DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

(Common to all branches)

[As per Choice Based Credit System (CBCS) scheme]

(From the academic year 2021-22)

Course Code	21MA21	CIE Marks	50
Credits	03	SEE Marks	50
Contact Hours/Week (L-T-P)	3-0-0	Total Marks	100
Contact Hours	42	Exam Hours	03

Course Learning Objectives: This course (**21MA21**) will enable students to master the basic tools of differential & integral calculus, differential equations and elementary linear algebra and become skilled for solving problems in science and engineering.

MODULE-I

Ordinary differential equations(ODE's)of first order:- **8 Hours**

Linear and reducible to linear differential equation. Exact and reducible to exact differential equations. 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 equations only.

RBT Levels: L1, L2 & L3

MODULE-II

Ordinary Differential Equations (ODE's) of higher order:- **9 Hours**

Differential equation of higher order with constant coefficients and examples. **S**econd order linear ODE's with constant coefficients by the method of variation of parameters; Cauchy's and Legendre homogeneous differential equations. Initial and boundary value problems. **Applications to oscillations of a spring and L-C-R circuits**.

RBT Levels: L1, L2 & L3

MODULE-III

Partial Differential Equations(PDE's):- **9 Hours**

Formation of PDE's by elimination of arbitrary constants and arbitrary functions. Solution of non-homogeneous PDE by direct integration method. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of PDE's by the method of separation of variable.

Application of Partial Differential Equations(PDE's):-

Introduction, derivation of one dimensional wave equation and heat equation, various possible solutions of one dimensional wave equation and heat equation and Laplace equation by the method of separation variables and examples.

RBT Levels: L1, L2 & L3

MODULE-IV

Vector Calculus:- **8 Hours**

Vector Differentiation: Scalar and vector fields**.** Gradient, directional derivative; divergence and curl physical interpretation; solenoidal and irrotational vector fields- Illustrative problems.

Vector Integration: Line integrals, Greens Theorem, Gauss Divergence Theorem and Stokes Theorem (Only Statements) Illustrative examples. Applications to work done by a force and flux.

RBT Levels: L1, L2 & L3

MODULE-V

Laplace Transformations: **8 Hours**

Defination, Transforms of elementary functions. Laplace transform of Derivatives and integrals and problems, periodic function and Unit step function- Illustrative problems.

Inverse Laplace transforms, properties - Illustrative problems, Solution of linear differential equations.

RBT Levels: L1, L2 & L3

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed.,2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10thEd.(Reprint),2016.

Reference books:

1. Early Transcendental Calculus- James Stewart, Thomson Books, 5e 2007
2. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
3. B.V.Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
5. Thomas G.B. and Finney R.L."Calculus and Analytical Geometry"9th Edition, Pearson,

E-Books and Online resources:

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

Pedagogy (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

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

CO1: Explain various physical models through first order and first degree ordinary differential equations and solve them by analytically

CO2: Explain various physical models through second and higher order ordinary differential equations and solve them analytically

CO3: Understand a variety of partial differential equations and solution by exact methods and apply methods of separation of variables to solve heat, wave, laplace equations.

CO4: Illustrate the applications vector calculus to understand the solenoidal and irrotational vectors and also to exhibit the interdependence of line, surface and volume integrals.

CO5: Apply the knowledge of Laplace transform and inverse Laplace transform to solve the differential equations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	3	1										1
CO3	3	2										1
CO4	3	1										1
CO5	3	1										1
AVG	3	1.2										1

Method of Examination:

Note:- The SEE question paper will be set for 100 marks and the marks scored by the student will be proportionately reduced to 50.

- The question paper will have **ten** full questions carrying equal marks.
- Each full question carries **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.