JECRC University

Department of Mathematics

Minutes of the meeting

Date: 26th April, 2018

A meeting of Board of Studies (Mathematics) held on 26th April, 2018 at 10:00 AM to revise the syllabi of B.Sc. Mathematics and Statistics course and M.Sc. Mathematics course in JECRC University.

The meeting was chaired by Dr. Jagdev Singh and external member of the BOS (Mathematics) meeting was Prof. K. C. Jain (Professor of Mathematics, MNIT, Jaipur) and attended by the following members:

1. Prof. R. P. Sharma
2. Dr. Devendra Kumar
3. Dr. Deepa Mordia
4. Dr. Monika Jain
5. Dr. Vishwas Deep Joshi

Various decisions were taken and several issues were discussed at length and following decision was taken unanimously:

(i) The revised codes and revised syllabi for M.Sc. Mathematics course for session 2018-2020 were approved. The revised course contents were incorporated in the enclosed document.

(ii) The revised codes of B.Sc. (Mathematics & Statistics) for session 2018-2021 were also approved.

(Prof. K.C. Jain) 26-4-2018

(Dr. Jagdev Singh) 26.4.2018

(Prof. R. P. Sharma) 26/4/2018

(Dr. Devendra Kumar) 26.4.2018

(Dr. Deepa Mordia)

(Dr. Monika Jain) 26/4/18

(Dr. V. D. Joshi)

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Department of Mathematics and Statistics

Course Structure and Syllabi

B.Sc. Mathematics Minor Course

Session 2018-21

Semester I

S. No.	Subject Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1.		Core 1A Major	4	-	2	4	1	5	
2.		Core 1B Major	4	-	2	4	1	5	
3.	BMA019A	Numerical Analysis and Algebra	4	-		4		4	F
	BMA020A	Mathematics Lab-1			2		1	1	S
4.		Core 3 Minor	4		2	4	1	5	
5.		Computer Applications	2	-	2	2	1	3	G
6.		Environment Studies	3	-	1*	3	1	4	C
								27	

***Field/Project Work and Report**

Semester II

S. No.	Subject Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1		Core 1A Major	4	-	2	4	1	5	
2		Core 1B Major	4	-	2	4	1	5	
3	BMA021B	Calculus	4	-		4		4	F
	BMA022A	Mathematics Lab-II			2		1	1	S
4		Core 3 Minor	4		2	4	1	5	
5		Computer Applications	-	-	2		1	1	G
6		Communication Skills	3	-	-	3		3	F
								24	

Semester III

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1		Core 1A Major	4	-	2	4	1	5	
2		Core 1B Major	4	-	2	4	1	5	
3	BMA023A	Linear Programming	4	-	-	4		4	C
	BMA024A	Mathematics Lab-III			2		1	1	S
4		Core 3 Minor	4		2	4	1	5	
5		Computer Applications	-	-	2		1	1	G
6		Communication Skills	3	-	-	3		3	F
								24	

Semester IV

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1		Core 1A Major	4	-	2	4	1	5	
2		Core 1B Major	4	-	2	4	1	5	
3	BMA025B	Differential Equations	4	-	-	4		4	C
	BMA026A	Mathematics Lab-IV			2		1	1	S
4		Core 3 Minor	4		2	4	1	5	
5		Computer Applications	2	-	2	2	1	3	G
6		Communication Skills	3	-	-	3		3	F
								26	

Semester V

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1		Core 1 A Major	4	-	2	4	1	5	
2		Core 1 B Major	4	-	2	4	1	5	
3	BMA027A	Analysis	4	-	-	4		4	S
	BMA028A	Mathematics Lab-V			2		1	1	S
4		Core 3 Minor	4		2	4	1	5	
5		Communication Skills	3	-	-	3		3	F
6		Value Education	3	-	-	3		3	G
								26	

Semester VI

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits		Total Credits	Paper Type
						L	P		
1		Core 1A Major	4	-	2	4	1	5	
2		Core 1B Major	4	-	2	4	1	5	
3	BMA029A	Linear Algebra	4			4		4	S
	BMA030A	Mathematics Lab-VI			2		1	1	S
4		Core 3 Minor	4	-	2	4	1	5	
5		Project		-	-			6	C
								26	

B.Sc. MATHEMATICS MINOR

Semester I						
Course Code	**Paper Type**	**Subject**	L	**T**	**P**	**Credits**
BMA019A	F	Numerical Analysis and Algebra	4	0	0	**4**
BMA020A	S	Mathematics Lab-1	0	0	2	**1**
					Total	**5**
Semester II						
BMA021B	F	Calculus	4	0	0	**4**
BMA022A	S	Mathematics Lab-II	0	0	2	**1**
					Total	**5**
Semester III						
BMA023A	C	Linear Programming	4	0	0	**4**
BMA024A	S	Mathematics Lab-III	0	0	2	**1**
					Total	**5**
Semester IV						
BMA025B	C	Differential Equations	4	0	0	**4**
BMA026A	S	Mathematics Lab-IV	0	0	2	**1**
					Total	**5**
Semester V						
BMA027A	S	Analysis	4	0	0	**4**
BMA028A	S	Mathematics Lab-V	0	0	2	**1**
					Total	**5**
Semester VI						
BMA029A	S	Linear Algebra	4	0	0	**4**
BMA030A	S	Mathematics Lab-VI	0	0	2	**1**
					Total	**5**

C- Core F- Foundation
S-Specialization ID- Interdisciplinary G-General

Program Specific Outcome: **B.Sc. (Minor)** Mathematics programme

PSO1: The graduates will become successful professionals by demonstrating logical and analytical thinking abilities.(Professional Skills)

PSO2: The graduates will work and communicate effectively in inter-disciplinary environment, either independently or in a team, and demonstrate leadership qualities.(Problem-Solving Skills)

PSO3: The graduates will engage in life-long learning and professional development through self-study, continuing education or professional and doctoral level studies.(Successful Career and Entrepreneurship)

Program Outcome(PO's)

Upon completion of the **B.Sc. (Minor)** Mathematics programme, students will be able to:

PO1.**Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.**Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO7. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context sociotechnological changes

Semester-I

BMA019A	Numerical Analysis and Algebra	Credit(s) : 04

OBJECTIVE:

- Derive appropriate numerical methods to solve algebraic and transcendental equations. develop appropriate numerical methods to solve a differential equation
- Derive appropriate numerical methods to solve a linear system of equations. Prove results for various numerical root finding methods. derive appropriate numerical methods to calculate a definite integral.
- Present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
- Present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).Present concepts and properties of various algebraic structures.

UNIT 1	Interpolation, Numerical differentiation, System of linear equation Eigen value computation
UNIT 2	Numerical Integration, Numerical solution to ordinary differential equations of first order.
UNIT 3	Numerical solutions of algebraic equations
UNIT 4	Definition of a group with examples and simple properties, Subgroups, Generation of groups, Cyclic groups, Coset, Lagrange's theorem. groups and Cayley's theorem. Normal subgroups, Quotient group
UNIT 5	Homomorphism and Isomorphism, Fundamental theorem of Homomorphism. The Isomorphism theorems for groups. Permutation.

Suggested Books

1. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, 1999.
2. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.
3. S. D. Conte, C de Boor, Elementary Numerical Analysis, McGraw-Hill, 1980.
4. C.E. Froberg, Introduction to Numerical Analysis, (Second Edition), Addition-Wesley, 1979.
5. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan Publishing Co. Inc. New York, 1982.
6. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.
7. D.T. Finkbeiner, Introduction to Matrices and Linear transformations, CBS Publishers, New Delhi, 1986.
8. K.B. Datta, Matrix and Linear Algebra, PHI Pvt. Ltd. New Delhi, 2000.
9. P.B. Bhattacharya, S.K.Jain, S.R. Nagpal, First Course in Linear Algebra, Wiley Eastern Ltd. New Delhi, 1983.
10. S. Singh, Modern Algebra, Vikas Publ. House, India.

Course Outcomes:

CO1. To be familiar with the finite differences for interpolation, differentiation, etc. Find the Lagrange Interpolation Polynomial for any given set of points. Use Unequal Interpolation.

CO2: Apply several methods of numerical integration, including Romberg integration.

CO3: Solve a linear system of equations using an appropriate numerical method. Find numerical approximations to the roots of an equation by Newton method, Bisection Method, Secant Method, etc. Find numerical solution of a differential equation by Euler's, Modified Euler's, Predictor Corrector and Runge Kutta fourth order Methods.

CO4: Demonstrate understanding of the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.

CO5. Demonstrate understanding of and the ability to verify relationships between operations satisfying various properties (e.g. commutative property). Demonstrate understanding of and the ability to work within various algebraic

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L	H		M			L	M	H
CO2			L	M	H			M	M	H
CO3		L	L	M	H			L	L	M
CO4		M	M	L	H	L			M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

BMA020A	Mathematics Lab-I	Credit(s) : 01

OBJECTIVE:
In this course you will learn how to use MATLAB as an effective tool in science and engineering. From the course content and understand the solution of simultaneous equations of more than three variables with MATLAB and Mathematica.

Exercises Based on MATLAB and Mathematica

1. Starting MATLAB and Mathematica Windows
2. Working in the Command Window
3. Arithmetic Operations with Scalars

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1: Able to use MATLAB for interactive computations
CO2: Familiar with memory and file management in MATLAB & Mathematica.
CO3: Able to generate plots and export this for use in reports and presentations. Use to MATLAB for interactive computations.
CO4: Able to use basic flow controls.
CO5: Familiar with strings and matrices and their use.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H
CO4	H		L		M			M	H	
CO5	M	M				L	M	L		M

H = Highly Related; M = Medium L = Low

Semester –II

BMA021B	Calculus	Credit(s) : 04

Objective

This course addresses the core objectives of critical thinking skills, communication skills, and empirical and quantitative skills.

- Students will be able to analyze, evaluate, or solve problems when given a set of circumstances or data. This common core objective will be assessed in the tests, quizzes and final exam.
- Students will be able understand and utilize mathematical functions and empirical principles and processes. This common core objective will be assessed using class activities, homework problems, tests and a final exam.

UNIT 1	Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates, Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves, , Newton's method, Radius of curvature for pedal curves, Tangential polar equations, Centre of curvature, Circle of curvature, Chord of curvature, evolutes.
UNIT 2	Tests for concavity and convexity, Points of inflexion, curve tracing.
UNIT 3	Functions of Two Variables: Limit, Continuity, Differentiability. Partial differentiation, Change of variables, Euler's, Taylor's theorem, Maxima and minima.
UNIT 4	Double and triple integrals, Change of order in double integrals, Beta and Gamma functions.
UNIT 5	Vector Calculus: Gradient, Divergence and Curl. Greens, Stokes and Gauss Theorems with applications.

Suggested books

1. Introduction to Calculus and Analysis, Volume I, by Richard Courant and Fritz John (Springer)
2. Pratiksha Saxena, Differential Calculus, McGraw-Hill Education India Pvt. Ltd, 2014.
3. Shanti Narayan, P. K. Mittal, Differential Calculus, S. Chand Publisher, Reprint Edition 2006.
4. Smith Bradley, Calculus, Prentice Hall, 1998.
5. Piskunov, Differential And Integral Calculus (Volume -1) 3rd Edition G. K. Publications Pvt. Ltd, 2012.
6. Shanti Narayan, P K Mittal, Vector Calculus, S.Chand Publishing, 4th Edition Revised edition, 1955.
7. Matthews, Paul C., Vector Calculus, Springer-Verlag, London, 1998.

Course Outcomes:

CO1: Find anti derivative of some simple functions and apply differentiation to solve some optimization problems,

CO2: Use Calculus to compute quantities Chain rule of differentiation, Mean value theorems, Taylor's and Maclaurin theorems,.

CO3: Use differentials/linearization to estimate values of functions of two or more variables that model the real world (e.g. if input variables are measured to within 1%, what is estimated error in function?)

CO4: Evaluate the integrals using Beta and Gamma functions.

CO5: Evaluate surface integrals, including surface integrals of vector fields. Use Stokes' Theorem, Divergence Theorem, Green's Theorem and Solve application problems requiring vector calculus.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L	H		M			L	M	H
CO2		M	L		H			M	M	H
CO3		L	L	M	H			L	L	M
CO4	M	M		L	H	L			M	M
CO5	H	H	M	M	L	M	L	M	L	H

H = Highly Related; M = Medium L = Low

BMA022A	Mathematics Lab-II	Credit(s) : 01

OBJECTIVE:

- To understand the solution of Numerical differentiation problems with MATLAB and Mathematica.
- To understand the solution of Numerical integration problems with MATLAB and Mathematica.
- To understand the solution of simultaneous equations of more than three variables with MATLAB and Mathematica.

Following topics given below will be taken up using MATLAB and Mathematica Softwares.

1. Numerical integration
2. Finding Area and Volume using Integration
3. Differentiation and Integration of Vector point functions.
4. 2-D and 3-D graphics (Spheres, Cone, Cylinder).

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1: Student should be able to find the solution of area and volume with the help of MATLAB and Mathematica.

CO2: Student should be able to find the solution of numerical differentiation problems with the help of MATLAB and Mathematica.

CO3: Student should be able to find the solution of numerical integration problems with the help of MATLAB and Mathematica.

CO4: Student should be able to draw 2-D and 3-D graph with the help of MATLAB and Mathematica.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H
CO4	H	M	L		M		L	H	M	M

H = Highly Related; M = Medium L = Low

Semester-III

BMA023A	Linear Programming	Credit(s) : 04

OBJECTIVE:

- To understand the Linear Programming Problem formulation and solution from graphical method.
- To describe methods for solving LPP and dual for several variables using different methods
- To develop an understanding of Transportation and assignment problem.

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UNIT 1	Linear Programming problem formulation, concave and convex sets, Graphical method.
UNIT 2	Simplex and Revised Simplex algorithm
UNIT 3	Duality theory, Dual simplex method
UNIT 4	Transportation Problems: Unbalanced & Balanced Transportation Problems, Degeneracy in Transportation Problems
UNIT 5	Assignment and Traveling Salesman problems.

Suggested Books

1. G. Hadley, Linear Programming, Narosa Publishing House, 1995.
2. S.I. Gass, Linear Programming: Methods and Applications (4th edition) McGraw-Hill,New York, 1975.
3. Kanti Swaroop, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi, 1998.
4. Hamdy A. Taha, Operations Research, Prentice-Hall of India, 1997.
5. S. I. Gass, Linear Programming: Method and Application.
6. G. Hadley, Linear Programming.
7. S. Vajda, An Introduction to Linear Programming & Theory of Games.

Course Outcomes:

CO1: Understanding the difference between feasible solution and optimal solution.
CO2: Understanding the basics concepts of linear programming.
CO3: Understanding the basics concepts of simplex method.
CO4: Understanding the various techniques to calculate dual of a primal problem.
CO5: Developing the ability to understand the transportation and assignment problem.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L			L	L	L	L	M	M
CO2		M		M	L	M	L	M	M	M
CO3		H		M	H		M	L	L	L
CO4		M		L	H	L	M		M	M
CO5	H	H		M	M		H	M	H	H

H = Highly Related; M = Medium L = Low

BMA024A	Mathematics Lab-III	Credit(s) : 01

OBJECTIVE:

- To understand the solution of Numerical problems with MATLAB and Mathematica.
- To understand the High performance numeric computation and visualization software.

Following topics will be taken up using MATLAB and Mathematica Softwares.

MATLAB- High performance numeric computation and visualization software.
MATHEMATICA- Stephen Wolfram.

1. LPP Solving using MATLAB and Mathematica Softwares.
2. Transportation Problems using MATLAB and Mathematica Softwares.

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1:- Student should be able to find the solution of Linear Programming problems with the help of MATLAB and Mathematica.

CO2:- Student should be able to find the solution of Transportation Problems with the help of MATLAB and Mathematica.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	

H = Highly Related; M = Medium L = Low

Semester-IV

BMA025B	Differential Equations	Credit(s) : 04

OBJECTIVE:

- Understand all of the concepts relating to the order and linearity of ODEs and PDEs, analytic and computational solution methods for ODEs and PDEs, and the real-world applications of ODEs.
- Understand all of the concepts relating Bessel and Legendre functions. Bessel and Legendre equations.
- Apply your understanding of the concepts, formulas, and problem solving procedures to thoroughly investigate relevant physical models.

UNIT 1	Ordinary differential equations of first order: initial and boundary conditions, homogeneous equations, linear equations, Exact differential Equation.
UNIT 2	First order higher degree equations solvable for x, y, p, Singular solution. Linear differential equations with constant coefficients, homogeneous linear differential equations, linear differential equations of second order with variable coefficients.
UNIT 3	Linear partial differential equations of first order. Non linear PDE of first order: Charpit's method.
UNIT 4	Linear partial differential equation of second and higher order of homogeneous and non homogeneous forms with constant coefficients. Second order PDE with variable coefficients. Monge's method.
UNIT 5	Solution of heat and wave equations in one and two dimensions by method of separation of variables. Solution of second order PDE with variable coefficient by Monge's method and the solution of heat and wave equations in one and two dimensions by method of separation of variables.

Suggested Books

1. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. Allahabad.
2. S. Balachandra Rao & H.R. Anuradha, Differential Equations with Applications and Programmes, University Press, Hyderabad, 1996.
3. R.S. Senger, Ordinary Differential Equations with Integration, Prayal Publ. 2000.
4. D.A. Murray, Introductory Course in Differential Equations, Orient Longman (India), 1967.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Son Inc., New York, 1999.
6. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
7. S.B. Rao and H.R. Anuradha, Differential Equations, University Press, 1996.
8. W.T.H. Piaggio, Elementary Treatise on Differential Equations and their applications, CBS Publishers N.Delhi,1985.

Course Outcomes:

CO1: Determine solutions to first order differential equations

CO2: Determine solutions to second order linear homogeneous differential equations with constant coefficients.

CO3: Determine solutions to second order linear non-homogeneous differential equations with constant coefficients

CO4: Solution of linear partial differential equation of second and higher order of homogeneous and non homogeneous forms with constant coefficients. Second order PDE with variable coefficients.

CO5: Solution of second order PDE with variable coefficient by Monge's method and the solution of heat and wave equations in one and two dimensions by method of separation of variables.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L			L	L	L	L	M	M
CO2		M		M	L	M	L	M	M	M
CO3		H		M	H		M	L	L	L
CO4		M		L	H	L	M		M	M
CO5	H	H		M	M		H	M	H	H

H = Highly Related; M = Medium L = Low

BMA026A	Mathematics Lab-IV	Credit(s) : 01

OBJECTIVE:

- To understand the softare of MATLAB and Mathematica and the solution of Centre of gravity by integration: C.G of plane area, arc, surface and solid of revolution
- To understand the Solution of Differential Equations obtained in planetary motions.
- To understand the solution of Simple Harmonic motions with MATLAB and Mathematica.

Following topics given below will be taken up using MATLAB and Mathematica Softwares.

1. Centre of gravity by integration: C.G of plane area, arc, surface and solid of revolution.
2. Solving Differential Equations obtained in planetary motions and Simple Harmonic motions.

Suggested Books:

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1: Student should be able to find the solution of problems related to C.G of plane area, arc, surface and solid of revolution with the help of MATLAB and Mathematica.

CO2: Student should be able to find the solution of problems related to Differential Equations obtained in planetary motions with the help of MATLAB and Mathematica.

CO3: Student should be able to find the solution of problems related to Simple Harmonic motions with the help of MATLAB and Mathematica.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H

H = Highly Related; M = Medium L = Low

Semester V

BMA027A	Analysis	Credit(s) : 04

OBJECTIVE:

- To understand the basic theory of sequence and series.
- To understand Riemann integrals and improper integrals.
- To develop an understanding of complex analysis.

UNIT 1	Riemann Integral, Integrability of continuous and monotonic functions, Fundamental theorems of integral calculus, Mean Value theorems of integral calculus.
UNIT 2	Improper integrals and their convergence. Comparison test, Abel's and Dirichlet's test, Integral as a function of a parameter and its applications.
UNIT 3	Sequences, Theorems on limits of sequences, Monotone convergence theorem, Cauchy's convergence criterion. Infinite series, series of non-negative terms. Comparison test, Ratio test, Rabbe's, logarithmic, De Morgan and Bertrand's tests. Alternating series, Leibnitz's theorem.
UNIT 4	Complex Analysis: Analytic functions, Harmonic functions, Elementary functions. Mapping by elementary functions, Mobius transformations, Conformal mappings.
UNIT 5	Complex integration, Singularity, poles and residue, contour integration.

Suggested Books

1. Shanti Narayan, A Course of Mathematical Analysis. S. Chand & Co. New Delhi.
2. T. M. Apostol, Mathematical Anslysis, Narosa Publishing House, New Delhi,1985.
3. R.R. Goldberg, Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970.
4. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
5. P.K. Jain and S.K. Kaushik, An Introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
6. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co. New Delhi.
7. E. T. Copson, Metric Spaces, Cambridge University Press, 1968.
8. R.V. Churchil & J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990.

Course Outcomes:

CO1: Understanding the basic concepts of sequences.
CO2: Understanding the basics concepts of Infinite series.
CO3: Understanding the various fundamental aspects of Riemann Integrals.
CO4: Understanding the basics concepts of improper integrals and their convergence.
CO5: Developing the ability to understand the analytic functions, mapping by elementary functions and complex integration.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M		L	L		L	M	M	M	L
CO2	M		L	L		L	M	L	M	M
CO3	M		L	L		L	M	M	M	M
CO4	M		L	L		L	M	H	M	M
CO5	M		L	L		L	M	M	M	M

H = Highly Related; M = Medium L = Low

BMA028A	Mathematics Lab-V	Credit(s) : 01

OBJECTIVE:

- To understand the solution of Numerical differentiation problems with MATLAB and Mathematica.
- To understand the solution of Numerical integration problems with MATLAB and Mathematica.
- To understand the solution of simultaneous equations of more than three variables with MATLAB and Mathematica.

Following topics given below will be taken up using MATLAB and Mathematica Softwares.

1. Numerical differentiation
2. Numerical Integration
3. Solving simultaneous equations of more than three variables

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1: Student should be able to find the solution of numerical differentiation problems with the help of MATLAB and Mathematica.
CO2: Student should be able to find the solution of numerical integration problems with the help of MATLAB and Mathematica.
CO3: Student should be able to find the solution of simultaneous equations of more than three variables problems with the help of MATLAB and Mathematica

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H

H = Highly Related; M = Medium L = Low

Semester –VI

BMA029A	Linear Algebra	Credit(s) : 04

OBJECTIVE:

- To understand vector space and linear dependent and independent of vectors.
- To describe linear transformations and their properties i.e. their matrix representations.
- To describe Cayley Hamilton theorem.
- To define Inner product spaces and Gram-Schmidt orthogonalization process

UNIT 1	Vector spaces, subspaces and linear spans, linear dependence and independence. Finite dimensional vector spaces
UNIT 2	Linear transformations and their matrix representations, Algebra of linear transformations
UNIT 3	Rank and nullity theorem. Change of basis. Dual spaces, bi dual space and natural isomorphism.
UNIT 4	Eigen values and eigen vectors of LT. Diagonalization, Cayley Hamilton theorem.
UNIT 5	Inner product spaces, Cauchy-Schwarz inequality, orthogonal vectors. Orthonormal basis, Bessel's inequality, Gram-Schmidt orthogonalization process.

Suggested Books

1. N. Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition, Prentice-Hall of India, New Delhi, 1971.
3. N. Jacobson, Basic Algebra, Vols I & II, W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. K.B. Dutta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd, New Delhi, 2000.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I - Groups, Narosa Publishing House, Vol. I 1996.

Course Outcomes:

CO1: Understanding the vector space and their properties.
CO2: Understanding the Linear transformations and their properties.
CO3: Understanding the rank and nullity theorem.
CO4: Understanding the Cayley Hamilton theorem and their properties
CO5: Find out orthonormal basis with the help of Gram-Schmidt orthogonalization process.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H
CO4	L						M	M	L	
CO5	M	L					L	L	L	H

H = Highly Related; M = Medium L = Low

BMA030A	Mathematics Lab-VI	Credit(s) : 01

OBJECTIVE:

- To understand the software of MATLAB and Mathematica and the solution of problems related to complex plane.
- To understand the solution of problems related to complex integration with MATLAB and Mathematica.
- To understand the solution of problems related to Singularities, Poles and Residues with MATLAB and Mathematica.

Following topics given below will be taken up using MATLAB and Mathematical Softwares.

1. Complex Plane: Complex curves and Region in Complex plane
2. Complex Integration
3. Singularities, Poles and Residues.

Suggested Books:

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcomes:

CO1: Student should be able to find the solution of problems related to complex plane with the help of MATLAB and Mathematica.

CO2: Student should be able to find the solution of problems related to complex integration with the help of MATLAB and Mathematica.

CO3: Student should be able to find the solution of problems related to Singularities, Poles and Residues with the help of MATLAB and Mathematica

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H		H	H	H	
CO2	M			M			M	H	H	
CO3	L	L	M				M	M	M	H

H = Highly Related; M = Medium L = Low