St. Thomas College of Engineering & Technology
Vellilode, Sivapuram PO. Mattanur. Kannur District, Kerala
Approved by AICTE New Delhi, Govt. Of Kerala and Affiliated to APJ Abdul Kalam Technological University

COURSE HANDOUT

(B. Tech - Semester 3)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COLLEGE VISION

To be an Institute of repute recognized for excellence in education, innovation, and social contribution.

COLLEGE MISSION

M1: Infrastructural Relevance - Develop, maintain and manage our campus for our stakeholders.
M2: Life-Long Learning - Encourage our stakeholders to participate in lifelong learning through industry and academic interactions.
M3: Social Connect - Organize socially relevant outreach programs for the benefit of humanity.

DEPARTMENT VISION

To produce professionally competent, ethically sound and socially responsible Electronics and Communication Engineers.

DEPARTMENT MISSION

M1: Provide excellent infrastructure and lab facilities for quality education.

M2: Promote industry-academic interactions to keep up with technological advancements.

M3: Develop interpersonal skills and social responsibility among students through project-based and team-based learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Graduates of B. Tech ECE program after graduation will:

PEO1: Exemplify technical competence in designing, analyzing, testing and fabricating electronic circuits.

PEO2: Acquire leadership qualities, rapport, communication skills in the organization and adapt to changing professional and societal needs.

PEO3: Work effectively as individuals and as team members in multidisciplinary projects

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

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, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and 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.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Define, design, implement, model, and test electronic circuits and systems that perform signal processing functions.

PSO2: Segregate and select appropriate technologies for implementation of a modern communication system.

CONTENTS

COURSE INFORMATION SHEETS OF SEMESTER 3 COURSES

GYMAT 301

MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 3

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE -3	**SEMESTER: 3** **L-T-P-CREDITS**: 3-0-0-3
COURSE CODE: GYMAT301 **REGULATION**: 2024	**COURSE TYPE**:NON CORE
COURSEAREA/DOMAIN: APPLIED MATHEMATICS	**CONTACT HOURS**:36
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME**: NIL

SYLLABUS

MODULE	DETAILS	HOURS
I	Fourier Integral, From Fourier series to Fourier Integral, Fourier Cosine and Sine integrals, Fourier Cosine and Sine Transform, Linearity ,Transforms of Derivatives, Fourier Transform and its inverse, Linearity ,Transforms of Derivative. (Text 1: Relevant topics from sections 11.7,11.8,11.9)	9

II	Complex Function, Limit, Continuity, Derivative, Analytic functions, Cauchy-Riemann Equations (without proof), Laplace's Equations, Harmonic functions, Finding harmonic conjugate, Conformal mapping, Mappings of w= z^2 ,w=e^z ,w=$\frac{1}{z}$, w= sin z. (Text 1: Relevant topics from sections 13.3, 13.4, 17.1, 17.2, 17.4)	9
III	Complex Integration: Line integrals in the complex plane (Definition &Basic properties), First evaluation method, Second evaluation method, Cauchy's integral theorem (without proof) on simply connected domain, Independence of path, Cauchy integral theorem on multiply connected domain (without proof), Cauchy Integral formula (without proof). (Text 1: Relevant topics from sections 14.1, 14.2, 14.3)	9
IV	Taylor series and Maclaurin series, Laurent series (without proof),Singularities and Zeros – Isolated Singularity, Poles, Essential Singularities, Removable singularities, Zeros of Analytic functions – Poles and zeroes, Formulas for Residues, Residue theorem (without proof),Residue Integration- Integral of Rational Functions of cos θ and sin θ. (Text 1: Relevant topics from sections 15.4, 16.1, 16.2, 16.3, 16.4)	9
Total hours		36

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Advanced Engineering Mathematics Erwin Kreyszig John Wiley & Sons 10th edition,2016
R1	Complex Analysis Dennis G. Zill, Patrick D.Shanahan Jones & Bartlett 3rd edition, 2015
R2	Higher Engineering Mathematics , B. V. Ramana, McGraw-Hill Education , 39th edition,2023
R3	Higher Engineering Mathematics , B.S. Grewal , Khanna Publishers , 44th edition, 2018

R4	Fast Fourier Transform -Algorithms and Applications , Kim, Jae Jeong Hwang , Springer , 1st edition,2011

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
GYMAT 301	MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 3	Basic knowledge in Complex numbers.	S 3

COURSE OBJECTIVES:

1.	To introduce the concept and applications of Fourier transforms in various engineering fields.
2.	To introduce the basic theory of functions of a complex variable, including residue integration and conformal transformation, and their applications.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	PO1	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
GYMAT301.1	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering.													
	3	**3**		**2**								**2**	**3**	2
	APPLY													
GYMAT301.2	Understand the analyticity of complex functions and apply it in conformal mapping.													
	3	**3**		**2**								**2**	**1**	**1**
	APPLY													
GYMAT301.3	Compute complex integrals using Cauchy's integral theorem and Cauchy's integral formula.													

	3	**3**		**2**								**2**	1	2
	APPLY													
GYMAT301.4	Understand the series expansion of complex function about a singularity and apply residue theorem to compute real integrals.													
	3	**3**		**2**								**2**	1	2
	APPLY													
MAPPING AVERAGE	**3**	**3**		**2**								2	1.50	1.75

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
GYMAT 301.1	PO1	3	Demonstrates strong fundamental knowledge of mathematics to solve geological or applied science problems.
	PO2	3	Formulates and analyzes problems using mathematical models and techniques.
	PO4	2	Requires selection and application of appropriate Fourier methods to evaluate and interpret results in practical contexts.
	PO12	2	Fourier analysis is foundational in many advanced courses and real-life applications (e.g., DSP, telecommunications), encouraging students to continue learning.
	PSO1	3	Direct application of Fourier transform theory to solve problems in fields like electrical, electronics, and communication engineering.
	PSO2	2	Students use the Fourier transform as a tool for frequency domain analysis of signals and systems.
GYMAT 301.2	PO1	3	Applies mathematical reasoning to understand and interpret natural phenomena.
	PO2	3	Solves domain-specific problems using advanced mathematical tools.

	PO4	2	Conformal mapping helps model and analyze physical systems, allowing students to study system behavior and validate results through simulations**.**
	PO12	2	Mastery of advanced mathematical concepts like conformal mapping enables students to pursue further studies. It helps them adapt to emerging mathematical tools and techniques in engineering and research. This fosters a mindset for lifelong learning.
	PSO1	1	This outcome strengthens students' capability to apply complex analysis in real-world engineering contexts such as electromagnetic theory, fluid mechanics, and structural analysis, enhancing their problem-solving skills using conformal transformations.
	PSO2	1	By learning and applying analyticity and conformal mapping, students gain exposure to mathematical tools and techniques used in simulations and design of engineering systems, supporting software-based and analytical approaches in professional practice.
GYMAT 301.3	PO1	3	Understands and applies core mathematical concepts to geological processes or technical applications.
	PO2	3	Develops and validates mathematical models for real-world geological problems.
	PO4	2	Complex integration helps model and interpret real-life engineering systems. It supports analytical investigation and verification of results in research and simulations.
	PO12	2	Learning complex integral techniques develops problem-solving habits and mathematical maturity. This prepares students to adapt to advanced studies and emerging analytical tools throughout their careers.
	PSO1	1	This outcome reinforces the application of mathematical theorems like Cauchy's in solving engineering problems, strengthening their analytical capabilities in contexts such as electromagnetics or control systems.
	PSO2	2	Cauchy's theorems are foundational in many engineering tools and

			techniques. Mastery of these supports simulation, design, and analytical tasks in professional practice and advanced software environments.
GYMAT 301.4	PO1	3	Uses mathematical skills for analyzing field or lab data relevant to the domain.
	PO2	3	Interprets and solves complex problems with analytical and numerical techniques.
	PO4	2	The ability to work with complex series and evaluate real integrals using residues aids in the mathematical investigation of real-world engineering problems and supports accurate solution development and validation.
	PO12	2	Understanding these advanced mathematical methods prepares students for future research and learning. It supports the development of skills required to adopt modern analytical tools and techniques throughout their careers.
	PSO1	1	Mastery of complex series and the residue theorem directly enhances students' capacity to solve real engineering problems in domains like electrical circuits, vibrations, and heat conduction.
	PSO2	2	These concepts are widely used in mathematical modeling and simulation Proficiency in them helps students perform accurate analysis using engine and theoretical methods.

CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)

GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Applications of complex analysis in engineering	Bridge course - Providing few real-life examples	PO1,PO2, PO12,PSO1,PSO2

WEB SOURCE REFERENCES:

1.	https://nptel.ac.in/courses/111/105/111105096/
2.	https://nptel.ac.in/courses/111/101/111101054/

DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD		**ICT TOOLS**	
CLASSROOM WITH LCD PROJECTOR		**ELECTRONIC CLASSROOM**	

INSTRUCTION METHODS

FACE TO FACE INSTRUCTION	Direct		**FLIPPED CLASSROOM**	
	Project-based instruction		**BLENDED LEARNING**	
	Problem-based instruction		**ONLINE COURSES/MOOCs**	
	Technology enhanced learning		**OTHERS (IF ANY)**	

	Experiential learning			
	Participative learning			

CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS		**TUTORIALS**		**SERIES EXAMINATIONS**		**UNIVERSITY EXAM**	
LAB PRACTICES		**VIVA**		**INTERNAL LAB EXAM**		**REPORT/ DOCUMENT PREPARATION**	
PRESENTATION		**EVALUATION BY GUIDE**		**INTERIM EVALUATION**		**FINAL EVALUATION**	

CO ASSESSMENT TOOLS –INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	

ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	ASSESSMENT ITEMS	CLASS SESSIONS	LAB/FIELD/TUTORIAL HOURS
GYMAT301.1	S1,A1	11	
GYMAT301.2	S2,A2	15	
GYMAT301.3	S2,A2	9	
GYMAT301.4	S3,A3	13	
		TOTAL HOURS OF INSTRUCTION : 48	

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Approved by HOD