K.S.INSTITUTE OF TECHNOLOGY, BANGALORE

(AFFLIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM)

DEPARTMENT OF MATHEMATICS

CALCULUS AND LINEAR ALGEBRA

(Common to all Branches)

Course Title: CALCULUS AND LINEAR ALGEBRA

Course Code : 18MAT11

Credits: 04 **L-T-P : 3-2-0**

Contact Hours/Week : 04 **IA Marks : 40**

Exam. Marks : 60

Exam. Hours : 03

MODULE	RBT Levels	No. of Hrs
Module I: Differential Calculus-1 Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Curvature and radius of curvature- Cartesian and polar forms (without proof). Centre and circle of curvature (formulae only) –applications to evolutes and involutes.	**L1 & L2**	**10**
MODULE-II **Differential Calculus-2**-Taylor's and Maclaurin's series expansions for one variable (statements only), indeterminate forms - Hospital's rule. Partial differentiation; Total derivatives-differentiation of composite functions. Maxima and minima for a function of two variables; Method of Lagrange multipliers with one subsidiary condition. Applications of maxima and minima with illustrative examples. Jacobians-Simple problems.	**L1 & L2**	**10**
MODULE- III **Integral Calculus: Multiple integrals:** Evaluation of double and triple integrals. Evaluation of double integrals- change of order of integration and changing into polar co-ordinates. Applications to find area, volume and centre of gravity. **Beta and Gamma functions:** definitions, Relation between beta and gamma functions and simple problems.	**L1 & L2**	**10**
MODULE IV **Ordinary differential equations (ODE's)of first order :** Exact and reducible to exact differential equations. Bernoulli's equation. Applications of ODE's-orthogonal trajectories, Newton's law of cooling and L-R circuits. Nonlinear differential equations: Introduction to general and singular solutions; Solvable for p only; Clairaut's and reducible to Clairaut's equation only	**L1 & L2**	**10**
MODULE-V **Elementary Linear Algebra:** Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method, Gauss – Jordan method and Gauss-Seidel method. Eigen values and eigen vectors-Rayleigh's power method. Diagonalization of a square matrix of order two	**L1 & L2**	**10**

Course outcomes: On completion of this course,students are able to learn

* Make use of matrix theory for solving system of linear equations and compute the notation of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.

* Apply the knowledge of calculus to solve problems related to polar curves and its applications Eigen values and Eigen vectors required for matrix diagonalization process.

* Establish in determining the bending of a curve.

* Solve first order linear/nonlinear differential equations analytically using standard methods

* Utilize the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes

Question paper pattern:
*The question paper will have ten full questions carrying equal marks.
*Each full question consisting of 16 marks.
*There will be two full questions (with a maximum of four sub questions) from each module. *Each full question will have sub question covering all the topics under a module.
*The students will have to answer five full questions, selecting one full question from each module.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Life-Long Learning
4. Accomplishment of Complex Problems

Text Books: -

- **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015

E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016

Reference Books:

- **B.V.Ramana**: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.

Gupta C.B., Singh S.R. and Mukesh Kumar: "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

Useful websites:

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

VTU EDUSAT PROGRAMME - 20

K.S.INSTITUTE OF TECHNOLOGY, BANGALORE

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DEPARTMENT OF MATHEMATICS

ADVANCED CALCULUS AND NUMERICAL METHODS

(Common to all Branches)

Course Title: ADVANCED CALCULUS AND NUMERICAL METHODS

Course Code : 18MAT21
Credits: 04 **L-T-P : 3-2-0**
Contact Hours/ Week : 04 **IA Marks : 40**
Exam. Marks: 60
Exam. Hours : 03

MODULE	RBT Levels	No. of Hrs
Module I: Differential Calculus-1 **Vector Differentiation:** Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields-Illustrative problems. **Vector Integration:** Line integrals, Theorems of Green, Gauss and Stokes (without proof). Applications to work done by a force and flux.	**L1 & L2**	**10**
MODULE-II Differential Equations of higher order :-Second order linear ODE's with constant coefficients-Inverse differential operators, method of variation of parameters; Cauchy's and Legendre homogeneous equations. Applications to oscillations of a spring and L-C-R circuits.	**L1, L2 & L3**	**10**
MODULE- III **Partial Differential Equations (PDE's)**:-Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one dimensional heat and wave equations and solutions by the method of separation of variables.	**L1, L2&L3**	**10**
MODULE_IV **Infinite Series**:-Series of positive terms-convergence and divergence. Cauchy's root test and D'Alembert's ratio test(without proof)-illustrative examples. **Power Series solutions:**-Series solution of Bessel's differential equation leading to Jn(x)-Bessel's function of first kind-orthogonality. Series solution of Legendre's differential equation leading to .Pn(x)-Legendre polynomials. Rodrigue's fonnula (without proof), problems.	**L1& L2**	**10**
MODULE-V Numerical Methods:Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae (All formulae without proof). Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's (l/3)ri and (3/8)111 rules, Weddle's rule (without proof) -Problems.	**L1, L2&L3**	**10**

Course outcomes: On completion of this course,students are able to learn

* Apply the knowledge of numerical methods in the modelling of various physical and engineering phenomena.
* Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
* Construct a variety of partial differential equations and solution by method of separation of variables.
* Illustrate the applications of multivariate calculus to understand the solenoid and irrational vectors and also exhibit the inner dependence of line, surface and volume integrals.
* Explain the application of infinite series and obtain series solutions of ordinary differential equations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Life-Long Learning
4. Accomplishment of Complex Problems

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DEPARTMENT OF MATHEMATICS

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

(Common to all Branches)

Course Title: TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES **Course Code : 18MAT31**

Credits: 03 **L-T-P : 2-2-0**

Contact Hours/Week : 04 **Total Hours: 50**

Exam. Marks : 60 **IA Marks : 40**

Exam. Hours : 03

MODULE	RBT Levels	No. of Hrs
MODULE-I **Laplace Transform:** Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems. **Inverse Laplace Transform**: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.	L1, L2 & L3	10
MODULE-II **Fourier Series**: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.	L1,L2	10
MODULE- III **Fourier Transforms:** Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems. **Difference Equations and Z-Transforms:** Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.	L1,L2	10
MODULE IV **Numerical Solutions of Ordinary Differential Equations(ODE's)**: Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge -Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.	L1,L2 & L3	10
MODULE-V **Numerical Solution of Second Order ODE's:** Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae). **Calculus of Variations:** Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.	L3	10

Course outcomes: At the end of the course the student will be able to:

- **CO1:** Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- **CO2:** Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- **CO3:** Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- **CO4:** Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- **CO5:**Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and variational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
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- The students will have to answer five full questions, selecting one full question from each module.

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1. Engineering Knowledge
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2. *B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.*
3. Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016

Reference books:

1. **C. Roy Wylie, Louis C. Barrett:** Advanced Engineering Mathematics, McGraw-Hill Book Co, 6th Edition, 1995.
2. **S.S.Sastry:** Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010.
3. **B.V. Ramana:** Higher Engineering Mathematics, McGraw-Hill, 11th Edition,2010.
4. **N.P.Bali and Manish Goval:** A Textbook of Engineering Mathematics, Laxmi Publications, 6th Edition, 2014.
5. **Chandrika Prasad and Reena Garg:** Advanced Engineering Mathematics, Khanna Publishing, 2018.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
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3. http://academicearth.org/
4. Vtu edusat programme - 20

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DEPARTMENT OF MATHEMATICS

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

(Common to all Branches)

Course Title: COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course Code : 18MAT41
Credits: 03 **L-T-P : 2-2-0**
Contact Hours/Week : 04 **Total Hours: 50**
SEE Marks : 60 **CIE Marks : 40**
Exam. Hours : 03

MODULE	RBT Levels	No. of Hrs
MODULE-I Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions: Milne-Thomson method-Problems.	L1 & L3	10
MODULE-II Conformal transformations: Introduction, Discussion of transformations : $w = z^2$, $w=e^z$,$w= z+(1/z)$, Bilinear transformations- Problems. Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.	L1&L 3	10
MODULE- III Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.	L1&L 3	10
MODULE_IV Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems. Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-$y = ax+b$,$y= ax^b$ and $y=ax^2+bx+c$.	L1& L3	10
MODULE-V Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.	L1,L2 &L3	10

Course Outcomes: On completion of this course, students are able to:

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Utilize conformal transformation and complex integral arising in fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Fit a suitable curve for given data and analyze the relationship between two variables using statistical methods.
- Apply the knowledge of joint probability distributions in attempting engineering problems for feasible random events and also Understand the concepts of sampling theory and apply it to related real life problems.

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module.

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