THIRD Semester B E (COMMON TO ALL BRANCHES)

<table>
<tr><td>Course Title</td><td colspan="7">TRANSFORM AND NUMERICAL ANALYSIS</td></tr>
<tr><td>Course Code</td><td colspan="7">P21MA301(COMMON TO ALL BRANCHES)</td></tr>
<tr><td>Category</td><td colspan="7">Basic Science Course (BS)</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Total teaching hours</td><td rowspan="2">Credits</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Total</td></tr>
<tr><td>02</td><td>02</td><td>00</td><td>00</td><td>04</td><td>52</td><td>03</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. marks=100</td><td colspan="3">Duration of SEE: 03 Hours</td></tr>
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Course Learning Objectives:	
1	Adequate exposure to basics of engineering mathematics so as to enable them to visualize the applications to engineering problems.
2	Analyze periodic phenomena using concept of Fourier series, series solution of Engineering problems
3	Understand Fourier transforms of functions and use it to solve initial value, boundary value problems
4	Apply Z-Transform technique to Solve difference equations and Numerical Technique to estimate interpolation, Extrapolation and area - (All formulae without proof)-problems only
5	Use mathematical IT tools to analyze and visualize the above concepts.

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Fourier Series:** Introduction, periodic function, even and odd functions, properties. Special waveforms - square wave, half wave rectifier, saw-tooth wave and triangular wave. Dirichlet's conditions, Euler's formula for Fourier series (no proof). Fourier series for functions of period 2L (all particular cases) – problems, Half Range Fourier series- Construction of Half range cosine and sine series and problems Practical harmonic analysis- Illustrative examples from engineering field. **Self - study: Derive Euler's formula, Fourier series in complex form.**	08	04
II	**Partial differential equations (PDE's):** Formation of PDE's. Solution of non-homogeneous PDE by direct integration. Solutions of homogeneous PDE involving derivative with respect to one independent variable only, Method of separation of variables (first and second order equations). **Applications of PDE's: Various Possible solution of PDE's** Classification of second order PDE, various possible solutions for One-dimensional wave and heat equations, by the method of separation of variables. Solution of all these equations with specified boundary conditions (Boundary value problems). Illustrative examples from engineering field. **Self - study:** Charpit's Method -simple problem. Various possible solutions of Two dimensional Laplace equation.	08	02
III	**Finite Differences and Interpolation**: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided difference interpolation formula (All formulae without proof)-problems only. **Numerical Differentiation**: Derivatives using Newton-Gregory forward and backward interpolation formulae, Applications to Maxima and Minima of a tabulated function. **Numerical Integration:** Newton-Cotes quadrature formula, Simpson's 1/3 rd rule and Simpson's 3/8th rule. Weddle's rule (All rules without proof)-	08	02

	Illustrative problems **Self - study:** Inverse Lagrange's interpolation formula Central differences.		
IV	**Fourier Transforms:** Infinite Fourier transforms. Properties- linearity, scaling, shifting and modulation (no proof), Fourier sine and cosine transforms. Inverse Fourier Transforms, Inverse Fourier cosine and sine transforms. Problems. Convolution theorem and Parseval's Identity (no proof)-problems. **Self - study:** Finite Fourier transform, Fourier transform of derivatives of functions.	08	02
V	**Z - Transforms:** Definition. Z-transforms of basic sequences and standard functions. Properties-linearity, scaling, Damping rule, first and second shifting, multiplication by *n*, initial and final value theorem (statement only) -problems. Inverse Z- transforms- problems. **Difference Equations:** Definition. Formation of Difference equations, Linear & simultaneous linear difference equations with constant coefficients-problems, Solutions of difference equations using Z- transforms. **Self - study:** Convolution theorem and problems, Application to deflection of a loaded string.	08	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Analyze engineering problems using the fundamental concepts in Fourier series, Fourier Transforms and Basics ideas of PDE's.

CO2: Explain various methods to find the Fourier constants, solution of PDE's, Estimation of interpolation and find the area, solution of difference equations.

CO3: Apply the acquired knowledge to construct the Half-range Fourier series, Finding Fourier transforms and Inverse Laplace transforms for some standard functions.

CO4: Evaluate Z-transform of various functions, solutions of differential equations with initial and boundary conditions.

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International PublishingHouse Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/resources/lecture-28-fourier-series-part-1/
4. https://www.thefouriertransform.com/
5. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php

Fourth Semester B E COMMON TO (CV, MEC, IP, AUT)

Course Title	APPLIED MATHEMATICAL METHODS						
Course Code	21MA401A (COMMON TO CV, MEC, IP, AUT)						
Category	Basic Science Course (BS)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	00	00	04	52	03
CIE Marks: 50	**SEE Marks: 50**	**Total Max. marks=100**		**Duration of SEE: 03 Hours**			

Course Learning Objectives:			
1	Adequate exposure to basics of engineering mathematics so as to enable them to visualize the applications to engineering problems.		
2	Analyze the concept of complex variables in terms real variables		
3	Understand the concept of statistical methods to fit curves of samples and correlation and regression analysis		
4	To have a insight into numerical techniques to find solution of equations having no analytic solutions		
5	Provide insight into develop probability distribution of discrete and continuous random variables Testing hypothesis of sample distribution		
6	Special functions familiarise the power series solution to analyse the problems in ordinary differential equations		
Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Calculus of complex functions:** Introduction to functions of complex variables. Definitions of limit, continuity and differentiability, Analytic functions: Cauchy- Riemann equations in Cartesian and polar forms (no proof) and consequences. Applications to flow problems. Construction of analytic functions: Milne-Thomson method-Problems. **Conformal transformations**: Introduction. Discussion of transformations $w = z^2$, $w = e^z$, $w =$ z+1/z , $(z \neq 0)$. Bileneartransformations- Problems. **Self-Study:** Derivation of Cauchy- Riemann equation in Cartesian and polar forms.	08	04
II	**Complex integration:** complex line integrals. Cauchy theorem, Cauchy integral formula. Taylor's and Laurent's series (Statements only) and illustrative examples. Singularities, poles and residues. (Statement only). Examples. **Curve Fitting:** Curve fitting by the method of least squares, fitting the curves of the forms $y = ax +$ b , $y = ab^x$, $y = ae^{bx}$ *and* $y = ax^2 + bx +$c **Statistical Methods:** Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression, problems. **Self-Study:**– Contour integration Type-I & Type-II.	08	02
III	**Solution of algebraic and transcendental equations**: Introduction, Bisection method, Regula-Falsi & Newton-Raphson method :- Illustrative examples only. **Numerical solution of ordinary differential equations (ODE's)**: Numerical solutions of ODE's of first order and first degree – Introduction. Taylor's series method. Modified Euler's method, Runge - Kutta method of fourth order (All formulae without proof). Illustrative examples only. **Numerical methods for system of linear equations**- Gauss-Jacobi and Gauss- Seidel iterative methods. Determination of largest eigen value and corresponding eigen vector by power method. **Self-Study Component**: Secant method, Picard's method	08	02

IV	**Random variables and Probability Distributions:** Review of random variables. Discrete and continuous random variables-problems. Binomial, Poisson, Exponential and Normal distributions (with usual notation of mean and variance)-:problems. **Joint Probability Distributions :** Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables **Self-study:** Geometric and Gamma distributions- problems.	08	02
V	**Special functions:** Power series solution of a second order ODE, Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$. Expansions for $J_{1/2}(x) and\ J_{-1/2}(x)$.. Series solutions of Legendre's differential equation leading to $P_n(x)$-Legendre's polynomials. Rodrigue's formula (No Proof) - simple illustrative examples **Self - Self study:** Basics of Power series; analytic, singular point and basic recurrence relations.	08	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Apply the concepts of an analytic function and their properties to solve the problems arising in Engineering field

CO2: Use the concept correlation and regression analysis to fit a suitable mathematical model for the statistical samples arise in engineering field.

CO3: Explain various numerical techniques to solve equations approximately having no analytical solutions.

CO4: Interpret discrete and continuous probability distributions in analyzing the probability models and solve problems involving Markov chains.

CO5: Estimate the series solutions of ordinary difference equation.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation,animations, videos

TEXT BOOKS

1. B. S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

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1. V. Ramana : Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php
4. https://www.iitg.ac.in/physics/fac/charu/courses/ph503/book.pdf