COURSE INFORMATION SHEET

Course code: MA 207R1

Course title: Mathematics IV

Pre-requisite(s): Mathematics - III

Co- requisite(s): ---

Credits: L: 5 T: 1 P: 0 C: 6

Class schedule per week: 5 Lectures, 1 Tutorial.

Class: IMSc

Semester / Level: IV / 2

Branch: Physics and Chemistry

Name of Teacher:

Course Objectives: This course enables the students to understand

1.	various methods to solve linear differential equations of second and higher order
2.	special functions viz. Legendre's and Bessel's and different properties associated with them
3.	diverse mathematical techniques for solving partial differential equations of first order and higher order, along with their applications in wave and heat equations using Fourier series
4.	the theory of functions of a complex variable, complex differentiation and integration
5	infinite series (Taylor and Laurent series) for complex variable function, the theory of residues with applications to evaluation of integrals

Course Outcomes: After the completion of this course, students will be able to

CO1	investigate the occurrence of differential equations in science and engineering and the methods available for their solutions.
CO2	formulate any real life problem in terms of special functions associated with differential equations.
CO3	gain an understanding of solving problems associated with partial differential equations
CO4	gain an understanding on complex variable function, analytic functions and their properties using different theorems and demonstrate a depth of understanding in advanced mathematical topics
CO5	enhance and develop the ability of using the language of mathematics in science and engineering

NIMS 16/11/21

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Syllabus

MA 207R1 **MATHEMATICS – IV** 5-1-0-6

MODULE – I: Ordinary Differential Equations

First order differential equations and their applications. Separation of variables, equations reducible to separable form. Linear differential equations, Wronskian, Linear independence and dependence of solutions, Linear differential equations of second and higher order, Operator method, Euler – Cauchy's differential equation, Legendre's linear differential equation, Method of variation of parameters. **[12L]**

MODULE – II: Series Solution and Special Functions

Power series, ordinary and singular points of differential equation, Power and Frobenius series solutions, Bessel's differential equation and its series solution, Bessel function of first kind and its properties, Legendre's differential equation and its series solution, Legendre's polynomial and its properties. **[12L]**

MODULE – III: Integral Transforms and Partial Differential Equations

Laplace transforms, its properties and its applications, Fourier series, Euler formulae for Fourier series for length of interval 2π, Fourier series for arbitrary length of interval, Half range Fourier series, Fourier transforms and its properties.
Linear and quasi – linear partial differential equations, Lagrange's method, Method of separation of variables and its application in solving one dimensional wave and heat equations **[12L]**

MODULE – IV: Complex Analysis - I

Function of a complex variable, Limit, Continuity, Differentiability, Analyticity, Analytic functions, Cauchy – Riemann equations (Cartesian and Polar form). Complex Integration, Cauchy's theorem, Cauchy's Integral formula, Cauchy's Integral Formula for derivatives **[12L]**

MODULE – V: Complex Analysis - II

Power series, Radius of convergence, Taylor and Laurent series for complex variable functions, Singularities and its types, Residues, Residue theorem and its applications. **[12L]**

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
3. D. G. Zill and W.S. Wright, Advanced Engineering Mathematics, Fourth Edition, 2011.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
5. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing, Third Edition, 2009

Reference Books:

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value
2. Problems, 9th Edition., Wiley India, 2009.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

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4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. G. F. Simmons, Differential Equations with Applications and Historical Notes, TMH, 2nd ed.,2003.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Applications of differential equations in diverse real life problems.
2. Different mappings of complex variable functions and use of complex variable theory in theory offunctions of real variables

POs met through Gaps in the Syllabus:

2, 3, 9

Topics beyond syllabus/Advanced topics/Design: NA

POs met through Topics beyond syllabus/Advanced topics/Design: NA

Course outcome (co) attainment assessment tools & evaluation procedure

Direct assessment

Assessment tool	% contribution during co assessment
Mid semester examination	25
End semester examination	50
Quiz (s)	10+10
Assignment	5

Assessment components	CO1	CO2	CO3	CO4	CO5
Mid semester examination	√	√	√		
End semester examination	√	√	√	√	√
Quiz (s)	√	√	√		
Assignment	√	√	√	√	

Indirect assessment –

1. Student feedback on course outcome

Mapping of course outcomes onto program outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	2	2	1	1	1	1	3	3	2	2	2	2	3
CO2	3	2	2	2	1	1	2	1	3	3	2	2	2	2	3
CO3	3	3	2	2	1	1	1	1	3	3	2	2	2	2	3
CO4	2	2	3	1	1	1	1	1	3	3	2	2	2	2	3
CO5	2	2	3	3	1	2	1	1	3	3	2	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:

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

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If satisfying< 34%=1, 34-66% =2, > 66% = 3

CD Code	Course delivery methods
CD1	Lecture by use of boards/lcd projectors/ohp projectors
CD2	Tutorials/assignments
CD3	Seminars
CD4	Mini projects/projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of nptel materials and internets
CD9	Simulation

Mapping between COs and Course Delivery (CD) methods

Course Outcome	Course Delivery Method Used
CO1	CD1,CD2
CO2	CD1, CD2
CO3	CD1, CD2
CO4	CD1, CD2
CO5	CD3

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