE OBJECTIVE:**

- To design linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees.
- To learn sorting, searching and indexing methods to increase the knowledge of usage of data structures in algorithmic perspective
- To select and design data structures and algorithms that is appropriate for problems
- To understand the concepts behind NP Completeness, Approximation algorithms

**UNIT - I ABSTRACT DATA TYPES AND LINEAR DATA STRUCTURES 9**

Abstract Data Types (ADTs) - Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions Infix to Postfix conversion – Queue ADT – Operations – Circular Queue – DE Queue – Applications of Queues.

**UNIT - II NON-LINEAR DATA STRUCTURES 9**

Tree – Binary tree ADT-Tree -Traversals Algorithms –Search Tree – Binary Search Trees-AVL Trees (Insertion, Deletion) –Splay Trees (Insertion, Deletion, Searching)-Red-Black Trees.

**UNIT - III DIVIDE AND CONQUER STRATEGY AND GREEDYSTRATEGY 9**

Divide and Conquer Strategy: Quick Sort-Multiplication of large integers and Strassen's Matrix Multiplication. Greedy Technique: Prim's Algorithm - Kruskal's Algorithm- Dijkstra's Algorithm - Huffman Trees and Code.

**UNIT - IV DYNAMIC PROGRAMMING AND BACKTRACKING 9**

Dynamic Programming: Computing binomial coefficient - Warshall's and Floyd's algorithm. Backtracking: General method – N Queens Problem – Hamiltonian Circuits .Exhaustive search: DFS, BFS.

**UNIT - V BRANCH-AND-BOUND,NP PROBLEMS AND APPROXIMATION ALGORITHMS 9**

Branch and Bound-Assignment -Knapsack problem – Traveling salesman problem - NP-Complete and NP-Hard problems. Approximation Algorithms - NP Hard Problems-Knapsack and Travelling Sales Man Problem

**TOTAL : 45 PERIODS**

## **COURSE OUTCOME(S):**

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

- CO1** Design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
- CO2** Implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting.
- CO3** Analyse and design various problems using divide and conquer and greedy strategy
- CO4** Create the algorithms using dynamic programming and backtracking and to solve problems.
- CO5** Apply Branch and Bound technique to different real time applications.
- CO6** Solve problems using approximation algorithms.

## **TEXT BOOKS:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, —Data Structures & Algorithms in PythonII, John Wiley & Sons Inc., 2021.
2. Anany Levitin, "Introduction to design and analysis of algorithms",3rd Edition,Pearson Education,2017.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, New Delhi, 2012.

## **REFERENCE BOOKS:**

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.
2. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C++II, Fourth Edition,Pearson Education, 2014.
3. Sara Baase and Allen Van Gelder, Computer Algorithms – Introduction to Design & Analysis, Third Edition, Pearson Education, New Delhi, 2000.
4. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, New Delhi, 2012.
5. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Sorce, Gurgaon, 1976
6. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms,Second Edition, Universities Press, Hyderabad, 2008.

## **WEB REFERENCES:**

- 1.<https://www.geeksforgeeks.org/c-language-set-1-introduction/>
- 2.<https://www.codechef.com/certification/data-structures-and-algorithms/prepare>
- 3.<https://www.w3schools.in/data-structures-tutorial/intro/>

**ONLINE COURSES / RESOURCES:**

1. <https://nptel.ac.in/courses/>
2. <https://www.w3schools.in/data-structures-tutorial/>
3. [https://www.tutorialspoint.com/data\\_structures\\_algorithms/](https://www.tutorialspoint.com/data_structures_algorithms/)

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2					1	1	1	2
CO2	2	3	1	2					2	2	1	2
CO3	2	1		1					2	1	1	2
CO4	1	2	3	1								
CO5	1	1										
CO6	1	1										

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				<b>60 %</b>



23ES1206	PROGRAMMING IN PYTHON	L	T	P	C
		3	0	0	3

**COURSE OBJECTIVE:**

- To know the basic programming constructs and control structures in python
- To use python data structures – Lists, Tuples and Dictionary
- To define Python functions and use Strings
- To learn about input/output with files in Python.
- To understand python packages and GUI concepts

**UNIT - I INTRODUCTION TO PYTHON PROGRAMMING AND CONTROL STRUCTURES 9**

Introduction to Python, Demo of Interactive and script mode, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions, Type Casting. Illustrative problems: find minimum in a list, guess an integer number in a range, Towers of Hanoi.

Control Structures: Selective statements – if, if-else, nested if, if – elif ladder statements ; Iterative statements - while, for, range functions, nested loops, else in loops, break, continue and pass statements. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT - II FUNCTIONS AND STRINGS 9**

Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion and Lambda functions. Illustrative programs: power of a number, sorting, Fibonacci series using lambda.

Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions, Regular expression: Matching the patterns, Search and replace. Illustrative programs: check whether the string is symmetrical, reverse a string, length of a string.

**UNIT - III COLLECTIONS 9**

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions  
Tuples: Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.

Illustrative programs: Interchange first and last element in a list, maximum and minimum N elements in a tuple, sort dictionary by key or value, size of a set.

**UNIT -IV FILES AND EXCEPTION HANDLING 9**

Files: Open, Read, Write, Append and Close. Tell and seek methods. Illustrative programs: word count, copy file.

Command line arguments, Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-Up actions.

Illustrative programs: prompt the user to input an integer and raises a Value Error exception if the input is not a valid integer, open a file and handles a File Not Found Error exception if the file does not exist, prompt the user to input two numbers and raises a Type Error exception if the inputs are not numerical, executes an operation on a list and handles an Index Error exception if the index is out of range.

## **UNIT -V**

## **PACKAGES & GUI**

**9**

**Python packages:** Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc. Illustrative programs: create a pandas series using numpy, make a pandas data frame with 2D list.

**GUI Programming:** Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples. Python programming with IDE. Illustrative programs: create a GUI marksheet, calendar, file explorer using Tkinter,

**TOTAL: 45 PERIODS**

### **COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

- CO1** Illustrate conditionals and loops for solving problems using Python programs.
- CO2** Express proficiency in the handling of strings and functions
- CO3** Apply Python lists, tuples, dictionaries, sets etc to Represent compound data
- CO4** Compare and contrast reading and writing data from/to files and handle exceptions in Python programs.
- CO5** Experiment with python packages in data analysis and design GUI
- CO6** Build real time applications using problem solving concepts in python.

### **TEXT BOOKS:**

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. ReemaThareja,"Problem Solving and Programming with Python", 2<sup>nd</sup> edition, Oxford University Press, New Delhi, 2019.
3. Alan D. Moore, Python GUI Programming with Tkinter, Design and Build Functional and User-friendly GUI Applications, Packt Publishing, 2021.

### **REFERENCE BOOKS:**

1. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018
2. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
3. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

**ONLINE COURSES / RESOURCES:**

1. <https://docs.python.org/3/tutorial/>
2. <https://www.w3schools.com/python/>
3. <https://www.tutorialspoint.com/python/index.htm>
4. <https://www.javatpoint.com/python-tutorial>
5. <https://nptel.ac.in/courses/>

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	1	2							1
CO2	2	3	3	1	2							1
CO3	2	3	3	1	2							1
CO4	2	3	3	1	2							1
CO5	2	3	3	1	2							1
CO6	2	3	3	1	2							1

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				<b>60 %</b>

23HS1203	COMMUNICATIVE ENGLISH AND LANGUAGE SKILLS II	L	T	P	C
		2	0	2	3

### COURSE OBJECTIVE:

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
- To improve the relevant language skills necessary for professional communication
- To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification and developing their speaking skills and to speak fluently in real contexts.
- To improve the verbal ability skill and communicative skill of the students.
- To prepare them for various public and private sector exams & placement drives.

### UNIT I INTERPERSONAL COMMUNICATION 6

**Listening:** Listening to Telephone Etiquettes and Conversations. **Speaking:** Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks. **Reading:** Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting). **Writing:** Writing a Short Biography of an Achiever Based on Given Hints, **Grammar:** Punctuation, Numerical Expressions and Sentence pattern. **Vocabulary Development:** Idioms and Phrases

**ACTIVITY:** Writing and speaking about achievements of eminent personalities

### UNIT II TECHNICAL COMMUNICATION 6

**Listening:** Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. **Speaking:** Participating in Debates, TED Talks. **Reading:** Reading Technical Essays/ Articles and Answering Comprehension Questions. **Writing:** Summary Writing, Minutes of the meeting. **Grammar:** Prepositional Phrases and Relative Clauses. **Vocabulary Development:** Abbreviations and Acronyms.

**ACTIVITY:** Reading transcripts of TED Talks and presenting them

### UNIT III PROCESS DESCRIPTION 6

**Listening:** Listening to a Process Description and Drawing a Flowchart. **Speaking:** Participating in Group Discussions, Giving Instructions, Presentation. **Reading:** Reading Instruction Manuals **Writing:** Process Descriptions – Writing Instructions **Grammar:** Use of Imperatives, Order of Adjectives, Impersonal Passive Voice and Phrasal verbs **Vocabulary Development:** Misspelt words. Homophones and Homonyms.

**ACTIVITY:** Reading Newspaper articles and presenting them

### UNIT IV REPORT WRITING 6

**Listening:** Listening to a Presentation and Completing Gap-Filling Exercises. **Speaking:** Making Formal Presentations, **Reading:** Reading and Interpreting Charts/Tables and diagrams. **Writing:** Interpreting Charts/Tables and Diagrams, Writing a Report. **Grammar:** Reported Speech; Interrogatives- Question Tags and Articles – omission of articles  
**Vocabulary Development:** Technical Jargon

**ACTIVITY:** Presentation on Technical and non-technical topics of interests with reference to IELTS

## **UNIT V INTERVIEW SKILLS 6**

**Listening:** Listening to a Job Interview and Completing Gap-Filling Exercises **Speaking:** Mock Interview, Telephone Interviews & Etiquette, and Group Discussion. **Reading:** **Reading** a Job Interview, SOP, Company Profile and Completing Comprehension Exercises **Writing:** Job Applications and Resume. **Grammar:** Conditional Clauses, Modal verbs, Verbal Analogy. **Vocabulary Development:** Technical Vocabulary, Purpose Statement

**ACTIVITY:** Preparing an effective Resume' and participating in Mock interview.

**TOTAL :30 PERIODS**

### **COURSE OUTCOME**

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

- CO1** Recognise the need for life skills; apply them to different situations, the basic communication practices in different types of communication
- CO2** Gain confidence to communicate effectively in various situations to acquire employability skills.
- CO3** Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
- CO4** Communicate effectively & appropriately in real life situation and enhance student's problem solving skill
- CO5** Prepare for various public and private sector exams & placement drives.

### **TEXT BOOKS:**

1. Board of Editors. English for Engineers and Technologists Volume 2 Orient Black Swan Limited, 2020
2. Richards, C. Jack. Interchange, New Delhi: CUP, 2017
3. Aggarwal R.S. (2017). Quantitative Aptitude for Competitive Examinations 3rd (Ed.) New Delhi: S.Chand Publishing

## **REFERENCE BOOKS:**

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad, 2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

## **WEB REFERENCES:**

1. <https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabularyexams/wordformation>
2. <https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018>
3. <http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm>
4. <https://www.edudose.com/english/grammar-degree-of-comparison-rules/>

## **ONLINE COURSES / RESOURCES:**

1. <https://basicenglishspeaking.com/wh-questions/>
2. <https://agendaweb.org/verbs/modals-exercises.html>

**LANGUAGE SKILLS LAB**

**30 Hours**

**LIST OF EXPERIMENTS**



1. Speaking- Sharing personal information- Self introduction
2. Speaking- Group Discussion, Small talk or Peb Talk
3. Speaking- Presentation- Formal and Informal
4. Speaking- Mock Interview
5. Speaking- FAQ"s on Job Interview
6. Speaking – JAM
7. Speaking- Debate and Story Narration
8. Writing: Error Detection- Spotting and reasoning the errors from the passages in competitive exams.
9. Writing: Letter of recommendation
10. Writing: Elements of a good essay
11. Writing: Types of essays. Descriptive – Narrative-Issue based.

**REFERENCE:**

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.
5. Sharma Arun.(2016). Quantitative Aptitude, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.

### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2									3	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2
CO6									3	1		3

Assessment (40% weightage) (Theory Component)		Assessment (60% weightage) (Laboratory Component)		End Semester Examination
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Evaluation of Laboratory Observation, Record	Test	Written Examination
40	60	75	25	
100				100
50 %				50 %



23ES1212	TECHNICAL SKILL PRACTICES I	L	T	P	C
		0	0	2	1

### COURSE OBJECTIVE:

- To impart essential problem solving skills through general problem solving concepts.
- To provide basic knowledge on programming essentials using C as implementation tool.
- To introduce various programming methods using C.

### LIST OF EXPERIMENTS

1. Data Types, Variables, Operators
2. Expressions, Precedence , Operators
3. Conditional Statements , Switch Statements
4. Looping, Nested Loops
5. Problems on Bit Manipulation
6. Patterns
7. Number Problems
8. Array Basics , Static vs Dynamic Array, Two Dimensional Matrix
9. Structure , Union ,Storage Classes
10. Function , Parameters passing
11. Recursion
12. Strings
13. Pointers
14. Command Line Arguments, Pre-processors
15. File Handling & Exception Handling.

**TOTAL: 30 PERIODS**

### COURSE OUTCOME(S):

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

- CO1** Propose solutions for a given problem.
- CO2** Infer the fundamental programming elements in C language and learn to apply basic control structures in C.
- CO3** Demonstrate the applications of structures and unions.
- CO4** Visualize the capabilities of modular programming approach in C.
- CO5** Understand the basic principles of pointers and their association during implementations.
- CO6** Apply various input, output and error handling functions in C.

### TEXT BOOKS:

1. ReemaThareja, ``Programming in C'', 2nd edition, OXFORD University Press, New Delhi, 2019.
2. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication,2016.

### REFERENCES BOOKS:

1. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education,2014.

2. Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw Hill, 2000.

**ONLINE COURSES / RESOURCES:**

1. <https://www.javatpoint.com/c-programming-language-tutorial>
2. <https://www.tutorialspoint.com/cprogramming/>
3. <https://nptel.ac.in/Courses/>

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3	3							3
<b>CO2</b>	3	3	3	3	3							3
<b>CO3</b>	3	3	3	3	3							3
<b>CO4</b>	3	3	3	3	3							3
<b>CO5</b>	3	3	3	3	3							3
<b>CO6</b>	3	3	3	3	3							3

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%

23AD1212	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

### COURSE OBJECTIVE:

- To demonstrate array implementation of linear data structure algorithms
- To design and implement the Application of Stack and Queue
- To understand the complex data structures such as tree.
- To solve real time problems.

### LIST OF EXPERIMENTS

1. Write a program for Array based implementation of stack.
2. Design a program for Implementation of Evaluating Postfix Expressions.
3. Design, develop and execute a program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non- negative single digit operands and binary arithmetic operators. The operators are + (add), - (subtract), \*(multiply), /(divide).
4. Write a program to perform Binary search tree operations.
5. Write a program for implementation of AVL tree.
6. Design a program for implementation of various operations that can be performed on Red Black Tree.
7. Write a program for Quick sort using Divide and Conquer strategy (without using Built in Function).
8. Write a program for Minimum cost spanning tree using Greedy approach.
9. Write a program for Huffman Coding.
10. Design, develop and execute a program to read a sparse matrix of integer values. and make a transpose of it. Use the triple to represent an element in sparse matrix.
11. Write a program for All pairs shortest path problem using dynamic programming.
12. Design a program Backtracking – N Queens Problem.
13. Design a program Branch and Bound – Travelling salesman problem.
14. Design a program using Approximation algorithms for knapsack problems.
15. Mini Project on Real time Applications.

**TOTAL: 60 PERIODS**

### COURSE OUTCOME(S):

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

- CO1** Develop programs to implement linear data structures algorithms.
- CO2** Implement applications using Stacks and Linked lists.
- CO3** Understand the concept of trees in real world scenarios.
- CO4** Decide on the data structure for any practical problem.
- CO5** Apply backtracking technique to real time applications.
- CO6** Solve approximation algorithms in case study.

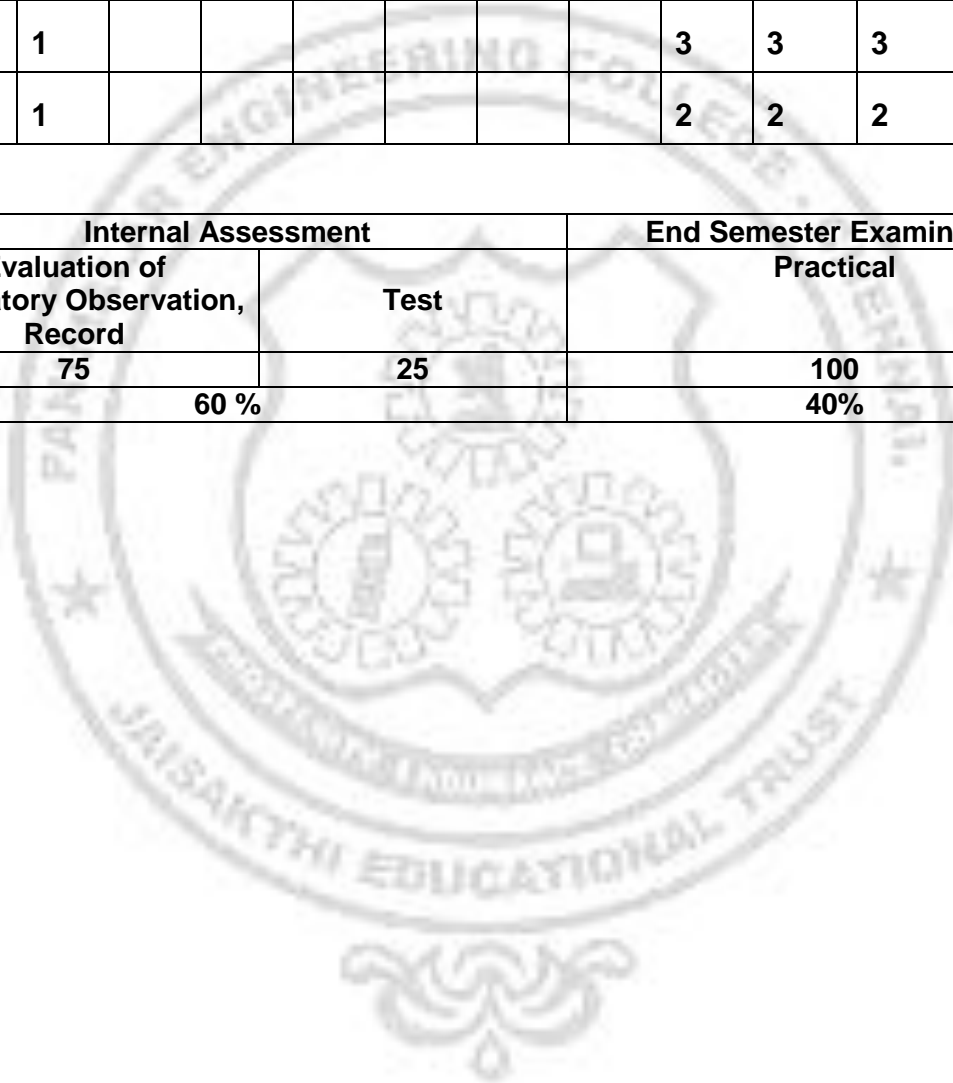
### Software Requirement:

PYTHON 3.11.4

### CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1					2	1	2	2
CO2	3	3	1	1					1	1	1	3
CO3	2	1	3	1					1	1	2	3
CO4	3	1	3	3					1	2	3	3
CO5	1	1							3	3	3	1
CO6	1	1							2	2	2	2

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%



23ES1215	PROGRAMMING IN PYTHON LABORATORY	L	T	P	C
		0	0	4	2

### COURSE OBJECTIVE:

- To write, test, and debug simple Python programs
- To implement Python programs with conditions and loops
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To learn to implement string functions and file operations
- To understand python packages and GUI development.

### LIST OF EXPERIMENTS

1. Basic Python Programs
2. Write programs to demonstrate different number data types in python
3. Develop python programs to demonstrate various conditional statements
4. Implement user defined functions using python
5. Develop python scripts to demonstrate built-in functions
6. Develop python programs to perform various string operations like slicing, indexing & formatting
7. Develop python programs to perform operations on List & Tuple
8. Demonstrate the concept of Dictionary with python programs
9. Develop python programs to perform operations on Sets.
10. Develop python codes to perform matrix addition, subtraction and transpose of the given matrix
11. Develop python codes to demonstrate the concept of function composition and anonymous functions.
12. Demonstrate python codes to print try, except and finally block statements
13. Implement python programs to perform file operations
14. Write a python code to raise and handle various built in exceptions.
15. Implement python programs using packages numpy and pandas
16. UI development using tkinter

### Mini Project :Suggested Topics(but not limited to)

1. Dice roll simulator

2. Guess the number game
3. Random password generator

**TOTAL: 60 PERIODS**

**COURSE OUTCOME(S):**

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

- CO1** Develop and execute simple Python programs
- CO2** Implement programs in Python using conditionals and loops for solving problems.
- CO3** Develop functions to decompose a Python program.
- CO4** Compare various string operations in Python.
- CO5** Experiment with Python packages in data analysis
- CO6** Create GUI for python applications

**WEB REFERENCES:**

1. <https://www.programiz.com/python-programming/examples>
2. <https://www.geeksforgeeks.org/python-programming-examples/>
3. <https://beginnersbook.com/2018/02/python-programs/>
4. <https://www.javatpoint.com/python-programs>
5. [https://www.w3schools.com/python/python\\_examples.asp](https://www.w3schools.com/python/python_examples.asp)

**CO- PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	2	3	3	1	2							1
<b>CO2</b>	2	3	3	1	2							1
<b>CO3</b>	2	3	3	1	2							1
<b>CO4</b>	2	3	3	1	2							1
<b>CO5</b>	2	3	3	1	2							1
<b>CO6</b>	2	3	3	1	2							1

Internal Assessment		End Semester Examination
Evaluation of Laboratory Observation, Record	Test	Practical
75	25	100
60 %		40%



23TA1201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

**UNIT – I WEAVING AND CERAMIC TECHNOLOGY 3**

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

**UNIT – II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

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

**UNIT – III MANUFACTURING TECHNOLOGY 3**

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

**UNIT –IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

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

**UNIT –V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software — Tamil Virtual Academy — Tamil Digital Library — Online Tamil Dictionaries — Sorkuvai Project.

**Total : 15 PERIODS**

**TEXT-CUM 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)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published 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 by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (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

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				<b>60 %</b>

23TA1201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

**UNIT – I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3**

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

**UNIT – II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3**

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

**UNIT – III உற்பத்தி தொழில்நுட்பம் 3**

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**UNIT –IV வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3**

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

**UNIT -V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3**

அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

**Total : 15 PERIODS**

**TEXT-CUM REFERENCE BOOKS:**

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சந்திரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published 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 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.)
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10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

Internal Assessment				End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		
Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Individual Assignment / Case Study / Seminar / Mini Project	Written Test	Written Examinations
40	60	40	60	
<b>40%</b>				<b>60 %</b>

23MC1001	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0

### COURSE OBJECTIVE:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection

### UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers– energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In situ and ex-situ conservation of biodiversity.

### UNIT - II ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– solid waste management: causes, effects and control measures of municipal solid wastes, biomedical wastes and e-wastes – role of an individual in prevention of pollution – pollution case studies.

### UNIT - III NATURAL RESOURCES 6

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Land resources: Land



2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,(2016)

3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004)..

#### **REFERENCE BOOKS:**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.

2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.

3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.

4. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

#### **WEB REFERENCES:**

1. <https://www.nationalgrid.com/stories/energy-explained>

2. <https://www.conservationindia.org/articles/human-elephant-conflict>

3. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/pollutant-monitoring>

4. <https://www.undp.org/sustainable-development-goals>

#### **ONLINE COURSES / RESOURCES:**

1.<https://nptel.ac.in/courses/105107213>

2.<https://nptel.ac.in/courses/105107181>

3.<https://nptel.ac.in/courses/103106162>

4.<https://nptel.ac.in/courses/103107212>

23HS1204	INTERPERSONAL COMMUNICATION SKILLS II	L	T	P	C
		0	0	2	0

### COURSE OBJECTIVES

- To induce the basic reading and writing skills of the freshers.
- To enhance the active listening skills of the learners through practice to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications
- To succor the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments
- To improve communication skills of the learners in a professional setting

### CONTENTS

**Listening:** Listening to Telephonic Conversation- on various jobs , recruitments and processes and professional etiquette

**Speaking:** Answering Telephonic Calls Attending telephonic interviews Presenting Work Activities, Presentation on Business Ideas and Iconic Personalities

**Reading:** Inferring information from business/professional letters Newspaper activities (Skimming / scanning) acquiring knowledge related to leading successful personalities and business consultancies.

**Writing:** Art of Letter Writing – Business Letters and Emails – acknowledging the performances and promoting the base and superstructures.

**TOTAL : 30 PERIODS**

### TEXT BOOKS:

1. Crucial Conversations: Tools for Talking When Stakes Are High by Kerry Patterson, Joseph Grenny, Ron McMillan, and Al Switzler, 2014
2. 2. Simply Said: Communicating Better at Work and Beyond by Jay Sullivan, 2016

### REFERENCE BOOKS:

1. Words That Work: It's Not What You Say, It's What People Hear by Dr. Frank Luntz, 2011.
2. Fine Art of Small Talk: How To Start a Conversation, Keep It Going, Build Networking Skills — and Leave a Positive Impression! By Debra Fine

### WEB REFERENCES:



1. <https://teambuilding.com/blog/communication-books>
2. <https://www.helpguide.org/articles/relationships-communication/effective-communication.htm>

### ONLINE COURSES / RESOURCES:

1. <https://in.indeed.com/career-advice/career-development/letter-of-recommendation>
2. <https://in.indeed.com/career-advice/career-development/types-of-business-letters>

### COURSE OUTCOME:

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

- CO1** Comprehend conversation and short talks delivered in English.
- CO2** Participate effectively in informal conversation; introduce themselves and their friends and express opinions English.
- CO3** Read articles of a general kind in magazines and newspaper
- CO4** Write short essays of a general kind and personal letters and emails in English.
- CO5** Gain understanding of basic grammatical structures and use them in right context.
- CO6** Use appropriate words in a professional context.

### CO&PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>									3	3		2
<b>CO2</b>									3	3		2
<b>CO3</b>									2	3		2
<b>CO4</b>									2	3		2
<b>CO5</b>									2	3		2
<b>CO6</b>									3	3		2

23HS1205	QUANTITATIVE APTITUDE PRACTICES II	L	T	P	C
		0	0	1	0

**COURSE OBJECTIVE:**

- To improve students comprehension of geometry and mensuration, average as well as help them hone their problem-solving abilities
- To develop students ability to use the techniques for resolving riddles, streams, boats, and coding problems.

**Module 1      Geometry and Mensuration 3**

Lines and angles – circles – triangles – quadrilaterals – polygons - coordinate geometry area & volume of 2D and 3D figures.

**Module 2      Average, Time, Work 3**

Logarithm - Average - time and work - time and distance

**Module 3      Boats and streams 3**

Relative speed – problems on trains – boats and streams – races and games

**Module 4      Logical Reasoning - I 3**

Odd man out and series – venn diagram - seating arrangement – decision making

**TOTAL : 12 PERIODS**

**COURSE OUTCOME:**

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

- CO1** Acquire knowledge of solving geometry and mensuration, average, percentage, time and work questions effortlessly.
- CO2** Understand and exhibit sound knowledge to the boats and streams, venn diagram and decision making.

**TEXT BOOKS:**

1. Aggarwal R.S.(2017). Quantitative Aptitude for Competitive Examinations 3rd edition New Delhi: S. Chand Publishing.
2. Abhijit guha(2016). Quantitative Aptitude for All Competitive Examinations, 6th edition. Noida: McGraw Hill Education Pvt.Ltd.
3. FACE.(2016).Aptipedia Aptitude Encyclopedia1(Ed.).New Delhi: Wiley Publications.

**REFERENCE BOOK:**

1. Sharma arun.(2016).Quantitative aptitude,7th(Ed.).Noida : McGraw Hill Education Pvt.Ltd.
2. Praveen. R.V 3<sup>rd</sup> edition, Quantitative aptitude and reasoning, PHI learning publication.

**WEB REFERENCES:**

[https:// www.indiabix.com](https://www.indiabix.com)

**Mode of Evaluation: Online Test**

