

**MOHAMED SATHAK A J COLLEGE OF ENGINEERING**  
**Chennai – 603103**

**REGULATIONS 2024**  
**(CHOICE BASED CREDIT SYSTEM)**

**B.Tech. – ELECTRONICS AND COMMUNICATION ENGINEERING w/s in**  
**ADVANCE COMMUNICATION TECHNOLOGY**

**I. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1: Technical Proficiency and Innovation**

Graduates will possess strong technical knowledge and skills in **Advance Communication Technology** enabling them to solve complex problems, design and implement, innovative and sustainable solutions for Industry and Society.

**PEO2: Professional and Ethical Leadership**

Graduates will achieve successful careers and contribute towards technological advancements in terms of leadership, ethical responsibility, effective communication, and teamwork.

**PEO3: Lifelong Learning and Societal Contribution**

Graduates will engage in lifelong learning to be updated with cutting edge technology and apply their skills to address global challenges thus promoting socio economic development.

**II. PROGRAM OUTCOMES (POs)**

- i. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- ii. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- iii. **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.
- iv. **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 for complex problems
- v. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- vi. **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.

- vii. **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.
- viii. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- ix. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- x. **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.
- xi. **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.
- xii. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

### III. PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates will be able to

- PSO1: Design and implement sustainable solutions in **Advance Communication Technology** domain by using innovation, technical knowledge acquired, modern hardware and software tools.
- PSO2: Adapt and excel in **Advance Communication Technology** domain through continual learning, higher education, research and use of new technology for societal and industry needs.
- PSO3: Contribute in leadership roles to create new opportunities and ensuring adherence of economic, environmental and ethical standards.

PEO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	3						2	1	3	3	2
2						2	2	3	3	3	3	1	3	1	3
3						3	3		1			3	2	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

**Department of ECE Specialization in - Advanced Communication Technology**

**Curriculum for the students Admitted from 2024 - 2025 onwards**

**Semester - I**

S.No	Subject Code	Subject	L	T	P	Credit	Conduct Periods	Category
	24IP101	Personality and Character Development Activity: Induction Program : (Universal Human Value - I) - 3 Weeks						
<b>Theory Course</b>								
1	24TA101	Heritage of Tamils / தமிழர் மரபு	1	0	0	1	1	HSMC
2	24EN101	Technical Communication - I	3	0	0	3	3	HSMC
3	24MA101	Matrices and Calculus	3	1	0	4	4	BSC
4	24PY111	Engineering Physics	3	0	2	4	5	BSC
5	24CH111	Engineering Chemistry	3	0	2	4	5	BSC
6	24CS112	Computational Thinking	1	0	2	2	3	ESC
7	24GE121	Engineering Visualization	1	0	4	3	5	ESC
<b>Laboratory Course</b>								
8	24EN121	English for Enhancing Self Competence	0	0	2	1	2	EEC
9	24GE124	Electrical and Electronics Workshop Practice	0	0	2	1	2	ESC
10	24GE122	Product Tinkering Laboratory	0	0	2	1	2	ESC
			<b>15</b>	<b>1</b>	<b>16</b>	<b>24</b>	<b>32</b>	

# HERITAGE OF TAMILS

(Common to all branches)

Course Code	24TA101	Course Type	Theory
Teaching Periods/Week (L: T:P)	1:0:0	Credits	1
Total Teaching Periods	15	IAT + ESE Marks	40 + 60
Teaching Department	Tamil		

## Course Objectives:

1. To familiarize about the importance of Tamil Language and its literature
2. To teach about the heritage of Tamil from art and sculpture
3. To teach about the culture of Tamil from Folk music and martial arts
4. To impart knowledge on thinai concepts
5. To provide insight on the contribution of Tamil in freedom struggle and Indian culture

## 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.

**Teaching-Learning Process** Pedagogy: Lecture, PPT  
RBT Level: L1, L2, L3

## Unit: II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

3

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

**Teaching-Learning Process** Pedagogy: Lecture, PPT  
RBT Level: L1, L2, L3

## Unit: III FOLK AND MARTIAL ARTS

3

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

**Teaching-Learning Process** Pedagogy: Lecture, PPT  
RBT Level: L1, L2, L3

## 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.

**Teaching-Learning Process** Pedagogy: Lecture, PPT  
RBT Level: L1, L2, L3

**Unit: V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**

**3**

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

**Teaching-Learning Process Pedagogy:** Lecture, PPT

**RBT Level:** L1, L2, L3

**Total**

**15**

**Pedagogical Methods:**

- |   |
|---|
| Unit 1: Sol Vilayattu                             |
| Unit 2: Drawing                                   |
| Unit 3: Theme based activities (Folk and Dance)   |
| Unit 4: Essay & Poetry Writing (Thinai)           |
| Unit 5: Try to learn about basic Siddha Vaithiyam |

**Course Outcomes:**

After successful completion of this course, the students will be able to

- |   |
|---|
| CO1: Explain the salient features of Tamil language and its literature.                   |
| CO2: Discuss about the heritage of Tamil exhibited by various forms of art and sculpture. |
| CO3: Describe Tamil heritage displayed by folk music and martial arts                     |
| CO4: Discuss and describe the features of five Thinais in Tamil.                          |
| CO5: Describe the contribution of Tamil in freedom struggle and Indian culture.           |

**Text Books:**

- |  |
|--|
| T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)  |
| T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. ISBN 9788185693343. |

**References**

- |   |
|---|
| R1: Dr.K.K.Pillay “Social Life of Tamils A joint publication of TNTB & ESC and RMRL – (in print)  |
| R2: Social Life of the Tamils - The Classical Period (Published by: International Institute of Tamil Studies  |
| R3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).ISBN 9788185329567.                              |
| R4: The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)   |
| R5: 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) |
| R6: Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) ISBN 8170260548.  |
| R7: Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)  |
| R8: Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)   |

**Web links and Video Lectures (e-Resources):**

1. [https://onlinecourses.nptel.ac.in/noc24\\_cs36/preview](https://onlinecourses.nptel.ac.in/noc24_cs36/preview) - Unit IV
2. <https://digimat.in/nptel/courses/video/113106106/L01.html> - Unit I

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
2	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
3	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
4	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
5	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
AVG	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-

'1' – Low, '2' – Medium, '3' - High, '-' – No correlations

**தமிழர் மரபு**  
(Common to all branches)

Course Code	24TA101	Course Type	Theory
Teaching Periods/Week (L: T:P)	1:0:0	Credits	1
Total Teaching Periods	15	IAT + ESE Marks	40 + 60
Teaching Department	Tamil		

**Course Objectives:**

1. தாய்மொழியின் நிகரற்ற தொன்மையை விளக்குவது
2. பழம் தமிழரின் துறை சார்ந்த ஓவியங்கள் மற்றும் சிற்பங்கள் நவீன கலைகள் குறித்து விளக்குவது
3. வியக்க வைக்கும் பழந்தமிழரின் கலைகள், இசை மற்றும் வீரவிளையாட்டுகள் பற்றி தெரியப்படுத்துவது
4. தமிழர்களின் திணைக் கோட்பாடுகளை பற்றி விளக்குவது
5. தமிழரின் தன்னிகரற்ற ஈடுபாடு - சித்த மருத்துவம் மற்றும் விடுதலைப் போராட்டம் பற்றி விளக்குவது

**அலகு - I மொழி மற்றும் இலக்கியம்**

3

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

**Teaching-Learning Process Pedagogy:** Lecture, PPT  
**RBT Level:** L1, L2, L3

**அலகு - 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 - இசைக் கருவிகள் மிருதங்கம் - பறை வீணை யாழ் நாதஸ்வரம் தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**Teaching-Learning Process Pedagogy:** Lecture, PPT  
**RBT Level:** L1, L2, L3

**அலகு - III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**

3

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

**Teaching-Learning Process Pedagogy:** Lecture, PPT  
**RBT Level:** L1, L2, L3

**அலகு - IV தமிழர்களின் திணைக் கோட்பாடுகள்**

3

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

**Teaching-Learning Process Pedagogy:** Lecture, PPT**RBT Level:** L1, L2, L3**அலகு - V இந்திய தேசிய இயக்கம் மற்றும் இந்திய**

3

**பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - ச்யமரியாதை இயக்கம் இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கல்கள்-தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு

**Teaching-Learning Process Pedagogy:** Lecture, PPT**RBT Level:** L1, L2, L3**Total****15****Pedagogical Methods:**

- Unit 1: Sol Vilayattu
- Unit 2: Drawing
- Unit 3: Theme based activities (Folk and Dance)
- Unit 4: Essay & Poetry Writing (Thinai)
- Unit 5: Try to learn about basic Siddha Vaithiyam

**Course Outcomes:**

After successful completion of this course, the students should be able to

- CO1: தமிழ் மொழி மற்றும் அதன் இலக்கியத்தின் முக்கிய அம்சங்களை விளக்குவார்கள்.
- CO2: கலை மற்றும் சிற்பத்தின் பல்வேறு வடிவங்களால் காட்சிப்படுத்தப்பட்ட தமிழின் பாரம்பரியத்தைப் பற்றி விவாதிப்பார்கள்
- CO3: நாட்டுப்புற இசை மற்றும் தற்காப்பு கலைகளால் காட்டப்படும் தமிழ் பாரம்பரியத்தை விளக்குவார்கள்
- CO4: தமிழில் ஐந்து திணைகளின் அம்சங்களைப் பற்றி விளக்குவார்கள்.
- CO5: சுதந்திரப் போராட்டத்திலும் இந்திய கலாச்சாரத்திலும் தமிழின் பங்களிப்பை விவரிப்பார்கள்.

**Text Books:**

- T1: தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்.)
- T2: கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)



## References

- R1: Dr.K.K.Pillay “Social Life of Tamils A joint publication of TNTB & ESC and RMRL – (in print)
- R2: Social Life of the Tamils - The Classical Period (Published by: International Institute of Tamil Studies)
- R3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).ISBN 9788185329567.
- R4: The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
- R5: 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)
- R6: Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) ISBN 8170260548.
- R7: Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- R8: Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

## Web links and Video Lectures (e-Resources):

3. [https://onlinecourses.nptel.ac.in/noc24\\_cs36/preview](https://onlinecourses.nptel.ac.in/noc24_cs36/preview) - Unit IV
1. <https://digimat.in/nptel/courses/video/113106106/L01.html> - Unit I

## CO-PO & PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
2	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
3	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
4	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
5	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-
AVG	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-

‘1’ – Low , ‘2’ – Medium , ‘3’- High, ‘-’ – No correlations

## TECHNICAL COMMUNICATION -I (Common to all branches)

<b>Course Code</b>	24EN101	<b>Course Type</b>	Theory
<b>Teaching Periods/Week (L: T:P)</b>	3:0:0	<b>Credits</b>	3
<b>Total Teaching Periods</b>	45	<b>IAT + ESE Marks</b>	40 + 60
<b>Teaching Department</b>	English		

### Course Objectives:

1. To facilitate students to develop their comprehension skills.
2. To equip the students to improve their receptive skills.
3. To equip learners with better vocabulary and enhance their writing skills.
4. To aid students to speak effectively in all kinds of communicative contexts.
5. To improve the learners' basic proficiency in workplace communication.

### Unit: I DEVELOPING COMPREHENSION SKILLS 9

**Listening:** Introduction to Informational listening **Reading:** Short Narratives and Skimming Passages. **Speaking** Introducing Oneself, Narrating a Story / Incident. **Writing:** Sequential Writing (Jumbled Sentences), Process/Product Description **Grammar:** Parts of Speech -Verbs – Main & Auxiliary-Pronouns **Vocabulary:** Misleading words- Spell check - Homonyms & homophones.

**Teaching-Learning Process**      **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

### Unit: II LISTENING AND EXTENDED READING 9

**Listening:** Listening for Comprehension-Gap Filling **Reading:** News reading-Scanning Passages – Reading Longer Texts- Cloze Reading **Speaking:** Importance of speaking skill - Short Conversation-Public Speaking Do's & Don'ts **Writing:** Note Making, Note Taking - Paragraph Writing - Types of Paragraph - Compare and Contrast **Grammar:** Tenses – Form, Function and Meaning - Basic Sentence structure-Articles **Vocabulary:** One-Word Substitutes, Phrasal Verbs – Cause and Effect expressions

**Teaching-Learning Process**      **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

### Unit: III INTRODUCTION TO FORMAL WRITING 9

**Listening:** Listening to Lectures and Taking Notes **Reading:** Reading on Visual Content **Speaking:** One-Minute Talk **Writing:** Informal Letter Writing , Email Writing, Data Interpretation-Pie chart, Bar chart **Grammar:** Tenses, Active Voice, Passive Voice, Impersonal-Preposition **Vocabulary:** Guessing the meaning from context, Cloze Exercise - Word power.

**Teaching-Learning Process**      **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

### Unit: IV ENHANCING SPEAKING ABILITY 9

**Listening:** Listening to Speeches **Reading:** Speed Reading **Speaking:** Just a Minute **Writing:** Instructions, Formal letter writing, Data Interpretation-Flow chart, Table **Grammar:** 'Wh' Questions / Yes or No Questions, Question Tag, Imperatives **Vocabulary:** Synonyms, Antonyms, Different forms of same words.

**Teaching-Learning Process**      **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

**Unit: V EXTENSIVE LANGUAGES FOR WORKPLACE****9**

**Listening:** Extensive Listening -Audio scripts – Listening to Conversation **Reading:** Extensive reading (Jigsaw Reading, Short Stories, Novels) - Introduction to Technical Article **Speaking:** Short Presentations on Technical Topics -Tips for Doing Presentation **Writing:** Recommendations, Essay Writing **Grammar:** Collocation, Concord -Compound words **Vocabulary:** Informal Vocabulary and Formal Substitutes

**Teaching-Learning Process**      **Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2, L3

**Total****45****Pedagogical Methods:**

Unit 1: Speaking task
Unit 2: Reading task
Unit 3: Speaking task
Unit 4: Reading task
Unit 5: Speaking task

**Course Outcomes:**

After successful completion of this course, the students will be able to

CO1: Apply comprehension skills and interpret different contents.
CO2: Read and comprehend various texts and audiovisual contents
CO3: Infer data from graphs and charts and communicate it in varied contexts.
CO4: Participate in diverse speaking situations.
CO5: Present, discuss and coordinate with peers in workplace using language skills.

**Text Books:**

T1: Anna University English Department, “English for Engineers and Technologists”, Orient Black Swan, ISBN-978-93-5442-067-2, Edition 2022 –Vol-I.
T2: Ashraf Rizvi. M, “Effective Technical Communication”, McGraw Hill Education, Second edition (2017)- ISBN-9352605780, 978-9352605781 2 <sup>nd</sup> Edition.
T3: Sylvan Barnet, Hugo Bedau, and John O’Hara, “Critical Thinking Reading and Writing”, Bedford/St. Martin’s: 11th Edition, ISBN-13 : 978-1319332051 (16 December 2022)

**References**

R1: Addison Wesley Longman, “Technical English”, Pearson, ISBN:978-1292042862, 8 <sup>th</sup> Edition 2013.
R2: Norman Lewis, “Word Power Made Easy”, Goyal Saab; Latest edition (1 January 2020), ebook ISBN-978-0-307-81749-5
R3: Pinnacle , “SSC 60 Days English Vocabulary book” 3rd edition, English and Hindi, 20,000+ words, , ISBN-715791456, 3rd Edition - 19 September 2023

**Web links and Video Lectures (e-Resources):**

1. <https://leverageedu.com/blog/internship-request-letter/> - Unit - IV
2. <https://www.englishgrammar.org/> - All Units Grammar
3. <https://www.indeed.com/career-advice/career-development/letter-of-introduction> - Unit III

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	1	3	-	2	1	1	1
2	-	-	-	-	-	-	-	-	1	3	-	2	1	1	1
3	-	-	-	-	-	-	-	-	1	3	-	2	1	1	1
4	-	-	-	-	-	-	-	-	1	3	-	3	1	1	1
5	-	-	-	-	-	-	-	-	1	3	-	3	1	1	1
AVG	-	-	-	-	-	-	-	-	1	3	-	2.4	1	1	1

'1' – Low, '2' – Medium, '3' - High, '-' – No correlations

# MATRICES AND CALCULUS

(Common to All Branches)

Course Code	24MA101	Course Type	Theory
Teaching Periods/Week (L: T:P)	3:1:0	Credits	4
Total Teaching Periods	60	IAT + ESE Marks	40 + 60
Teaching Department	Mathematics		

## Course Objectives:

1. To impart knowledge on the concepts of matrix algebra techniques needed for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize students with single integrals and multiple integrals.
4. To illustrate the simple applications of vector calculus.
5. To make the students to understand the concept of analytic function.
6. To introduce the basic concepts of complex integration.

## Unit: I MATRICES

12

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**Teaching-Learning Process** Pedagogy: Lecture, NPTEL Videos  
**RBT Level:** L1 - L3

## Unit: II DIFFERENTIAL CALCULUS

12

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

**Teaching-Learning Process** Pedagogy: Lecture, NPTEL Videos  
**RBT Level:** L1 - L3

## Unit: III INTEGRAL CALCULUS & MULTIPLE INTEGRAL

12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts - Double integrals - Double integral in polar coordinates - Area-enclosed by plane curves – Triple integrals – Volume of solids.

**Teaching-Learning Process** Pedagogy: Lecture, PPT  
**RBT Level:** L1 - L3

## Unit: IV VECTOR CALCULUS

12

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems.

**Teaching-Learning Process** Pedagogy: Lecture, NPTEL Videos  
**RBT Level:** L1 - L3

**Unit: V ANALYTIC FUNCTIONS AND COMPLEX INTEGRATION****12**

Analytic functions –Necessary and sufficient conditions for analyticity -Construction of analytic function -Conformal mapping – Mapping by functions  $w=z+c$ ,  $cz$ ,  $1/z$  -Bilinear Transformation, Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series

**Teaching-Learning Process Pedagogy:** Lecture, PPT**RBT Level:** L1 - L3**Total****60****Pedagogical Methods:**

- |   |
|---|
| Unit 1: To Explore the applications of matrices in real-world scenarios.  |
| Unit 2: Use differential equations to model the rate of change of pollutant concentration over time and space.    |
| Unit 3: Apply integral calculus to optimize production levels, pricing strategies, and economic decision- making. |
| Unit 4: Apply concepts of gradient, divergence, and curl in various coordinate systems to analyze vector fields.  |
| Unit 5: Use Python to visualize complex functions in the complex plane., Example: $w= 1/z^2$                      |

**Course Outcomes:**

After successful completion of this course, the students will be able to

- |  |
|--|
| CO1: Use the matrix algebra methods to diagonalize a given matrix and identify the special properties of matrices.                                 |
| CO2: Demonstrate different differentiation techniques and find maxima and minima of a given function.  |
| CO3: Find area enclosed by plane curves and volume of solids using integration techniques.   |
| CO4: Apply the concepts of gradient, curl and divergence across various disciplines.   |
| CO5: Utilize the concepts of analytic functions and construct analytic functions.  |
| CO6: Apply the basic concepts of complex integration to solve complex integrals. Expand a given function into Taylor’s Series and Laurent’s Series |

**Text Books:**

- |   |
|---|
| T1: Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10th Edition, New Delhi, 2016.ISBN : 9788126567880 |
| T2: B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 45th Edition, 2016.ISBN : 9789382332300        |

**References**

- |  |
|--|
| R1: M. K. Venkataraman, “Engineering Mathematics”, Volume I, 4th Edition, The National Publication Company, Chennai, 2003. ISBN : 9788183311261  |
| R2: Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2015. ISBN : 9789385509183 |
| R3: S.S. Sastry, “Engineering Mathematics”, Vol. I & II, PHI Learning Private Limited, 4th Edition, New Delhi, 2014 ISBN : 9788120350039   |
| R4: Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.ISBN : 9781259064917                                 |

**Web links and Video Lectures (e-Resources):**

1. <https://archive.nptel.ac.in/courses/111/108/111108157/> - Unit I
2. <https://archive.nptel.ac.in/courses/111/106/111106146/> - Unit II
3. <https://archive.nptel.ac.in/courses/111/105/111105122/> - Unit III
4. <https://archive.nptel.ac.in/courses/111/105/111105122/> - Unit IV
5. <https://archive.nptel.ac.in/courses/111/103/111103070/> - Unit V

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
2	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
3	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
4	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
5	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
<b>AVG</b>	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-

'1' – Low, '2' – Medium, '3' - High, '-' – No correlations

## ENGINEERING PHYSICS (Common to all branches)

<b>Course Code</b>	24PY111	<b>Course Type</b>	Integrated
<b>Teaching Periods/Week (L: T:P)</b>	3:0:2	<b>Credits</b>	4
<b>Total Teaching Periods</b>	75	<b>IAT + ESE Marks</b>	50+50
<b>Teaching Department</b>	Physics		

### Course Objectives:

1. To impart knowledge on physical properties of materials and inculcate interest in students in observing facts experimentally.
2. To teach various types of oscillations.
3. To teach the acoustic properties and its applications.
4. To equip the students with understanding the importance of thermal physics and its applications
5. To impart the basics of optics, lasers, and their applications.
6. To introduce the importance and applications of quantum mechanics.

### Unit: I      **MECHANICS OF MATERIALS** 9

Rigid Body - Centre of mass - Rotational Energy - Moment of inertia (M.I) - Moment of Inertia for uniform objects with various geometrical shapes. Elasticity - Hooke's law - Poisson's ratio - stress-strain diagram for ductile and brittle materials - uses- Bending of beams - Cantilever - supported beams - uniform and non-uniform bending - Young's modulus determination - I shaped girders -Twisting couple

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2, L3

### Unit: II      **OSCILLATIONS AND ACOUSTICS** 9

Simple harmonic motion – Torsional pendulum – Damped oscillations – Shock Absorber – Forced oscillations and Resonance – Applications of resonance.- Waves and Energy Transport – Sound waves – Intensity level – Standing Waves – Doppler effect and its applications – reverberation – Sabine's Reverberation formula- Speed of blood flow. Ultrasound – applications – Echolocation and Medical Imaging.

**Teaching-Learning Process Pedagogy:** Lecture Method, NPTEL

**RBT Level:** L1, L2, L3

### Unit: III      **THERMAL PHYSICS** 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints – bimetallic strips – thermal conduction, convection and radiation – heat conduction in solids – thermal conductivity – Forbe's and Lee's disc method: theory and experiment – conduction through compound media (series and parallel) – thermal insulation -applications: heat exchangers, refrigerators, ovens and solar water heaters.

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2, L3



**Unit: IV OPTICS AND LASERS****9**

Interference – Thin film interference – Air wedge – Applications – Interferometers – Michelson Interferometer – Polarization – polarizers – Laser – characteristics – Spontaneous and Stimulated emission- population- inversion – Metastable states – optical feedback – Nd-YAG laser, CO2 laser, Semiconductor laser – Industrial and medical applications – Optical Fibers – Total internal reflection – Numerical aperture and acceptance angle – Fiber optic communication – Fiber sensors – Fiber lasers.

**Teaching-Learning Process Pedagogy:** Lecture Method, NPTEL

**RBT Level:** L1, L2, L3

**Unit: V QUANTUM PHYSICS****9**

Black body radiation (Qualitative) – Planck’s hypothesis – Einstein’s theory of Radiation – Matter waves – de Broglie hypothesis – Electron microscope – Uncertainty Principle – The Schrodinger Wave equation (time-independent and time-dependent) – Physical significance of wave function – Normalization – Particle in an infinite potential well-particle in a three-dimensional box – Degenerate energy states – Barrier penetration and quantum, tunneling – Tunneling microscope.

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2

**Total****45****Pedagogical Methods:**

Unit 1: Models- Based on Moment of Inertia, cantilever and center of mass

Unit 2: Case Studies – Based on the intensity of different animals, birds, and mammals.

Unit 3: Chart – Based on the difference between Forbes and Lee’s disc apparatus

Unit 4: Presentation- Application of Laser and different types of Lasers

Unit 5: Problems Assignment – problems DeBroglie, Schrodinger

**PRACTICAL (Any seven experiments)****30**

1. Torsional Pendulum-Determination of rigidity modulus of wire and moment of inertia of the disc
2. Non-uniform bending -Determination of Young’s modulus of the material of the beam.
3. Uniform bending–Determination of Young’s modulus of the material of the beam.
4. Lee’s Disc Experiment - Determination of thermal conductivity of bad conductors.
5. Laser-Determination of the wavelength of the laser using grating - Determination of the width of the groove of the compact disc using laser. - Estimation of laser parameters
6. Optical fibre -Determination of Numerical Aperture and acceptance angle
7. Simple harmonic oscillations of cantilever
8. Air wedge - Determination of thickness of a thin sheet/wire
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
10. Melde’s string experiment

## Equipments required

S.No	Name of the Equipment and Accessories	Required numbers for batch of 30 students
1	Torsional Pendulum Kit	5
2	Simple harmonic oscillations of cantilever	5
3	Travelling Microscope (Non-Uniform / Uniform)	5
4	He-Ne/Diode laser (red), Grating	5
5	Air Wedge Apparatus	5
6	Diode laser (green or red), fiber optic Kit	5
7	Ultrasonic interferometer apparatus with high-frequency wave generator	5
8	Lee's Disc Apparatus	2
9	Vernier Calliper, Screw Gauge	5
10	Melde's String Kit	1

## Course Outcomes:

After successful completion of this course, the students will be able to

- CO1: Explain the mechanical properties of materials like brittle and ductile.
- CO2: Discuss different types of oscillation and its applications.
- CO3: Summarize the acoustic properties and its applications.
- CO4: Discuss the thermal properties of materials and their applications.
- CO5: Summarize the principle of operation, characteristics, and application of laser and optics.
- CO6: Explain the concepts of quantum physics and its applications.

## Text Books:

- T1: D. Halliday, R. Resnick and J. Walker, "Principles of Physics" John Wiley & Sons, 2012 ISBN 978-1-118-23072-5
- T2: N. Garcia, A. Damask and S. Schwarz, "Physics for Computer Science Students", Springer Verlag, 2012. ISBN-13: 978-0-387-97656-3

## References

- R1: D. Kleppner and R. Kolenkow. "An Introduction to Mechanics", McGraw Hill Education, 2014. ISBN: 978-0-521-19811-0
- R2: K. Thyagarajan and A. Ghatak. "Lasers: Fundamentals and Applications". Springer, 2012 ISBN: 978-1-4419-6441-0

**Web links and Video Lectures (e-Resources):**

1. <https://youtu.be/aQf6Q8t1FQE?si=HKYtEGMgu-y7WnLB> - Unit-1
2. <https://youtu.be/yBC-PuCMMWw?si=IZ4sz88U33vD55To> - Unit-2
3. [https://youtu.be/DPK1z3QSY\\_8?si=J04HysWSvmQJwRFo](https://youtu.be/DPK1z3QSY_8?si=J04HysWSvmQJwRFo) - Unit-3
4. <https://youtu.be/PK4yFaGHSFc?si=rrPgMVbD6fMPAPql> - Unit-4
5. <https://youtu.be/TcmGYe39XG0?si=hBMV6uBRAIa3eHE3> - Unit-5

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	-	-	-	-	-	-	-	1	1	1	1
2	3	2	1	2	-	-	-	-	-	-	-	1	1	1	1
3	3	2	1	2	-	-	-	-	-	-	-	1	1	1	1
4	3	2	1	2	-	-	-	-	-	-	-	1	1	1	-
5	3	2	1	2	-	-	-	-	-	-	-	1	1	1	-
6	3	1	-	-	-	-	-	-	-	-	-	1	1	1	-
AVG	3	1.83	1	2	-	-	-	-	-	-	-	1	1	1	1

'1' – Low, '2' – Medium, '3' - High, '-' – No correlations

## ENGINEERING CHEMISTRY (Common to all branches)

<b>Course Code</b>	24CH101	<b>Course Type</b>	Integrated
<b>Teaching Periods/Week (L:T:P)</b>	3:0:0	<b>Credits</b>	3
<b>Total Teaching Periods</b>	75	<b>IAT + ESE Marks</b>	50 + 50
<b>Teaching Department</b>	Chemistry		

### Course Objectives:

1. To impart knowledge on treatment of water for potable and industrial purposes.
2. To introduce the basic concepts and applications of phase rule and composites.
3. To explain the applications of energy sources and storage devices.
4. To facilitate the understanding of different types of fuels, their properties and combustion characteristics.
5. To acquaint the students with the basics of nanomaterials, their properties, and applications.

### Unit: I WATER TECHNOLOGY

9

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

**Teaching-Learning Process**    **Pedagogy:** Lecture Method, PPT & Demonstration  
**RBT Level:** L1, L2, L3

### Unit: II PHASE RULE AND COMPOSITE MATERIALS

9

Phase rule: Introduction, definition of terms with examples. One component system: water system– Reduced phase rule; Construction of a simple eutectic phase diagram – Thermal analysis; Two component system: Lead–silver system, application: Pattinson process. Composites: Introduction: Definition & Need for composites; Constituents: Matrix materials, and Reinforcement. Classification of Matrix materials, properties, and its applications: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Types of Reinforcement, properties, and its applications: fiber, particulates, flakes, and whiskers. Properties and applications of: Hybrid composites – definition and examples.

**Teaching-Learning Process**    **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

### Unit: III ENERGY SOURCES AND STORAGE DEVICES

9

Energy sources: Nuclear fission and nuclear fusion. Nuclear energy: Light water nuclear power plant and breeder reactor. Solar energy: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy – Geothermal energy. Storage devices: Batteries – types of batteries – primary battery (dry cell), secondary battery (lead acid battery, lithium–ion–battery), fuel cells – H<sub>2</sub> –O<sub>2</sub> fuel cell, microbial-fuel cell, and super capacitors. E-Vehicle

**Teaching-Learning Process**    **Pedagogy:** Lecture Method, PPT  
**RBT Level:** L1, L2, L3

**Unit: IV FUELS AND COMBUSTION****9**

Fuels: Introduction and Classification. Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking, octane number, cetane number; Power alcohol and biodiesel. Gaseous fuels – Natural gas, CNG and LPG.

Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis – ORSAT Method. CO<sub>2</sub> emission and carbon footprint.

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2, L3

**Unit: V NANOMATERIALS****9**

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

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT

**RBT Level:** L1, L2, L3

**Total****45****Pedagogical Methods:**

- |   |
|---|
| Unit 1: Model Making – Municipal Water treatment              |
| Unit 2: Poster Presentation – Composite Materials             |
| Unit 3: Pick one and Talk More                                |
| Unit 4: Problems – Theoretical Calculation of Calorific Value |
| Unit 5: Seminar on Applications of Nanomaterials              |

**PRACTICAL (Any seven experiments)****30**

1. Preparation of Na<sub>2</sub>CO<sub>3</sub> as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Determination of strength of acids in a mixture of acids using conductivity meter.
9. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
10. Estimation of iron content of the given solution using potentiometer.

### Equipment required

S.No	Description of Equipment	Required Numbers for Batch of 30 students
1	pH Meter	15
2	Conductivity Meter	15
3	Potentiometer	15
4	Electronic balance (Four Digit)	1
5	Hot Plate with Magnetic Stirrer	1
6	Hot Air Oven	1
7	Muffle Furnace	1
8	Burette, Pipette, Conical Flask & Other glassware.	30

### Course Outcomes:

After successful completion of this course, the students will be able to

- CO1: Summarize the water quality parameters and explain various methods to produce soft water for industrial and potable use.
- CO2: Apply the knowledge of phase rule and composites for material selection requirements.
- CO3: Discuss various energy resources, storage devices and their uses in household and industrial applications.
- CO4: Differentiate various types of fuels based on their state, characteristics and calorific value for Engineering processes and applications.
- CO5: Differentiate the nano and bulk materials, their synthesis and its applications in various fields.

### Text Books:

- T1: P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018. ISBN 9789383186773.
- T2: Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008. ISBN 9780070669321.
- T3: S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018. ISBN 9788121903592.
- T4: S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT. LTD, New Delhi, 2013. ISBN 9788126543342.

### References

- R1: B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018. ISBN 9783642280290.
- R2: O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2<sup>nd</sup> Edition, 2017. ISBN 9789352605774.
- R3: Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014. ISBN 9789381714522.
- R4: Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019. ISBN 9781108724449.
- R5: O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013. ISBN 9781461442615.
- R6: Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015. ISBN 9788131526699.

**Web links and Video Lectures (e-Resources):**

1. <https://www.youtube.com/watch?v=ugDRuS8dtY4> – Unit 1
2. <https://www.youtube.com/watch?v=SaJ749CkypA> – Unit 3
3. [https://www.youtube.com/watch?v=YSRs3PuYT\\_k](https://www.youtube.com/watch?v=YSRs3PuYT_k) – Unit 5

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	2	-	2	2	-	-	-	-	2	-	-	1
2	3	1	-	-	-	1	2	-	-	-	-	1	-	-	1
3	3	2	-	1	-	-	1	-	-	-	-	-	-	-	1
4	3	1	-	-	-	2	2	-	-	-	-	-	-	-	1
5	3	1	-	-	-	2	2	-	-	-	-	1	-	-	1
<b>AVG</b>	3	1.2	-	1.5	-	1.8	1.8	-	-	-	-	1.4	-	-	1

'1' – Low, '2' – Medium, '3' - High, '-' – No correlations

# COMPUTATIONAL THINKING

(Common to CSE / IT / AIDS / CSBS / CSCS / AIML / EEE / ECE)

<b>Course Code</b>	24CS112	<b>Course Type</b>	Integrated
<b>Teaching Periods/Week (L: T:P)</b>	1:0:2	<b>Credits</b>	2
<b>Total Teaching Periods</b>	45	<b>IAT + ESE Marks</b>	50 + 50
<b>Teaching Department</b>	Computer Science and Engineering		

**Course Objectives:** To Equip the students with the Knowledge in

1. Problems in a way that enables a computer to solve them.
2. Organising and analysing data using logical approaches.
3. Developing solutions through algorithmic thinking.
4. Identifying, analysing, and implementing possible solutions to achieve the most efficient and effective combination of steps and resources.
5. Generalising and transferring the problem-solving process to a wide variety of problems.

## **Unit: I INTRODUCTION TO COMPUTATIONAL THINKING 1+4**

Understanding the concepts: Decomposition, pattern recognition/data representation, generalization, abstraction, and algorithms, Representation, automation, Analysis, visualization. Logical thinking - reasoning

**Teaching-Learning Process Pedagogy:** Chalk and Talk

**RBT Level:** L1, L2, L3, L4

## **Unit: II UNDERSTANDING DATA 2+6**

Performing analytics on numeric data using any spreadsheet software and representing the data using charts, histograms, scatter plots, graphs etc. Understanding patterns in data sequences, puzzles, and nonograms. Data Encryption – ciphering sentences and Compression.

**Teaching-Learning Process Pedagogy:** Chalk and Talk, PPT

**RBT Level:** L1, L2, L3, L4

## **Unit: III DECOMPOSITION AND PATTERN RECOGNITION 3+8**

The divide and Conquer, pattern recognition, Algorithmic thinking - creating oral algorithms for everyday tasks – visualizing algorithms through sequence of steps, pseudocode, flow charts, selection, iteration, functions, procedures and parameters.

**Teaching-Learning Process Pedagogy:** Chalk and Talk, PPT

**RBT Level:** L1, L2, L3, L4

## **Unit: IV ABSTRACTIONS AND SCRATCH 3+6**

Understanding Abstraction Object Description, Abstraction and Modeling, Objects and Objects based modeling -Repair, Reuse, Recycle, Scratch / equivalent - Motion, events, control

**Teaching-Learning Process Pedagogy:** Chalk and Talk, PPT

**RBT Level:** L1, L2, L3, L4



**Unit: V FILES AND PREPROCESSOR UNDERSTANDING COMPLEXITY 6+6**

Understanding complexity, sorting algorithms, search algorithms, AI and Turing Test, FSA (Finite State Automata), Debugging, Enhancing the clarity of a program - documentation, style, idioms, Automation and Simulation, generalizing a solution.

**Teaching-Learning Process Pedagogy:** Chalk and Talk, PPT

**RBT Level:** L1, L2, L3, L4

**Total 45**

**Pedagogical Methods:**

Unit 1:	Explore algorithm design by creating oral algorithms.
Unit 2:	Decompose a complex problem into discrete steps and Design a simple algorithm for solving the problem
Unit 3:	Programming implementation
Unit 4:	Develop algorithms for sorting and determine the complexity of the algorithm and how it scales as the number of items to sort increases
Unit 5:	External Learning: Study the best practices of documentation, style, idioms, etc that are used to ensure the code can be understood and maintained over a long period.

**Practical Exercises:**

<b>MODULE I:</b>	Algorithmic thinking - creating oral algorithms for everyday tasks - Data abstraction and representation - Abstraction and translation of everyday data for use on a computer.
<b>MODULE II:</b>	Decomposing a complex problem - Strategies for decomposition and algorithm design - Divide and conquer - Simple program implementations.
<b>MODULE III:</b>	Overall data representation, abstraction, analysis and algorithm design. Program implementations.
<b>MODULE IV:</b>	Measuring the complexity of an algorithm - sorting algorithms - the notion of unsolvable problems. Programming illustrations.
<b>MODULE V:</b>	Enhancing the clarity of a program - documentation, style, idioms.

**System requirement**

Sl. No.	Description of Equipment	Required numbers for batch of 30 students
1.	INTEL based desktop PC with min. 4GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 8 or higher operating system / Linux Ubuntu 20 or higher	30

**Course Outcomes:**

After successful completion of this course, the students will be able to

CO1:	Formulate problems for effective computer-based solutions.
CO2:	Systematically organize and analyse data.
CO3:	Develop solutions using algorithmic approaches.
CO4:	Identify, evaluate, and implement optimal solutions by efficiently utilizing steps and resources.
CO5:	Apply and adapt the problem-solving process across diverse scenarios.

### Text Books:

- T1: Karl Beecher, Computational Thinking - A Beginner's Guide to Problem-Solving and Programming, BCS Learning, 2017.
- T2: Venkatesh G, Madhavan Mukund, Computational Thinking, Notion Press, 1st Edition, 2021.
- T3: Hunt, Kenny A. \_ Riley, David D, Computational Thinking for the Modern Problem Solver, CRC Press, 2015

### References

- R1: David Clark, Computational and Algorithmic Thinking Book 2, AMT Publishing, 2016.
- R2: Paul Curzon, “Computing Without Computers: A Gentle Introduction to Computer Programming, Data Structures, and Algorithms”, 2014.  
<https://teachinglondoncomputing.files.wordpress.com/2014/02/booklet-cwc-feb2014.pdf>
- R3: Wang Paul S, From computing to computational thinking, CRC Press, 2016.
- R4: Peter J. Denning, Matti Tedre, Computational Thinking, MIT Press, 2019.
- R5: Paolo Ferragina, Fabrizio Luccio, Computational Thinking\_ First Algorithms, Then Code, Springer International Publishing, 2018.
- R6: Aman Yadav, Ulf Berthelsen, Computational Thinking in Education\_ A Pedagogical Perspective, Routledge, 2021.
- R7: Zhiwei Xu, Jialin Zhang, Computational Thinking\_ A Perspective on Computer Science, Springer, 2021
- R8: Exploring Computational Thinking.<https://edu.google.com/resources/programs/exploring-computational-thinking/>.

### Web links and Video Lectures (e-Resources):

1. <https://teachinglondoncomputing.org> – Unit 1\_
2. <https://classic.csunplugged.org> Unit 3 & Unit 5
3. [http://Study.iitm.ac.in/D's/course\\_pages/bcs1001.html](http://Study.iitm.ac.in/D's/course_pages/bcs1001.html) - Unit 3
4. <http://Learning.com/blog/defining-computationalthinking> - Unit 1
5. <https://centre-for-humanities-computing.github.io> – Unit 1
6. <http://Nptel.ac.in/course/115106121> - All units

### CO-PO & PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1
CO2	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1
CO3	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1
CO4	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1
CO5	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1
AVG	3	3	3	2	1	1	-	-	-	-	-	1	3	2	1

‘1’ – Low, ‘2’ – Medium, ‘3’- High, ‘-’ – No correlations

# ENGINEERING VISUALIZATION

(Common to all branches)

Course Code	24GE121	Course Type	Integrated
Teaching Periods/Week (L:T:P)	1:0:4	Credits	3
Total Teaching Periods	75	IAT + ESE Marks	60 + 40
Teaching Department	Mechanical Engineering		

**Course Objectives:** To Equip the students with the knowledge in

1. BIS conventions and specifications for engineering drawing and constructing the conic curves, involutes, and cycloids
2. Projections of lines and planes.
3. Orthographic projection of solids and sections of solids.
4. Projection of sectioned solids and Development of surfaces
5. Isometric projections of simple solids.

## Unit: I PLANE CURVES

3+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of Ellipse, Parabola & Hyperbola using eccentricity method – Construction of Cycloid – Construction of Involute of circle, Square and polygons – Tangent and Normal to the above curves.

**Practical component:** AutoCAD – Solid modeling tool - Basics.

**Teaching-Learning Process Pedagogy:** Lecture, PPT, NPTEL  
**RBT Level:** L1-L4

## Unit: II PROJECTION OF POINTS, LINES AND PLANE SURFACE

3+12

Orthographic projection - First angle projection –Principal planes - Projection of points – Projection of Lines (Only First angle projection) inclined to both principal planes – Determination of true length and true inclinations by rotating line method – Projection of planes (Circle and polygons) inclined both principal planes by rotating object method.

**Practical component:** AutoCAD – Lines and Plane.

**Teaching-Learning Process Pedagogy:** Lecture, PPT, NPTEL  
**RBT Level:** L1-L4

## Unit: III PROJECTION OF SOLIDS

3+12

Projection of simple solids like prisms, pyramids, cones and cylinders, and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

**Practical component:** AutoCAD – Projection of simple solids

**Teaching-Learning Process Pedagogy:** Lecture, PPT, NPTEL  
**RBT Level:** L1-L4

## Unit: IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

3+12

Sectioning of solids in the simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining the true shape of the section. Development of the lateral surfaces of simple sectioned solids – Prisms, Pyramid, Cylinder, and Cone.

**Practical component:** AutoCAD – Section of simple solids and surfaces

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT, NPTEL  
**RBT Level:** L1, L2, L3, L4

**Unit: V ISOMETRIC PROJECTIONS****3+12**

Principles of isometric projection – isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones – combination of two solid objects in simple vertical positions.

**Practical component:** AutoCAD – Isometric projections of simple solids and truncated solids

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT, NPTEL

**RBT Level:** L1,L2,L3,L4

**Total****75****System requirement**

Sl. No.	Description of Equipment	Required numbers for batch of 30 students
1.	INTEL-based desktop PC with min. 4GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 8 or higher operating system	30
3.	Auto-CAD	30

**Course Outcomes:**

After successful completion of this course, the students will be able to

- CO1: Use BIS conventions and specifications for engineering drawing and constructing the conic curves, involutes, and cycloid
- CO2: Solve practical problems involving the projection of lines and Planes.
- CO3: Sketch the orthographic projection of simple solids.
- CO4: Draw the Sectional view of solids and development of simple surfaces.
- CO5: Sketch the isometric projections of simple solids.

**Text Books:**

- T1: Gopalakrishna K. R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017. ISBN – 9788184245686
- T2: Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019. ISBN - 978-9380358963

**References**

- R1: Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019. ISBN - 978-1259062889
- R2: Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015. ISBN - 9780199455397
- R3: Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 15<sup>th</sup> Edition, 2018. ISBN - 9788122430422

**Web links and Video Lectures (e-Resources):**

1. <https://nptel.ac.in/courses/112103019> - Unit 1
2. <https://www.youtube.com/watch?v=72EGcYdx7sA&t=16s> - Unit 2
3. <https://www.youtube.com/watch?v=8w--gcrCsuY> – Unit 3
4. <https://www.youtube.com/watch?v=yKYivtPembM> – Unit 4
5. <https://www.youtube.com/watch?v=qhOffFTIsV0> – Unit 5

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	2	-	-	-	-	1	-	2	2	1	-
2	3	2	1	2	2	-	-	-	-	1	-	2	2	1	-
3	3	2	1	2	2	-	-	-	-	1	-	2	2	1	-
4	3	2	3	2	2	-	-	-	-	1	-	2	2	1	-
5	3	2	1	2	2	-	-	-	-	1	-	2	2	1	-
<b>AVG</b>	3	2	1.4	2	2	-	-	-	-	1	-	2	2	1	-

'1' – Low , '2' – Medium , '3'- High, '-' – No correlations

# ENGLISH FOR ENHANCING SELF COMPETENCE

(Common to all branches)

<b>Course Code:</b>	24EN121	<b>Course Type:</b>	Practical
<b>Teaching Periods/Week (L:T:P):</b>	0:0:2	<b>Credits:</b>	1
<b>Total Teaching Periods:</b>	30	<b>IAT + ESE:</b>	60 + 40
<b>Teaching Department:</b>	English		

## Course Objectives:

1. To articulate and learn various social behaviors and etiquette.
2. To develop writing and speaking skills for professional requirements.
3. To acquire techniques of fundamental communication skills.

## Unit: I PERSONALITY TRAITS 6

Self-Introduction, Ways to Identify Self (SWOT Analysis- Johari Window), Concepts of Self-Management and Self-Motivation, Self-Assessment.

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT, YouTube videos

**RBT Level:** L1, L2, L3

## Unit: II COMMUNICATION SKILLS 6

Effective Communication Skills, Interpersonal & Social Skills

**Teaching-Learning Process Pedagogy:** PPT, YouTube videos

**RBT Level:** L1, L2, L3

## Unit: III SOCIAL BEHAVIOUR 6

Time Management, Personal Grooming, Making Small Talk, Inter-Cross-Cultural Communication, Professional Presentation Techniques.

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT, YouTube videos

**RBT Level:** L1, L2, L3

## Unit: IV CULTURAL ETIQUETTE 6

Formal Presentation, Sensitivity towards multi-cultural work spaces, Presentation skills –Formal Presentation - Just a minute

**Teaching-Learning Process Pedagogy:** PPT, YouTube videos

**RBT Level:** L1, L2, L3

## Unit: V JOB-RELATED COMMUNICATION 6

Resume & Cover Letter, Formal E-mails, Framing Requests, Greetings, Salutations, Close, Interview-Types-Interview Questions-Techniques, Introduction to Interviews-FAQ's

**Teaching-Learning Process Pedagogy:** Lecture Method, PPT, YouTube videos

**RBT Level:** L1, L2, L3

**Total 30**

## System requirement

Sl. No.	Description of Equipment	Required numbers for batch of 30 students
1.	INTEL based desktop PC with min. 4GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 8 or higher operating system	30
3.	Hot Potatoes / Globalina	30

## Course Outcomes:

After successful completion of this course, the students will be able to

**CO1:** To listen to and comprehend general as well as complex academic information

**CO2:** To speak fluently and accurately in formal and informal communicative contexts

**CO3:** To express their opinions effectively in both formal and informal discussions.

## CO-PO & PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	2	3	-	2	1	1	1
2	-	-	-	-	-	-	-	-	2	3	-	3	1	1	1
3	-	-	-	-	-	-	-	-	2	3	-	2	1	1	1
<b>AVG</b>	-	-	-	-	-	-	-	-	2	3	-	2.3	1	1	1

'1' – Low, '2' – Medium, '3' - High, '-' – No correlation

# ELECTRICAL AND ELECTRONICS WORKSHOP PRACTICE

(Common to all branches)

Course Code	24GE221	Course Type	Practical
Teaching Periods/Week (L:T:P)	0:0:2	Credits	1
Total Teaching Periods	30	IAT + ESE Marks	60 +40
Teaching Department	Electrical and Electronics Engineering		

## Course Objectives:

1. To equip students with a comprehensive understanding of electronic equipment and practical soldering skills.
2. To develop students' proficiency in making electrical wiring connections using appropriate techniques and perform energy audit.
3. To provide students with practical exposure in installation and maintenance of household electrical appliances.

## PRACTICAL

30

1. Study of components - R, L, C, Diode, Transistor and IC's.
2. Study of equipment's – RPS, Function Generator, CRO, Multimeter, Ammeter, Voltmeter, Wattmeter and Energy meter.
3. Measurement of voltage, current, frequency, time period for sine, square and triangular waves.
4. Soldering practice and breadboard practice.
5. Study of wires and cables.
6. Basic switchboard wiring with lamp, fan and three pin socket.
7. Fluorescent Lamp Wiring and Staircase Wiring.
8. Residential House wiring using Switches, Fuse, Indicator, Lamp and Energy meter.
9. Measurement of Energy and Earth Resistance.
10. Energy Audit.
11. Installation and Maintenance of Electrical Appliances –I Iron box, Emergency Lamp, Fan regulator.
12. Installation and Maintenance of Electrical Appliances –II Water heater, Stabilizer and UPS.

## List of Equipment:

S.No	Name of the Equipment	Quantity
1	Single phase house wiring setup (Fuse, Lamp, Socket, Switch, PVC Pipe, Lamp Holder, Energy Meter)	2
2	Staircase wiring setup (Lamp, Two-way Switch, Socket, Switch, PVC Pipe, Lamp Holder)	2
3	Fluorescent lamp wiring setup (Fluorescent Lamp, Socket, Switch, PVC Pipe, Fluorescent Lamp Holder, Choke, Starter)	2
4	Water heater (1500W, 230V)	2
5	Stabilizer (500W, 160 – 290V)	2
6	UPS (600 VA)	2
7	Fan regulator	2
8	Iron box setup	2
9	Emergency lamp setup	2
10	Soldering Iron, Lead	15
11	Multi meter (0-600V, 10A)	15



12	Continuity tester	2
13	Resistors	Adequate Number
14	Capacitors	Adequate Number
15	Diodes	Adequate Number
16	Transistors	Adequate Number
17	Inductors	Adequate Number
18	IC's	Adequate Number
19	RPS (0-30V)	5
20	Function Generator (0-1MHz)	5
21	CRO (20MHz)	5
22	Ammeter (0-10A) MI	10
23	Voltmeter (0-300V) MI	10
24	Wattmeter (300V,10A, UPF)	5
25	Energy meter (single phase, two wire, (5-30A)/240V, 50Hz)	5
26	Wires, Cables	Adequate Number
27	Clamp meter (0-1000A), (0-750V)	2
28	Megger (500V, 100Mohms)	1

**Course Outcomes:**

After successful completion of this course, the students will be able to

- CO1:** Identify various electronic components and assemble simple electronic circuits using soldering.  
**CO2:** Make wiring connections for household and conduct energy audit.  
**CO3:** Install and maintain household electrical appliances.

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	1	1	1	-	-	-	-	1	2	1	1
2	3	2	1	2	1	1	1	-	-	-	-	1	2	1	1
3	3	2	1	2	1	1	1	-	-	-	-	1	2	1	1
<b>AVG</b>	3	2	1	2	1	1	1	-	-	-	-	1	2	1	1

1 – „Low“, 2 – „Medium“, 3- „High“, „-“, – No correlations

**PRODUCT TINKERING LAB**  
(Common to all)

<b>Course Code</b>	24GE122	<b>Course Type</b>	Practical
<b>Teaching Periods/Week (L: T:P)</b>	0:0:2	<b>Credits</b>	1
<b>Total Teaching Periods</b>	30	<b>IAT + ESE Marks</b>	60 + 40
<b>Teaching Department</b>	Civil Engineering and Mechanical Engineering		

**Course Objectives:** To equip the students with

1. Hands-on experience in Mechanical Equipments.
2. Design of simple components using computer-aided design.
3. Basic concept of 3D Printing.
4. Hands-on training on basic plumbing works

**Practical Exercises**

**30**

1. Exercise on the usage of a hand-drilling machine
2. Demonstration of Centrifugal pumps.
3. Demonstration of two-wheeler and four-wheeler maintenance and repairs,
4. 3D Modelling of a single component.
5. Exercise on CAD Data Exchange and Generation of .stl files.
6. Identification of a product for Additive Manufacturing and its AM process plan
7. Printing of identified product on an available AM machine.
8. Demonstration on how to change the Tap fittings.
9. Preparing plumbing line sketches.
10. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows, and other components that are commonly used in households.
11. Laying pipe connection to the suction and delivery side of a pump
12. Connecting pipes of different materials: Metal, plastic, and flexible pipes used in household appliances.

**Equipment required**

<b>Sl. No.</b>	<b>Description of Equipment</b>	<b>Required numbers for batch of 30 students</b>
1.	Hand Drilling Machine	5 nos.
2.	Centrifugal pump Assembly	1 no.
3.	Two-Wheeler (Four Stroke Petrol Engine)	1 no.
4.	Four-Wheeler (Four Stroke Diesel Engine)	1 no.
5.	Pipe Vice	5 nos.
6.	Die Holder with Die set	5 nos.
7	Valves, Taps, Coupling, Unions, Reducers, and Elbows (Metal and Plastics)	5 nos. each
8	INTEL based desktop PC with min. 4GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	5 Nos
9	3D Printer	2 Nos

**Course Outcomes:**

After successful completion of this course, the students will be able to

CO1:	Perform the basic maintenance and servicing of mechanical equipments.
CO2:	Design simple components using computer-aided design.
CO3:	Develop a 3D component using additive manufacturing.
CO4:	Sketch and perform the plumping for the house's different connections.

**CO-PO & PSO Mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	2	-	-	-	-	-	-	1	2	-	1
2	2	-	-	-	3	-	-	-	-	-	-	1	2	-	1
3	2	-	-	-	3	-	-	-	-	-	-	1	2	1	1
4	2	-	-	-	2	-	-	-	-	-	-	1	2	-	1
AVG	2	-	-	-	2.5	-	-	-	-	-	-	1	2	1	1
‘1’ – Low , ‘2’ – Medium , ‘3’- High, ‘-’ – No correlations															