PROGRAM: Electronics and Communication Engineering	DEGREE: B-Tech(U.G)
COURSE: Mathematics III	**SEMESTER:** 3rd **CREDITS:** 4
COURSE CODE: M302	**COURSE TYPE:** ~~**CORE /ELECTIVE / BREADTH/**~~ **S&H**
COURSE AREA/DOMAIN: Basic Engineering	**CONTACT HOURS:** 3+1 (Tutorial) hours/Week.

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Fourier Series:** Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave, And forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period 2l, Dirichlet's conditions, Sum of Fourier series. Examples. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples. **Fourier Transform:** Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.	8

II	**Introduction to Functions of a Complex Variable:** Complex functions, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems. **Complex Integration:** Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Examples. Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's Taylor's series, Laurent's series. Examples **Zeros and Singularities of an Analytic Function & Residue Theorem.** Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta + c\sin\theta}$, $\int_C \frac{P(z)}{Q(z)} dz$ (elementary cases, P(z) & Q(z) are polynomials of 2nd order or less). **Introduction to Conformal Mapping** Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point.	13
III	**Probability:** Classical definition and its limitations. Axiomatic definition. Some elementary deduction: i) $P(O)=0$, ii) $0 \le P(A) \le 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings. Frequency interpretation of probability. Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pairwise &	8

	mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. **Random Variable & Probability Distributions. Expectation.** Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. Some important discrete distributions: Binomial & Poisson distributions and related problems. Some important discrete distributions: Binomial & Poisson distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.	
IV	**Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE) :** **Basic concepts of PDE.** Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transforms methods. **Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.** **PDE I**: One dimensional Wave equation. **PDE II:** One dimensional Heat equation. **PDE III:** Two dimensional Laplace equations. **Introduction to series solution of ODE**. Validity of the series solution of an ordinary differential equation. General method to solve $P_o y''+P_1 y'+P_2 y=0$ and related problems. **Bessel's equation.** Series solution, Bessel function, recurrence relations of Bessel's Function of first kind. **Legendre's equation.** Series solution, Legendre function, recurrence relations and orthogonality relation.	13
TOTAL HOURS		42

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Engineering Mathematics, Volume III, B.K.Pal, K.Das, U.N.Dhur & Sons Pvt
T	Higher Engineering Mathematics, Grewal B S: Khanna Publishers.
R	A Textbook of Engineering Mathematics, N.P.Bali, Manish Goyal, Laxmi Publications.
R	Higher Engineering Mathematics, Ramana, Tata McGraw Hill.
R	Advanced Engineering Mathematics, Kreyzig E.: John Wiley and Sons.
R	Complex Variables, Spiegel M.R., Lipschutz S., John J.S., and Spellman D., TMH.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
M 101	Mathematics I	Matrix, Series, Function of several variables, Mean Value Theorem.	Sem I
M 201	Mathematics II	Differential equation, Integral Transformation as Laplace transformation	Sem II

COURSE OUTCOMES:

SNO	DESCRIPTION	PO(1..12) MAPPING	PSO(1,2) MAPPING	Bloom's Level
M302.1	Solve problems of Fourier series and Fourier transformation.	PO1, PO2, PO3, PO12	PSO1,PSO2	L3
M302.2	Calculate differentiation and integration of complex valued function.	PO1, PO2, PO3, PO12	PSO1,PSO2	L3
M302.3	Apply the knowledge of distribution function to find probability.	PO1, PO2, PO3, PO12	PSO1,PSO2	L3
M302.4	Solve partial differential equation by separation of variable method.	PO1, PO2, PO3, PO12	PSO1,PSO2	L3
M302.5	Solve ordinary differential equation using series solution and special function.	PO1, PO2, PO3, PO12	PSO1,PSO2	L3

COURSE OUTCOMES VS POS MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**) :**

Course	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
M302.1	2	2	2	-	-	-	-	-	-	-	-	2	2	1
M302.2	2	2	2	-	-	-	-	-	-	-	-	2	2	1
M302.3	2	2	2	-	-	-	-	-	-	-	-	2	1	2
M302.4	2	2	1	-	-	-	-	-	-	-	-	2	2	1
M302.5	2	1	1	-	-	-	-	-	-	-	-	2	2	1
M-101	**2**	**1.8**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1.8**	**1.2**

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS
1	Classification of Partial Differential Equations and Canonical Forms	Should be included into syllabus.

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

Gap within the syllabus - mapping to CO, PO/PSO

SNO	DESCRIPTION	CO	PO (1 . .12) MAPPING	PSO MAPPING
1	Classification of Partial Differential Equations and Canonical Forms	CO4	PO1, PO2, PO3, PO12	PSO1,PSO2

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	Maximum Modulus Principle.

Gaps beyond the syllabus - Mapping to PO/PSO

SNO	DESCRIPTION	PO (1 . .12) MAPPING	PSO MAPPING
1	Maximum Modulus Principle	PO1, PO2, PO3, PO12	PSO1, PSO2

Lesson plan

Program: B-Tech-ECE **Credit: 4** **Contact: 3L + 1T**

Course name: Mathematics- III **Course Code- M302**

Lecture wise Break-up Of the Subject

Lecture No.	Subject	Text Books/ Reference	Teaching Aids/ Methods	Course outcome satisfied	Blooms level
L1	Definition & properties of Periodic Functions, Even & Odd Functions, Concept of Trigonometric Series, Graphs of some Periodic Functions. Fourier Series & Euler Formula for Fourier Coefficients.	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
L2	Convergence of Fourier Series, Establishment of the formula of Fourier Coefficient of a function of period 2L, Fourier Series of Periodic Square Wave & Half-wave Rectifier	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
L3	Fourier Series of an even &odd function of period 2L, Theorem on the Fourier coefficient of a sum of functions, Fourier Series of Saw tooth Wave	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
T1	Problems on Fourier series	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
L4	Fourier Cosine and sine Integral, Introduction to the concept of Fourier Cosine & Sine Transform	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
L5	To show that the Fourier Cosine & Sine Transform are linear operation, Establishment of formula of cosine & sine transform of Derivatives of functions	Te1	Chalk, Green glass board/ Lecture method	CO1	L3
L6	Fourier Transform and its inverse	Te1	Chalk, Green glass board/	CO1	L3

	Linearity of Fourier Transform, convolution Theorem		Lecture method		
T2	Problems on Fourier transform	Te1, Te4	Chalk, Green glass board/ Lecture		L3
L7	Functions of Complex Variables, Comparison with real valued function, concept of Limit & continuity.	Te2	Chalk, Green glass board/ Lecture method	CO2	L3
L8	Differentiation of Complex valued function. Analytic Function-Definition & properties.	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
L9	Necessary & Sufficient condition for differentiability Cauchy-Riemann equation.	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
T3	Problems on complex limit, continuity and differentiation	Te3, Te4	Chalk, Green glass board/ Lecture method	CO2	L3
L10	Complex conjugate, Milne Thompson method.	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
L11	Concept of Complex Integration Difference between Complex & Real Integration Cauchy's Theorem	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
L12	Cauchy's Integral Formula	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
T4	Problems on Milne Thompson method and complex integration	Te4	Chalk, Green glass board/ Lecture method	CO1,CO2	L3
L13	Taylor's Series & Laurent's Series	Te3	Chalk, Green glass board/ Lecture method	CO2	L3

L14	Zeros of an analytic function Geometric Meaning	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
L15	Concept of residue, Residue Theorem	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
T5	Problems on Taylor's and Laurent's Series	Te2, Te4	Chalk, Green glass board/ Lecture method	CO2	L3
L16	Introduction to Conformal Mapping Conformal Mapping of some special Complex functions	Te3	Chalk, Green glass board/ Lecture method	CO2	L3
L17	Definition of Probability, Basic Counting Technique. Different types of Events, Independent Events	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
L18	Conditional Probability & Bayes' Theorem	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
T6	Problems on residue and basic probability.	Te2, Te3, Te4	Chalk, Green glass board/ Lecture method	CO2, CO3	L3
L19	Random variables, Discrete & Continuous, Probability Distribution, Discrete & Continuous Probability Distribution.	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
L20	Probability Mass Function Probability Density Function Expectation & variance	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
L21	Basic Distributions, Mean, median, mode, expectation, variance of Binomial and Poisson distribution.	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
T7	Problems on distribution function	Te4, Te5	Chalk, Green glass board/	CO3	L3

			Lecture method		
L22	Normal, Exponential and Uniform-pdf, mean, median, mode, expectation, variance.	Te4	Chalk, Green glass board/ Lecture method	CO3	L3
L23	Solution of one dimensional wave equation	Te10	Chalk, Green glass board/ Lecture method	CO4	L3
L24	Solution of one dimensional heat conduction equation	Te10	Chalk, Green glass board/ Lecture method	CO4	L3
T8	Problems on continuous distribution and solution of partial differential equation.	Te1, Te4	Chalk, Green glass board/ Lecture method	CO3, CO4	L3
L25	Laplace equation in two dimensions by the method of separation of variables	Te10	Chalk, Green glass board/ Lecture method	CO4	L3
L26	Integral transform-Laplace and Fourier transforms of the P.D.E	Te10	Chalk, Green glass board/ Lecture method	CO4	L3
L27	Introductory idea of special functions, Power series solution, ordinary point, singular point, Frobenious method.	Te9	Chalk, Green glass board/ Lecture method	CO5	L3
T9	Problems on PDE and special function.	Te1, Te4	Chalk, Green glass board/ Lecture method	CO4, CO5	
L28	Bessel equation and it's solution, Bessel functions	Te9	Chalk, Green glass board/ Lecture method	CO5	L3
L29	Recurrence formula related to Bessel's function, orthogonality, Generating functions	Te9	Chalk, Green glass board/ Lecture method	CO5	L3

L30	Legendre's Equations and it's solution.	Te9	Chalk, Green glass board/ Lecture method	CO5	L3
T10	Problems on Bessel and Legender's equation.	Te4, Te9	Chalk, Green glass board/ Lecture method	CO5	L3
L31	Legendre's function of 1st and 2nd kind, Legendre's polynomial	Te9	Chalk, Green glass board/ Lecture method	CO5	L3
L32	Orthogonality, generating function. Rodrigue's formulae recurrence formula for Legendre's polynomial.	Te9	Chalk, Green glass board/ Lecture method	CO5	L3

References:

Te1: Advanced Engineering Mathematics, E.Kreyszig

Te2: Introduction to Complex Analysis, W.W.L.Chen

Te3: Notes on Complex Function Theory, Donald Sarason

Te4: Engineering Mathematics, Vol III,Das & Pal

Te5: Mathematical Statistics, De & Sen

Te6: Discrete Mathematical Structure, D.S.Malik & M.K.Sen

Te7: Introduction to Graph Theory, Douglas B. West

Te8: Probability & Statistics, Spiegel,Schilier,Srinivasan

Te9: Advanced Engineering Mathematics, H.K.Das

Te10: Advanced Engineering Mathematics,M.D.Greenberg