Bachelor of Science (Honours)

Mathematics

AY: 2018- 19

Program and Course Structure

School of Basic Science and Research
Department of Mathematics

B.Sc. (H) Mathematics

SBR0302

Batch 2018-21

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience.
2. Enrichment by educational initiatives that encourage global outlook.
3. Develop research, support disruptive innovations and accelerate entrepreneurship.
4. Seeking beyond boundaries.

Core Values

1. Integrity
2. Leadership
3. Diversity
4. Community

1.2 Vision and Mission of the School

Vision of the School

Achieving excellence in the realm of science to address the challenges of evolving society.

Mission of the School

1. Equip the students with knowledge and skills.
2. Capacity building by providing academic flexibility to student and faculty members.
3. To establish centre of excellence for innovative research.
4. Address the deficiencies of the society pertaining to environment
5. To strengthen academic- industry collaboration for better. Employability.
6. Developing a culture for continued betterment in all facets of life.

Core Values

1. Integrity
2. Leadership
3. Diversity
4. Community

- **Integrity**

1.3 Vision and Mission

Department of Mathematics

Vision of the Department

To become a globally recognized destination for education in applied mathematics and research.

Mission of the Department

1. To develop mathematical skills in students and make them employable across a wide range of professions and promote interest research.

2. To develop entrepreneurial skills in students to serve the society at large.

3. To develop skills for the applications of mathematics in the various fields.

Core Values

1. Integrity
2. Leadership
3. Diversity
4. Community

1.4 Program Educational Objectives (PEO's)

PEO1: To prepare students for developing their subject knowledge in the courses of their study to enable them to shine in various fields such as sciences, engineering and technology, IT etc.
PEO2: To develop positive attitude and skills this will enable the students to become a multi facet personality.
PEO3: To prepare students for entrance examinations conducted by IIT's/Universities to pursue PG and Ph. D. programs.
PEO4: To develop students into confident communicators and team players.

1.4.1Program Outcomes (PO's)

PO1: Mathematical knowledge: Application of Mathematical knowledge in various fields of science, engineering and management etc.
PO2: Nature of Mathematics: Understand the concise, precise and rigorous nature of Mathematics.
PO3: Critical thinking: Develop the skill to think critically on abstract concepts of Mathematics.
PO4: Problem analysis: Develop the ability to analyze a problem logically and dissect into micro-parts and thus resolving the problem to accessible components.

PO5: Presentation skill: Develop the skill to pleasant exposition for successful presentation for any career interview with confidence.

PO6: Mathematical logic: Formulates and develops mathematical arguments in logical manner.

PO7: Team Work: Work as a team player and strive for self-excellence.

PO8: **Ethics:** Realize and understand professional, ethical and cultural responsibilities.

PO9: Communication: Communicate effectively with an elite audience.

PO10: Life-long learning: Engage in life-long learning towards enduring professional development.

1.4.2 Map PEOs with Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4	School Mission 5	School Mission 6
PEO1:	3	2	3	1	2	3
PEO2:	3	2	3	1	2	3
PEO3:	3	3	3	3	3	3
PEO4:	3	2	3	1	3	3

1.4.3 Mapping of Program Outcome Vs Program Educational Objectives

	PEO1	PEO2	PEO3	PEO4
PO1	3	3	3	2
PO2	3	3	3	2
PO3	3	3	3	2
PO4	3	2	3	2
PO5	2	3	2	3
PO6	3	3	3	2
PO7	1	2	1	3
PO8	2	2	1	3
PO9	2	2	2	3
PO10	2	2	2	3

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

1.4.5 Program Outcome Vs Courses Mapping Table:

1.4.5.1 COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
MSM101	3	3	2	3	2	2	1	2	2	1
MSM103	3	3	2	3	3	2	2	1	2	2
MTH 215	2	3	3	3	2	2	2	1	2	2
MSM203	3	3	2	2	3	2	2	2	2	2
MSM205	3	3	2	3	2	2	2	2	1	2
MSM206	2	3	2	3	2	2	3	2	2	2
MSM207	2	3	2	3	2	3	2	2	2	2
MSM208	3	3	3	3	2	2	2	2	3	2
MSM210	2	3	2	3	3	2	2	2	2	1
MSM219	3	3	2	3	2	2	2	2	1	2
MSM 250	3	3	2	3	3	2	3	2	2	3
MSM251	3	3	2	3	3	2	2	2	2	2
MSM253	3	3	3	3	2	2	2	2	2	3
MSM301	3	3	2	2	3	2	2	2	2	2

MSM302	3	3	2	2	3	2	2	2	2	2
MSM303	3	3	2	3	3	2	2	2	2	2
MSM304	3	3	2	3	2	3	2	2	2	2
MSM305	3	3	2	3	2	2	2	2	2	2
MSM307	3	3	3	3	2	2	2	2	2	1
MSM308	2	3	2	2	3	2	2	2	2	2
MSM310	3	3	3	2	2	2	2	3	2	2
MSM311	3	3	2	2	3	2	2	2	2	2
MSM313	3	3	2	3	2	2	2	3	2	2
MSM351	3	3	2	3	2	3	2	2	2	2
MSM353	2	3	2	3	2	3	3	3	2	2
MSM 354	2	3	2	3	2	3	3	3	2	2
MSM 355	3	3	2	3	2	3	2	2	2	2

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

Program Structure Template
Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: I

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/ CO-REQUISITE	Type of Course: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	PHB 114	Mechanics and Properties of Matter	3	1	0	4	4	Co Requisite	DSE
2.	BCH 101	Physical Chemistry-1	3	1	0	4	4	Co Requisite	DSE
3.	MSM 101	Foundation Course in Mathematics	3	1	0	4	4	Pre-Requisite	CC
4.	CSE115	Introduction to programming	3	1	0	4	4	Co Requisite	DSE
5.	FEN 101/ FEN 103	Basic/ Intermediate English-1	2	0	0	2	2	Co Requisite	SEC
	PRACTICALS								
5.	PHB 151	Physics Lab-1	0	0	2	2	1	Co Requisite	AECC
6	BCH 151	Chemistry Lab-1	0	0	2	2	1	Pre Co Requisite	AECC
7.	ARP 101	Communicative English 1	1	0	2	3	2	Co Requisite	AECC
TOTAL			**13**	**4**	**4**	**21**	**20**		

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Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: II

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/ CO-REQUISITE	Type of Course1: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	PHB 115/ PHB 117	Optics/ Thermal Physics	3	1	0	4	4	Co-requisite	CC
2.	BCH 102	Organic Chemistry-1	3	1	0	4	4	Co-requisite	CC
3.	MSM 105/ MTH 215	Calculus-1 / Biostatistics (for Chemistry)	3	1	0	4	4	Co-requisite	CC
4.	MSM 106	Linear Algebra	3	1	0	4	4	Co-requisite	CC
5.	EVS106	Environmental Studies	3	0	0	3	3	Co-requisite	CC
	Practical/ Project								
7.	PHB 152	Physis Lab-2	0	0	3	3	1	Co-requisite	AECC
8.	BCH 152	Chemistry Lab-2	3	0	0	3	1	Co-requisite	AECC
TOTAL			**18**	**4**	**3**	**26**	**21**		

[1] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Program Structure Template
Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: III

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/ CO-REQUISITE	Type of Course2: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	MSM 204	Calculus II	3	1	0	4	4	Co-requisite	CC
2.	MSM 207	**Statistics I**	3	1	0	4	4	Co-requisite	CC
3.	MSM 229	Introduction To MATLAB	3	1	0	4	4	Co-requisite	AECC
4.	BCH 201	Inorganic Chemistry I	3	1	0	4	4	Co-requisite	DSE
5.	PHB 219	Electricity and Magnetism	3	1	0	4	4	Co-requisite	DSE
6.	OPE	Open Elective opted by students (under CBCS)	2	0	0	2	2	Pre-requisite	SEC
	PRACTICALS								
7.	MSM 251	Mathematics Lab. I	0	0	2	3	2	Co-requisite	AECC
8.	MSM 250	Statistics Lab I	0	0	2	2	1	Co-requisite	AECC
TOTAL			**17**	**5**	**4**	**27**	**25**		

[2] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Program Structure Template
Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: IV

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/ CO-REQUISITE	Type of Course3: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	MSM 214	Ordinary Differential Equations	3	1	0	4	4	Co-requisite	CC
2.	MSM 216	Analytical Geometry	3	1	0	4	4	Co-requisite	CC
3.	MSM 208	Real Analysis I	3	1	0	4	4	Co-requisite	CC
4.	MSM 213	Numerical Analysis	3	1	0	4	4	Co-requisite	CC
5.	MSM 211	Statistics II	3	1	0	4	4	Co-requisite	CC
6.	MSM 212	Mathematical Logic Building I	2	0	0	2	2	Co-requisite	AECC
	PRACTICALS								
7.	MSM 254	Mathematics Lab II (Using MATLAB)	0	0	3	3	2	Co-requisite	AECC
8.	MSM 253	Statistics lab II (Based on MSM 213, Using data analysis package of Excel)	0	0	3	3	2	Co-requisite	AECC
TOTAL			**17**	**5**	**6**	**28**	**26**		

[3] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Program Structure Template
Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: V

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE / CO-REQUISITE	Type of Course4: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	MSM 302	Real Analysis II	3	1	0	4	4	Co-requisite	CC
2.	MSM 315	Operation Research	3	1	0	4	4	Co-requisite	CC
3.	MSM 307	Abstract Algebra	3	1	0	4	4	Co-requisite	CC
4.	MSM 311	Partial Differential Equations	3	1	0	4	4	Co-requisite	CC
5.	MSM 312	Discrete Mathematics	3	1	0	4	4	Co-requisite	CC
6.	MSM 314	Mathematical Logic Building-2	2	0	0	2	2	Co-requisite	AECC
	Practical/ Project								
7.	MSM 355	Mathematics Lab III (Based on MSM 312, MSM 315)	0	0	3	3	2	Co-requisite	AECC
8.	MSM 361	Dissertation I	3	0	0	3	3	Co-requisite	AECC
TOTAL			**20**	**5**	**3**	**28**	**27**		

[4] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Program Structure Template
Department of Mathematics
School of Basic Sciences & Research
B. Sc. (H) Mathematics
Batch: 2018-2021
TERM: VI

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/ CO-REQUISITE	Type of Course5: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL (hrs.)**			
1.	MSM 301	Complex Analysis	3	1	0	4	4	Co-requisite	CC
2.	MSM 306	Mechanics	3	1	0	4	4	Co-requisite	CC
3.	MSM 308	Graph Theory	3	1	0	4	4	Co-requisite	CC
4.	MSM 316	Metrics Spaces	3	1	0	4	4	Co-requisite	CC
5.	MSM 313	Applied Statistics	3	1	0	4	4	Co-requisite	CC
	Practical/ Project								
6.	MSM 356	Mathematics Lab IV (LaTeX / HTML)	0	0	3	3	2	Co-requisite	AECC
7.	MSM 362	Dissertation 2	3	0	0	3	3	Co-requisite	AECC
TOTAL			18	5	3	26	25		

[5] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Foundation Course in Mathematics (MSM 101)

School: SBSR		**Batch : 2018- 2021**	
Program: B.Sc. (H)		**Academic Year: 2018-19**	
Branch: Maths, Physics, Chemistry		**Semester: I**	
1	Course Code	MSM 101	
2	Course Title	FOUNDATION COUSE IN MATHEMATICS	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	1. To familiarise the students with basic concepts of matrices, determinants and solving the system of linear equations. 2. To understand the basic concept of sets theory, co-ordinate geometry, complex number and vector algebra.	
6	Course Outcomes	CO1: Explain the concept of matrices and solve systems of linear equations and determinants. (K2,K3, K4) CO2: Explain the concept of complex numbers and calculate the nth roots of complex numbers and illustrate the solutions of simple Polynomial equations. (K2, K3, K4) CO3:Memorize the basic of Cartesian coordinate system and use algebraic techniques to explain intercepts and explore equations of lines on the number plane. (K1, K3, K4) CO4: Describe and differentiate the symmetries from graphs of conic sections. (K1, K2) CO5: Describe and use the concepts of set theory, relation and functions. (K1,K2,K3) CO6: Explain the basic concepts of vector algebra and use to find area of parallelogram and quadrilateral, Vector triple product.(K2,K 3,K4)	
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of linear algebra, complex number, co-ordinate geometry, sets theory and vector algebra.	
8	**Outline syllabus**	**Foundation course in Mathematics**	**CO Mapping**
	Unit 1	**Matrices**	
	A	Evaluation of determinants, Properties of determinants,	CO1
	B	Matrices: types of matrices, addition, subtraction and multiplication of matrices, symmetric and skew symmetric matrix. Inverse of matrix.	CO1

	C	Rank of a matrix, Consistency of system of equations, Characteristic equation, Cayley -Hamilton theorem.	CO1
	Unit 2	**Complex Numbers**	
	A	Representation of complex number in Argand plane, Modulus and argument of complex number	CO2
	B	Algebraic operations, De- Moivre's theorem	CO2
	C	Nth root of complex number, Euler's formula	CO2
	Unit 3	**Co-ordinate geometry**	
	A	Cartesian coordinate system, Distance between two points Equations of line in various forms	CO3
	B	Equation of circle in various forms, Equation of tangent and normal to the circle.	CO3, CO4
	C	Equation of ellipse, parabola and hyperbola	CO3, CO4
	Unit 4	**Sets Theory**	
	A	Definition of set, types of sets, Union and intersection of sets, Venn diagram, De-Morgan's law.	CO5
	B	Relation and functions.	CO5
	C	Composite function and inverse function.	CO5
	Unit 5	**Vector Algebra**	
	A	Addition and subtraction of vectors and their geometric application.	CO6
	B	Scalar and vector product, their physical application, Projection of vector on another vector, area of triangle.	CO6
	C	Area of parallelogram and quadrilateral, Vector triple product.	CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. Kreyszig, E., "Advanced Engineering Mathematics", John Wiley & Sons Inc. 1. Jain, M.K., and Iyengar, S.R.K., "Advanced Engineering Mathematics", Narosa Publications	
	Other References	1. Thomas, B.G., and Finny R.L., "Calculus and Analytical geometry", Pearson Education Asia, AdisonWisley. 2. Simmons, G.F., "Differential Equations with applications with applications", Tata McGraw-Hill.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C101.1	3	3	2	2	2	3	2	2	1	1
C101.2	2	3	3	2	2	2	1	2	1	1
C101.3	2	2	2	3	3	2	1	1	2	2
C101.4	2	3	2	2	2	2	1	2	2	2
C101.5	3	3	2	2	2	1	2	1	2	1
C101.6	3	3	2	3	2	2	1	2	2	1

Calculus I (MSM 105)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2018-19**
Branch: Mathematics		**Semester: II**
1	Course Code	MSM 105
2	Course Title	Calculus-I
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To make students familiar with the concepts of successive differentiation along with the concepts of partial differentiation, basic integration & multiple integration. A brief of first order ordinary differential equation has been also introduced.

6	Course Outcomes	CO1: Memorize the basic of differentiation & Successive differentiation and solve with Leibnitz's theorem. (K1, K3) CO2: Explain and solve the Taylor's theorem, Maclaurin's theorem of one variable & two variables, Maxima minima for one & two variables, Lagrange's multipliers method and point of inflexion for various functions. (K1, K2, K3) CO3: Describe the Partial differentiation, Homogeneous functions and drive Euler's theorem with applications and apply the concept of Jacobian and its applications. (K1, K2, K3,) CO4: Memorize the basics of Integration with by parts method, partial fraction, Definite integration & its properties and evaluate the Beta and Gamma function. (K1, K3, K6) CO5: Evaluation of double integrals, Change of order of integration, change of variables, Area bounded by the curves, evaluation of triple integrals and its applications. (K1, K6) CO6: Formulate and evaluate first order differential equation. (K2, K5, K6)	
7	Course Description	This course is an introduce the concepts of successive differentiation along with the concepts of partial differentiation, basic integration & multiple integration. A brief of formulation and evaluation of first order differential equation.	
8	Outline syllabus : **Calculus I**		CO Mapping
	Unit 1	**DIFFERENTIATION**	
	A	Concepts of limit, continuity and differentiability, differentiation of standard functions, product and quotient rule for differentiation, chain rule	CO1
	B	Successive differentiation and its applications, Leibnitz's theorem	CO1
	C	Taylor's theorem, Maclaurin's theorem, Maxima-minima, Points of inflexion	CO2
	Unit 2	**PARTIAL DIFFERENTIATION**	
	A	Partial differentiation, homogeneous functions, Euler's theorem	CO3
	B	Jacobian of explicit and implicit functions and its applications, Taylor's expansion in two variables	CO3

	C	Maxima-minima in two variables, Lagrange's multipliers method			CO2
	Unit 3	**INTEGRATION**			
	A	Integration of standard functions, integration by parts, by substitution			CO4
	B	Partial fractions, Definite integrals and its properties			CO4
	C	Beta and Gamma functions.			CO4
	Unit 4	**MULTIPLE INTEGRATION**			
	A	Evaluation of double integrals			CO5
	B	Change of order of integration, change of variables			CO5
	C	Area bounded by the curves, evaluation of triple integrals and its applications			CO5
	Unit 5	**ORDINARY DIFFERENTIAL EQUATIONS**			
	A	Formation of an ODE , Order and degree of an ODE			CO6
	B	First order differential equation and methods of solution including variable separable, homogeneous			CO6
	C	Exact differential equations, linear first order ODE, Equation reducible to exact differential equation.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Kreyzig, E., "Advanced Engineering Mathematics", John Willey & Sons.			
	Other References	2. Jain, M.K. and Iyenger, S.R.K., "Advanced Engineering Mathematics", Narosa Publications. 3. Thomas, B.G., and Finny R.L., "Calculus and Analytical Geometry", Pearson education Asia, Adison Wesley. 4. Simmons G.F., "Differential Equations with applications", Tata McGraw Hill.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C105.1	3	3	2	2	2	3	2	2	1	1
C105.2	2	3	3	2	2	2	2	2	1	2
C105.3	2	2	2	3	3	2	1	1	2	2
C105.4	2	3	2	3	2	2	1	2	2	2
C105.5	3	3	2	2	2	1	2	1	2	1
C105.6	3	3	3	3	3	3	2	1	2	1

BIO-STATISTICS(MTH-215)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc.		**Academic Year: 2018 - 19**
Branch: Chemistry/Bio-chemistry		**Semester: Even**
1	Course Code.	MTH215
2	Course Title	BIO-STATISTICS
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course status	Elective
5	Course Objectives	To make students familiar with the concept of Probability and Statistics with emphasis on some standard probability distributions and sampling distributions.
6	Course Outcomes	CO1:Describe the concept of Statistics and statistical inference and calculate find the measures of central tendency and dispersion of a data. (K1,K2,K3) CO2: Explain the concept of probability and evaluate the probability of various events in a random experiment, theorem on probability, conditional probability. (K2,K4,K5) CO3: Discuss the concept of normal distributions for evaluate relevant probabilities. (K1,K2,K5) CO4: Discuss about confidence interval and evaluate population parameters from the statistics of samples.(K1,K2,K5) CO5: Explain and evaluate statistical hypothesis using large and small

		samples. (K2,K4,K5) CO6: Describe and evaluate coefficient of correlation, rank correlation and regression lines relating two variables. (K1,K2,K5)		
7	Course Description	In this introductory statistics course we will explore the use of statistical methodology in designing, analyzing, interpreting, and presenting biological experiments and observations. We will cover descriptive statistics, probability, and hypothesis testing and statistical inference, correlation and regression techniques.		
8	Outline syllabus:			
UNIT 1	**Introduction and descriptive statistics.**			CO Mapping
A	Some basic concepts – sampling and statistical inference			CO1
B	Frequency distribution. Measures of central tendency – mean, median, mode, mean of the combined data.			CO1
C	Dispersion – mean deviation, variance, standard deviation, quartiles.			CO1
UNIT 2	**Probability.**			
A	Objective and subjective views on probability. Random experiment, sample space, events, mutually exclusive events, independent events, axioms of probability, conditional probability.			CO2
B	Calculation of probabilities using addition theorem and conditional probability theorems.			CO2
C	Normal distribution: use of tables to calculate probabilities and also the mean and SD of normal distribution with given probabilities.			CO2, CO3
UNIT 3	**Estimation.**			
A	Confidence interval of a population mean.			CO4
B	Use of the t distribution in the estimation of population mean in the small sample cases.			CO4
C	Estimation of proportions.			CO4
UNIT 4	**Testing of hypothesis.**			
A	Testing of hypothesis: single population mean and difference of two population means.			CO5
B	Testing of hypothesis: single population proportion.			CO5
C	Chi – square test – goodness of fit.			CO5
UNIT 5	**Correlation and regression.**			
A	Carl Pearson's Coefficient of correlation.			CO6
B	Rank correlation.			CO6
C	Regression lines.			CO6
	Mode of Examination	Theory		
	Weightage distribution	CA	MTE	ETE
		30%	20%	50%

	Text books	1. Gupta,S.C and Kapoor,V.K, "Fundamental of Mathematical Statistics".
	Other references	1. Daniel,WayneW.,"Biostatistics": Basic concept and Methodology for Health Science. 2. Grewal,B.S, "Higher Engineering Mathematics".

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C215.1	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**1**
C215.2	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**
C215.3	**2**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**2**
C215.4	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C215.5	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**
C215.6	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**

Linear Algebra (MSM 106)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc.(H)		**Academic Year: 2018-19**
Branch: Mathematics		**Semester: II**
1	Course Code.	MSM 106
2	**Course Title**	**LINEAR ALGEBRA**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course status	Compulsory
5	Course Objectives	To familiarise students with basics algebra of matrices, and its applications, vector space, Linear transformation and its properties, matrix representation of a linear transformation.

	Course Outcomes	CO1: Describe the concept of algebra of matrices and elementary row operations and calculate the rank of matrix and analyse consistency of a linear system. (K1, K2, K3, K4) CO2: Calculate the eigenvalues, eigenvectors, diagonalization of a matrix. (K2, K3) CO3: Explain and illustrate Cayley - Hamilton theorem and its applications. (K2,K3, K4). CO4: Discuss vector space and subspace, explain linear dependence and independence of vectors and calculate linear span, basis and dimension, sums and direct sums. (K2, K3, K4) CO5: Discuss about linear transformation and its properties, range and kernel of a linear transformation, calculate the rank and nullity of linear transformation and drive Rank-nullity theorem and explain inverse of linear transformation, operations with linear transformations.(K2, K3, K4) CO6: Explain matrix representation of a linear transformation and general linear transformations; evaluate change of basis, similarity of matrices. (K 4, K6)	
7	Course Description	This course is an introduce basics algebra of matrices, and its applications, vector space, Linear transformation and its properties, matrix representation of a linear transformation.	
8	Outline syllabus	Linear Algebra	CO Mapping
	Unit 1	**Algebra of matrices-1**	
	A	Algebra of matrices, elementary row operations	CO1
	B	Row reduced Echelon form, rank of a matrix	CO1
	C	Consistency of a linear system, inverse of a matrix (using elementary row operations.	CO1
	Unit 2	**Algebra of matrices-2**	
	A	Eigenvalues and eigenvectors	CO2
	B	Diagonalization of a matrix	CO2
	C	Cayley - Hamilton theorem (without proof) and its applications	CO3
	UNIT 3	**Vector Spaces**	
	A	Vector space and subspace of vector space.	CO4
	B	Linear dependence and independence of vectors, linear span.	CO4
	C	Basis and dimension, sums and direct sums.	CO4

	Unit 4	**Linear Transformation- 1**			
	A	Linear transformation and its properties.			CO5
	B	Range and kernel of a linear transformation, rank and nullity of linear transformation.			CO5
	C	Rank-nullity theorem, inverse of linear transformation, operations with linear transformations.			CO5
	Unit 5	**Linear Transformation- 2**			
	A	Matrix representation of a linear transformation			CO6
	B	Change of basis, similarity			CO6
	C	Matrices and general linear transformations.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Hoffman, K &Kunze, R. , Linear Algebra, 2nd edition, Prentice Hall of India, 1975. 2.Lipshutz, S., Lipsom, M., Linear algebra, 3rd edition, Schaum series, 2001.			
	Other References	1. Strang, G., Linear Algebra and its applications, 3rd edition, Thomson,1998. 2. Kreyszig , E., Advanced Engineering Mathematics, John Wiley & Sons. 3. V. Krishnamurthy, V.P. Mainra and J.L. Arora: An Introduction to Linear Algebra.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
C106.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C106.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C106.3	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**
C106.4	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C106.5	**3**	**2**	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**1**
C106.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**

Calculus II (MSM 204)

School: SBSR		**Batch : 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: III**
1	Course Code	MSM 204
2	**Course Title**	**Calculus- II**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To make students familiar with the advancement of calculus. The concept of Laplace transform, Fourier series, Vector differentiation & Vector Integration along with the brief of Z-transform has been introduced.
6	Course Outcomes	CO1: Explain and illustrate the concepts of vector differentiability of function along with its applications. (K2, K3, K4) CO2: Describe the properties of divergence and curl; evaluate irrotational and solenoidal vector fields. (K1, K2, K3, K5) CO3: Describe line integral, surface integral, and volume integral, explain its application and Gauss divergence theorem, Stoke's theorem and Green's theorem. (K2, K3, K4) CO4: Describe Laplace Transform of some standard functions & Inverse Laplace transform & explain its application and solve linear differential equations. (K2, K3, K4) CO5: Describe the Fourier Series and evaluate the expansion of functions in terms of Fourier series. (K2, K3, K6) CO6: Describe and analyze the basic concepts of Z-transform and it's application. (K1,K2, K4)
7	Course Description	This course is an initiate the advancement of calculus. The primary objective of the course is to develop the basic understanding of the concept of Laplace transform, Fourier series, Vector differentiation & Vector Integration along with the brief introduction of Z-transform.

8	Outline syllabus : **Calculus-II**		CO Mapping
	Unit 1	**Vector Differentiation:**	
	A	Vector and scalar fields, gradient, level surfaces, normal to a surface,	CO1
	B	directional derivative, angle between two surfaces, definitions of divergence and curl,	CO1
	C	Properties of divergence and curl, irrotational and solenoidal vector fields.	CO2
	Unit 2	**Vector Integration:**	
	A	Line integral, surface integral,	CO3
	B	Volume integral, applications of Gauss divergence theorem (Without proof),	CO3
	C	Stoke's theorem (Without proof) and Green's theorem (Without proof).	CO3
	Unit 3	**LAPLACE TRANSFORMATION**	
	A	Laplace transform of some standard functions, theorems and properties on Laplace transforms	CO4
	B	Inverse Laplace transformation	CO4
	C	Convolution theorem and application to solve simple linear differential equations	CO4
	Unit 4	**FOURIER SERIES**	
	A	Periodic function, Fourier series of period 2pi	CO5
	B	Change of interval	CO5
	C	Even and odd functions, Half range sine and cosine series	CO5
	Unit 5	**Z Transform:**	
	A	Definition of Z transform, examples of Z transform,	CO6
	B	properties of Z transform, Inverse Z transform, Convolution theorem,	CO6

	C	Application to solve simple difference equations.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Kreysig, E., "Advanced Engineering mathematics", John Willey & Sons			
	Other References	2. Jain, M.K. and Iyenger, S.R.K., "Advanced Engineering mathematics", Narosa Publications. 3. Thomas, B.G., and Finny R.L., "Calculus and Analytical geometry", Pearson Education Asia, Adison Wisley.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C204.1	3	3	2	2	2	3	2	2	1	1
C204.2	2	3	3	3	2	2	2	2	1	2
C204.3	2	3	2	2	3	2	1	1	2	2
C204.4	2	2	2	3	2	2	1	2	2	2
C204.5	3	2	2	3	2	1	2	1	2	1
C204.6	3	3	2	2	3	3	2	1	2	1

Statistics I (MSM 207)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: III**
1	Course Code.	MSM207
2	Course Title	STATISTICS I
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course status	Compulsory
5	Course Objectives	1. To introduce basic statistical concepts, logics and analytical tools, analyze and communicate quantitative data verbally, graphically, symbolically and numerically. 2. To make students familiar with the concept of Probability and Statistics and display data by means of various tables, charts, and graphs.
6	Course Outcomes	CO1: Describe the process and particular steps in designing studies, collecting and analyzing data, interpreting and presenting results; and develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries. (K2, K5) CO2: Describe the properties of discrete and continuous distribution functions. (K2) CO3: Calculate the measures of central tendency and dispersion of a data and describe the method used for analysis, including a discussion of advantages, disadvantages, and necessary assumptions. (K2, K3) CO4:Calculate and interpret the correlation between two variables and Calculate the simple linear regression equation for a set of data and know the basic assumptions behind regression analysis. (K2, K3) CO5: Understand the line of best fit as a tool for summarizing a linear relationship and predicting future observed values, develop the ability to use formal mathematical argument in the context of probability. (K2, K5) CO6: Develop the skills to interpret the results of statistical analysis. (K2, K5)
7	Course Description	This is an introductory course in statistics. Students are introduced to the fundamental concepts involved in using sample data to make

		inferences about populations. Included are the study of measures of central tendency and dispersion, finite probability, statistical inferences from large and small samples, linear regression, and correlation.
8	Outline syllabus:	
UNIT 1	**Presentation of data**	CO Mapping
A	Classification, tabulation, diagrammatic & graphical representation of grouped data.	CO1, CO6
B	Frequency distributions, cumulative frequency distributions	CO1, CO2, CO6
C	Histogram, Ogives, frequency polygon, Tree and leaf diagram.	CO1, CO6
UNIT 2	**Descriptive statistics**	
A	Measures of central tendency – arithmetic mean, median, quartiles, mode, harmonic mean, geometric mean.	CO1, CO3, CO6
B	Their properties, merits and demerits	CO1, CO3, CO6
C	Measures of dispersion – range, quartile deviation, mean deviation, standard deviation and coefficient of variation.	CO1, CO3, CO6
UNIT 3	**Moments**	
A	Moments, Skewness, Measures of skewness: Karl Pearson's coefficient of skewness.	CO1, CO3, CO6
B	Quartile coefficient of skewness, Measure of skewness based on moments.	CO1, CO3, CO6
C	Kurtosis, measure of Kurtosis.	CO1, CO3, CO6
UNIT 4	**Bi-variate data analysis**	
A	Bivariate data, principles of least squares, fitting of polynomial curves and fitting of curves reducible to polynomial form.	CO1, CO4, CO6
B	Correlation: Spearman's rank correlation, Partial and Multiple Correlation (only two independent variables case).	CO1, CO4, CO6
C	Regression lines.	CO1, CO4, CO5, CO6
UNIT 5	**Probability**	
A	Random experiment, sample space, events, definition of probability.	CO1, CO5, CO6
B	Mutually exclusive events, prob. Of compound events, conditional probability.	CO1, CO5, CO6
C	Baye's theorem.	CO1, CO5, CO6
	Mode of Examination	Theory

	Weightage distribution	CA	MTE	ETE
		30%	20%	50%
	Text books	1. 1. Gupta,S.C and Kapoor,V.K, "Fundamental of Mathematical Statistics".		
	Other references	4. Daniel,WayneW.,"Biostatistics": Basic concept and Methodology for Health Science. 5. Grewal,B.S, "Higher Engineering Mathematics".		

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C207.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**1**
C207.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C207.3	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**
C207.4	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C207.5	**3**	**2**	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**2**
C207.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Introduction to MATLAB (MSM 229)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc.(H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: III**
1	Course Code	MSM-229
2	**Course Title**	**Introduction to MATLAB**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	The goal of this course is to introduce the necessary mathematical concepts for MATLAB and cover the syntax and semantics of MATLAB including control structures, comments, variables, functions etc. Once the foundations of the language have been established students will explore different types of scientific programming problems including curve fitting, ODE solving etc.

6	Course Outcomes	CO1: Describe the fundamentals of MATLAB and use MATLAB for interactive computations. (K2, K3) CO2: Demonstrate with strings and matrices and their uses. (K2, K3) CO3: Illustrate basic flow controls (if-else, for, while). (K3) CO4: Create plots and export this for use in reports and presentations. (K3, K5) CO5: Develop program scripts and functions using the MATLAB development environment. (K4, K5) CO6: Write the program for evaluates linear system of equations, ordinary differential equations in MATLAB. (K5,K6)	
7	Course Description	The course will give the fundamental knowledge and practical abilities in MATLAB required to effectively utilize this tool in technical numerical computations and visualisation in other courses. Syntax and interactive computations, programming in MATLAB using scripts and functions, rudimentary algebra and analysis. One- and two-dimensional graphical presentations. Examples on engineering applications.	
8	Outline syllabus	**Introduction to MATLAB**	CO Mapping
	Unit 1	**Introduction**	
	A	Vector and matrix generation, Subscripting and the colon notation.	CO1
	B	Matrix and array operations and their manipulations,	CO1
	C	Introduction to some inbuilt functions.	CO1
	Unit 2	**Relational and Logical Operators**	
	A	Flow control using various statement and loops including If-End statement, If-Else –End statement	CO1, CO3
	B	Nested If-Else-End Statement,	CO3
	C	For – End and While-End loops with break commands.	CO3
	Unit 3	**m-files**	
	A	Scripts and functions	CO2,CO5
	B	concept of local and global variable	CO2,CO5
	C	few examples of in-built functions, editing, saving m-files.	CO2,CO5
	Unit 4	**Two dimensional Graphics**	
	A	Basic Plots, Change in axes and annotation in a figure	CO4
	B	multiple plots in a figure	CO4
	C	saving and printing figures	CO4
	Unit 5	**Applications of MATLAB**	
	A	Solving a linear system of equations,	CO5, CO6
	B	Curve fitting with polynomials using inbuilt function such as polyfit, solving equations in one variable,	CO5, CO6
	C	Solving ordinary differential equations using inbuilt	CO5, CO6

		functions			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book	An introduction to MATLAB : Amos Gilat			
	Other References	1. Applied Numerical Methods with Matlab for engineering and Scientists by stevenchapra, Mcgraw Hill. 2. Getting started with Matlab: RudraPratap			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C229.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C229.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C229.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
C229.4	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**
C229.5	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
C229.6	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2**

Ordinary Differential Equations (MSM 214)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 214
2	Course Title	ORDINARY DIFFERENTIAL EQUATION
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To Familiarise students with basic concepts of ordinary differential equations. Learn to solve first-order differential equations. Explore the methods to solve Linear differential equation of nth order with constant coefficients. Application of variation of parameters method to solve ordinary differential equations. Explore the use of series methods to solve

		problems with variable coefficients.	
6	Course Outcomes	CO1: Explain the classification of ordinary differential equations according to order and linearity. (K2, K4) CO2: Demonstrate several methods like variable separable, homogeneous, exact etc. to solve linear first-order differential equations. (K2, K3) CO3: Solve second order and higher order linear differential equations. (K3) CO4: Describe the solution of Cauchy Euler's equations and solve Simultaneous linear differential equations. (K2, K3) CO5: Discuss working rule for finding complete solution and method of variation of parameters to evaluate linear differential equation. (K3, K6) CO6: Discuss series solution of ordinary differential equations and evaluate 2nd order differential equation with variable coefficients. (K2, K6)	
7	Course Description	This course covers basic concepts of ordinary differential equations. Learn to solve first-order differential equations. Explore the methods to solve Linear differential equation of nth order with constant coefficients. Application of variation of parameters method to solve ordinary differential equations. Explore the use of series methods to solve problems with variable coefficients.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A	Basics of differential equations including order, degree, type of differential equation and formation of differential equations.	CO1
	B	Equations of first order and first degree including separation of variables, homogeneous and exact differential equations (including integrating factor).	CO2
	C	Linear differential equations.	CO2
	Unit 2		
	A	Linear differential equation of nth order with constant coefficients	CO1, CO3
	B	Auxiliary equations and complementary functions	CO3
	C	Particular integrals for various standard functions and their combinations.	CO3
	Unit 3		
	A	Homogeneous linear equations or Cauchy Euler's equations	CO4
	B	Equations reducible to homogeneous form	CO4
	C	Simultaneous linear differential equations.	CO4
	Unit 4		
	A	Linear equations of second order	CO3, CO5
	B	working rule for finding complete solution when an integral of C.F. is known	CO5
	C	removal of first order derivative, method of variation of parameters.	CO5

	Unit 5				
	A	Series solution of ordinary differential equations of 2nd order with variable coefficients			CO6
	B	various cases e.g., ordinary point, regular singular point			CO6
	C	Irregular singular points.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Ordinary and Partial Differential equations by M. D. Raisinghania, S Chand and Company Ltd. 2. Schaum's Outline series of Differential equations by Richard Bronson, Gabriel Costa.			
	Other References	1. An introduction to Ordinary Differential Equations by Earl. A. Codington, DOVER PUBLICATIONS, INC. New York.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C214.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C214.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C214.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
C214.4	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C214.5	**3**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**2**	**3**
C214.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Analytical Geometry (MSM 216)

School: SBSR		**Batch : 2019- 2022**
Program: B. Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 216
2	Course Title	Analytical Geometry
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0

	Course Status	Compulsory	
5	Course Objective	To make students familiar with the concepts of vectors(Three dimensional vectors), Planes(Equation of planes), Lines, Spheres, Cones, Cylinders and Quadric surfaces .	
6	Course Outcomes	CO1: Describe two dimensional and three dimensional vectors and calculate direction cosines, dot and cross products, triple products of vectors. (K1, K3) CO2: Discuss equation of planes, calculate distance and angle between two planes and explain about planes through three given non-collinear points and it's geometrical applications. (K2, K3, K4) CO3: Explain the equation of a straight line in different forms and calculate the magnitude of the shortest distance between two skew line and formulate the equation. (K2,K3, K4, K5) CO4: Discuss the equations of Sphere, Cylinder, Cone and evaluate tangent plane and normal at a point of the sphere, Orthogonal spheres. (K2, K6) CO5: Describe ellipsoid, hyperboloid of one sheet and two sheets. (K1, K2) CO6: Discuss and evaluate surface of revolution, ellipsoid of revolution, paraboloid of revolution. (K2, K6)	
7	Course Description	This course is an introduces three dimensional vectors, planes, Lines, Spheres, Cones, Cylinders and Quadric surfaces .	
8	Outline syllabus		CO Mapping
	Unit 1	**Vectors**	
	A	Two dimensional vectors, addition and subtraction, Scalar multiplication, simple applications of vectors in plane Geometry.	CO1
	B	Three dimensional vectors: direction cosines, resolution of vectors, section formula, dot and cross products, triple products.	CO1
	C	Geometrical and physical applications	CO1
	Unit 2	**Planes**	
	A	Equation of a plane, normal to a plane, Distance from a point to a plane, parallel planes.	CO2
	B	Planes through the intersection of two planes, Planes bisecting the angle between two planes	CO2
	C	Planes through three given non-collinear points, geometrical applications.	CO2
	Unit 3	**Lines**	
	A	Equation of a straight line in different forms; Condition for a line to lie on a plane; Condition for two lines to intersect	CO3
	B	Skew lines	CO3

	C	Equation and magnitude of the shortest distance between two skew lines.			CO3
	Unit 4	**Sphere, Cone, Cylinder**			
	A	Equation of a sphere, Tangent plane and normal at a point of the sphere, Orthogonal spheres			CO4
	B	Equation of a cone with guiding curve a circle, ellipse.			CO4
	C	Equation of a right circular cylinder.			CO4
	Unit 5	**Quadric surfaces**			
	A	Ellipsoid, hyperboloid of one sheet and two sheets.			CO5, CO6
	B	Elliptic paraboloid.			CO5, CO6
	C	Surface of revolution, ellipsoid of revolution, paraboloid of revolution.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	**1.** Thomas, B.G., and Finny R.L.: Calculus and Analytical geometry", Pearson education Asia, AdisonWisley.			
	Other References	1. Jonathan B. Cabero, et al :Analytic Geometry, National Book Store, Inc. 2. *B*. S. Grewal: Higher Engg. Mathematics, Khanna Publishers.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C216.1	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**1**
C216.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**1**
C216.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**3**	**2**
C216.4	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C216.5	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**2**
C216.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Real Analysis I (MSM 208)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 208
2	**Course Title**	**Real Analysis-I**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To make students familiar with the basic concepts of real analysis. The notion of limit, continuity, differentiability, sequences, infinite series & their convergence has been also introduced.
6	Course Outcomes	CO1: Discuss the basic concepts of set theory on R, open & closed sets, bounded & unbounded sets, countable & uncountable sets and calculate the limit points of sets. (K2, K3) CO2: Describe the concept of Limit, Continuity, and Continuous & Discontinuous functions, Uniform continuous functions and calculate same. (K2, K3) CO3: Define the definition of derivatives, increasing & decreasing functions, explain Darboux's theorem, Rolle's theorem, Men Value Theorem & its applications. (K1, K4) CO4: Calculate and analyze the convergent sequences, limit point of sequence, non-convergent sequence, and monotonic sequences. (K3,K4) CO5: Explain the concept of series and illustrate the test for series.(K2, K3, K4) CO6: Evaluate Positive terms series, Alternating series, Series with arbitrary terms. (K6)

7	Course Description	This is an introductory course of real analysis. Students are introduced to the fundamental concepts of real analysis. The notion of limit, continuity, differentiability, sequences, infinite series & their convergence has been also introduced	
8	Outline syllabus : **Real Analysis -1**		CO Mapping
	Unit 1	**ELEMENTS OF POINTS SET THEORY ON R**	
	A	Sets, Intervals: Open and closed, Bounded and unbounded sets, Supremum and infimum	CO1
	B	Neighborhood of a point, Open and Closed sets, Limits points of a set, Bolzano – Weierstrass Theorem (statement)	CO1
	C	Countable and Uncountable sets	CO1
	Unit 2	**LIMIT & CONTINUITY OF FUNCTIONS ON R**	
	A	Limit of a function, Theorems on algebra of limits, Limit or a function	CO2
	B	Sequential approach, Cauchy's criteria for finite limits	CO2
	C	Continuous functions, Discontinuous functions, Properties of continuous functions on closed intervals, Uniform continuous functions and related results	CO2
	Unit 3	**DIFFERENTIATION OF FUNCTIONS ON R**	
	A	Definitions of derivatives and related results, increasing and decreasing functions	CO3
	B	Darboux's theorem, Rolle's Theorem,	CO3
	C	Mean value theorems of differential calculus and their applications	CO3
	Unit 4	**SEQUENCES**	
	A	Sequences, Bounded and convergent sequences	CO4
	B	Limit Points of a sequence, Bolzano – Weierstrass Theorem, Limit inferior and superior,	CO4
	C	Non-convergent (divergent) sequence, Cauchy's general principle of convergence, monotonic sequences.	CO4

	Unit 5	**INFINTE SERIES & THEIR CONVERGENCE**			
	A	Series of positive terms: p- test, the comparison, Cauchy's root and D' Alembert ratio tests (without proof), Logarithmic and Integral test			CO5, CO6
	B	Alternating series, Leibnitz test, absolute and conditional convergence			CO5, CO6
	C	Series of arbitrary terms, Abel's and Dirichlet's tests.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. S.C. Malik and SavitaArora: Mathematical Analysis, Second Edition, Wiley EasternLimited, New Age International Limited, New Delhi, 1994.			
	Other References	2.D. Somasundram and B. Chaudhary: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1987. 3.Rudin, Walter, Principles of Mathematical Analysis, third edition, InternationalSeries in Pure and Applied Mathematics. McGraw-Hill Book Co., New York-Auckland-D usseldorf, 1976. 4.T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C208.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**1**
C208.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C208.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
C208.4	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C208.5	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**3**
C208.6	**3**	**2**	**3**	**1**	**2**	**2**	**2**	**1**	**2**	**1**

Numerical Analysis (MSM 213)

School: SBSR		**Batch : 2018- 2021**	
Program: B.Sc. (H)		**Academic Year: 2019-20**	
Branch: Mathematics		**Semester: IV**	
1	Course Code	MSM 213	
2	**Course Title**	**Numerical Analysis**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	1. To provide the student with numerical methods of solving the non-linear equations, interpolation, differentiation, and integration. 2.To improve the student's skills in numerical methods by using the MATLAB	
6	Course Outcomes	CO1:Solve a linear system of equations using an appropriation method and develop the algorithm in MATLAB. (K1,K3,K5,K6) CO2: Solve the algebraic or transcendental equations using numerical methods and develop the algorithm in MATLAB. (K1,K3,K5,K6) CO3: Discuss the finite difference methods to analyse the functions (K2,K4) CO4: Explain the divided difference and evaluate the function. (K2, K4, K5) CO5:Describe the numerical differentiation and evaluate the differentiation. (K1, K2, K5) CO6: Calculate a definite integral using an appropriation method and develop the algorithm in MATLAB. (K1,K3,K5,K6)	
7	Course Description	This course is an introduction to the numerical analysis. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems in MATLAB.	
8	Outline syllabus		CO Mapping
	Unit 1	**Solution of system of linear equations:**	
	A	Direct methods: Cramer's rule, Matrix inverse method	CO1
	B	Gauss elimination and Gauss-Jordan method	CO1
	C	Iterative methods: Jacobi's method, Gauss-Seidal method	CO1
	Unit 2	**System of Transcendental equations**	
	A	Initial approximation of the roots, Bisection method, Method of false position	CO2
	B	secant method, iteration method,	CO2

	C	Newton-Raphson method and its convergence			CO2
	Unit 3	**Finite differences and interpolation**			
	A	Finite difference operators, their properties and their interrelations, finite difference tables			CO3
	B	Newton's forward and Newton's backward interpolation formula			CO3
	C	Central difference formulae including Stirling's formula, Bessel's formula			CO3
	Unit 4	**Divided differences**			
	A	Operators and difference table			CO4
	B	Newton's divided difference formula,			CO4
	C	Lagrange's interpolation formula.			CO4
	Unit 5	**Numerical differentiation and integration**			
	A	Differentiation using Newton's forward and backward formula			CO5
	B	Newton-Cotes Quadrature formula - derivations & comparison of Trapezoidal rule			CO6
	C	Simpson's 1/3 and 3/8 rules.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1) An Introduction to Numerical Analysis by EndreSuli, David F. Mayers, Cambridge University Press, 2003. 2) Applied Numerical Analysis by C. F. Gerald, Pearson Education, 2009. 3) Elements of Numerical Analysis by R. S. Gupta, Macmillan India Ltd, 2009.			
	Other References	1) Numerical methods in Engineering & Science by B. S. Grewal, Khanna Publishers, 2013. 2) Numerical methods for Scientific and Engineering Computation by Jain, Iyengar, Jain, New Age International Publishers, 2004.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C213.1	3	3	2	2	2	3	2	2	2	1
C213.2	2	3	3	3	3	2	1	2	2	2
C213.3	2	3	2	2	2	2	2	2	2	2
C213.4	2	2	2	3	2	2	2	2	2	1
C213.5	2	3	2	2	2	2	1	1	2	1
C213.6	3	3	2	2	2	2	2	1	1	2

Statistics II (MSM 211)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: IV**
1	Course Code.	MSM 211
2	Course Title	STATISTICS II
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course status	Compulsory
5	Course Objectives	To make students familiar with the concept of probabilities of joint events such as unions and intersections from the probabilities of individual events. Determine the independence of events and use independence to calculate probabilities. Use Bayes' theorem to calculate conditional probabilities. Understand random variables and its distributions. Have Some special probability distributions -The Normal distribution. Motivate the use of statistical inference in practical data analysis. Understand hypothesis testing as making an argument.
6	Course Outcomes	CO1: Explain the basic concepts of probability, random variables, probability distribution, and joint probability distribution. Apply selected probability distributions to solve problems. (K2, K3, K4) CO2: Derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions. (K2, K3, K5)

		CO3: Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables. (K3, K5) CO4: Calculate the Expected value of the random variable. Use of normal distributions for computing relevant probabilities and area under standard normal probability curve. (K2, K3) CO5: Estimate and evaluate population parameters from the statistics of samples. (K2, K6) CO6: Assess statistical hypothesis using large and small samples. (K3, K6)
7	Course Description	This course covers the role of statistics in probability, discrete random variables and probability distributions, continuous random variables and probability distributions, joint probability distributions, random sampling and data description, point estimation of parameters, statistical intervals for a sample, and tests of hypotheses for large and small samples.

8	Outline syllabus: Statistics II		CO Mapping
	UNIT 1	**Probability**	
	A	Definition of probability, Bayes theorem and its applications.	CO1
	B	Random variables – discrete and continuous, probability mass function (pmf) and probability density function (pdf).	CO2, CO3
	C	Expectation of a random variable (rv) and its variance in discrete and continuous cases; Moment generating function (MGF).	CO3, CO4
	UNIT 2	**Probability Distributions**	
	A	Discrete distributions: Binomial distribution and Poisson distribution, Geometric distribution.	CO2, CO3
	B	Their mean and varianc , MGF.	CO2, CO3
	C	Continuous distributions: Exponential distribution, Gamma distribution, Weibull distribution.	CO2, CO3
	UNIT 3	**Normal distribution**	
	A	Normal distribution: Mean and variance, transformation to standard normal distribution, use of tables of standard normal prob. Distribution.	CO4
	B	Approximation of binomial probabilities using standard normal distribution.	CO4
	C	Sampling distributions: Distribution of sample proportions and sample means. (Large samples) Use of normal distribution for estimating population	CO5

		proportion and population mean using the corresponding sample statistics.			
	UNIT 4	**Sampling distributions**			
	A	Sampling distribution of difference of two sample means.			CO5
	B	Sampling distribution of difference of two sample proportions.			CO5
	C	Estimations and hypothesis testing for single sample and two sample cases.			CO5, CO6
	UNIT 5	**Hypothesis testing for small sample**			
	A	Applications of t-distribution.			CO5, CO6
	B	Chi-square test for goodness of fit.			CO5, CO6
	C	Applications of F- distribution.			CO5, CO6
	Mode of Examination	Theory			Mode of Examination
	Weightage distribution	CA	MTE	ETE	Weightage distribution
		30%	20%	50%	
	Text books	2. 1. Gupta, S.C and Kapoor, V.K, "Fundamental of Mathematical Statistics".			Text books
	Other references	6. Daniel, Wayne W.,"Biostatistics": Basic concept and Methodology for Health Science. 7. Grewal, B.S, "Higher Engineering Mathematics".			Other references

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C211.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C211.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C211.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
C211.4	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**
C211.5	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**
C211.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

MATHEMATICAL LOGIC BUILDING- I (MSM 212)

School: SBSR		**Batch : 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2018-19**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 212
2	**Course Title**	**MATHEMATICAL LOGIC BUILDING- I**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Compulsory
5	Course Objective	To make students familiar with the logical mathematics. The concept of speed mathematics, type of equations, permutation and combination, coding/decoding and allegation & mixture, inequalities.
6	Course Outcomes	CO1: Explain and illustrate the concepts speed maths, number system, LCM/HCF, unit digits & divisibility. (K2, K3, K4) CO2: Describe the properties of Quadratic Equations, Linear Equations and Logarithms and evaluate. (K1, K2, K3, K5) CO3: Describe permutation and combination; explain Probability, Chain Rule, Surds & Indices, and Square roots & Cube roots. (K2, K3, K4) CO4: Describe percentage; ratio & proportions explain its application and profit & loss. (K2, K3, K4) CO5: Describe the Coding/Decoding, Number Ranking, Blood Relations and evaluate partnerships, series completions, and puzzles. (K2, K3, K6) CO6: Describe and analyze the basic concepts of seating arrangements, directions, syllogism, analogies, allegation & mixture, inequalities and it's application. (K1,K2, K4)
7	Course Description	This course is developing logical mathematics concept. The primary objective of the course is to develop the basic understanding of the

		concept of speed mathematics, type of equations, permutation and combination, coding/decoding and allegation & mixture, inequalities.	
8	Outline syllabus :		CO Mapping
	Unit 1		
	A	Speed Maths, Number System,	CO1
	B	LCM/HCF, Unit Digits & divisibility	CO1
	C	Quadratic Equations, Linear Equations and Logarithms.	CO2
	Unit 2		
	A	Permutation and Combination,	CO3
	B	Probability, Chain Rule, Surds & Indices,	CO3
	C	Square roots & Cube roots.	CO3
	Unit 3		
	A	Percentage,	CO4
	B	Ratio & Proportions,	CO4
	C	Profit & Loss.	CO4
	Unit 4		
	A	Coding/Decoding, Number Ranking,	CO5
	B	Blood Relations, Partnerships,	CO5
	C	Series Completions, Puzzles.	CO5
	Unit 5		
	A	Seating Arrangements, Directions,	CO6
	B	Syllogism, Analogies,	CO6
	C	Allegation & Mixture, Inequalities.	CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Dr. R.S. Aggarwal, Quantitative aptitude, S. Chand Publication.			
	Other References	1. P.A. Anand, Quantitative aptitude, Wiley publication. 2. Dr. R.S. Aggarwal, A modern approach to verbal & non- verbal reasoning, S. Chand Publication. 3. R. V. Praveen, Quantitative aptitude & reasoning, PHI Publication.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C212.1	3	2	2	3	2	2	2	3	2	1
C212.2	2	2	3	3	2	2	2	2	1	2
C212.3	2	3	2	2	3	2	1	2	2	2
C212.4	2	2	2	3	2	2	2	2	2	2
C212.5	3	2	3	3	2	1	2	1	2	1
C212.6	3	2	2	2	3	2	2	1	2	2

Real Analysis II (MSM 302)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM 302

2	**Course Title**	**Real Analysis-II**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	To make students familiar with the basic concepts of Real analysis. The notion & properties of Riemann integration, sequences & series of a function and Improper Integrals has been also introduced.	
6	Course Outcomes	CO1: Discuss the basics of Real analysis included Mean value theorem, Taylor's &Maclaurin's Series, define the convergence & divergence of a series and calculate lim sup &liminf of divergent sequences. (K1, K2, K3) CO2: Discuss about the notion of Riemann Integration, solve Reimann sum & Riemann integrability of continuous functions, monotonic functions, and functions with finitely many discontinuities. (K1, K3) CO3: Calculate differentiation and Riemann integration, illustrate Fundamental theorem of Calculus, Evaluation of some limits of series using Riemann integration method. (K3, K4) CO4: Calculate point-wise convergence of series of functions, uniform convergence and evaluate term by term integration of infinite series, term by term differentiation. (K3,K6) CO5: Evaluate different types of improper integrals, convergence of improper integrals; apply tests for convergence. (K4,K5) CO6: Explain Gamma and Beta functions and evaluate some standard integrals. (K2, K4, K5)	
7	Course Description	This course is an introduce the basic concepts of Real analysis. The notion & properties of Riemann integration, sequences & series of a function and Improper Integrals has been also introduced.	
8	Outline syllabus :**Real Analysis -II**		CO Mapping
	Unit 1	**REVIEW OF REAL ANALYSIS-1**	
	A	Mean value theorems, Taylor and Maclaurin series expansions	CO1

	B	Convergence and divergence of series (convergence theorems, types of convergence)	CO1
	C	lim sup and liminf of divergent sequences	CO1
	Unit 2	**RIEMANN INTEGRATION**	
	A	Riemann Integration: motivation for the definition of the integral, bounded functions	CO2
	B	Partition of [a, b], Riemann sums, definition of Riemann integration, Preliminary theorems	CO2
	C	The Riemann integrability of (i) continuous functions (ii) monotonic functions (iii) functions with finitely many discontinuities.	CO2
	Unit 3	**PROPERTIES OF RIEMANN INTEGRATION**	
	A	Differentiation and Riemann integration, Integration by parts, Fundamental theorem of Calculus,	CO3
	B	Practical evaluation of integrals of some simple functions using definition of Riemann integration	CO3
	C	Evaluation of some limits of series using Riemann integration method.	CO3
	Unit 4	**SEQUENCES & SERIES OF FUNCTIONS**	
	A	Point-wise convergence of series of functions, Uniform convergence,	CO4
	B	Cauchy's criterion for uniform convergence, Weirstrass M-test, uniform convergence	CO4
	C	Term by term integration of infinite series, term by term differentiation.	CO4
	Unit 5	**IMPROPER INTEGRALS**	
	A	Different types of improper integrals, convergence of improper integrals at lower and upper limits of integration and convergence at intermediate points	CO5, CO6
	B	Tests for convergence, treatments of different types of improper integrals	CO5, CO6

	C	The Gamma and Beta functions, some standard integrals, different problems.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1.Walter Rudin: Principles of Mathematical Analysis, McGraw Hill Education(India) Private Limited, New Delhi , Edition 2013.			
	Other References	2.S.C. Malik and SavitaArora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C302.1	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**1**	**2**
C302.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C302.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
C302.4	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
C302.5	**3**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**1**	**1**
C302.6	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**1**

Operations Research (MSM 315)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM-315
2	**Course Title**	**Operations Research**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0

	Course Status	Compulsory	
5	Course Objective	To provide the students are able to formulate a real-world problem as a mathematical programming model, understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand, relationship between a linear program and its dual, including strong duality and complementary slackness and solve specialized linear programming problems like the transportation and assignment problems.	
6	Course Outcomes	CO1: Identify and develop operational research models from the verbal description of the real system. (K1, K5) CO2: Understand and apply the mathematical tools that are needed to solve optimisation problems. (K2, K3) CO3: Understand the applications of basic methods for solving L.P.P. and challenges in Linear programming. (K2, K3). CO4: Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering. (K3, K6) CO1: Identify and develop operational research models from the verbal description of the real system. (K1, K5) CO2: Understand and apply the mathematical tools that are needed to solve optimisation problems. (K2, K3) CO3: Understand the applications of basic methods for solving L.P.P. and challenges in Linear programming. (K2, K3). CO4: Discuss transportation problem and assignment problem, formulate and solve T.P, A.P. (K2, K3, K6) CO5:Describe the characteristics of Game Theory and solve two person zero sum game. (K1,K2, K3) CO6: Explain game theory and formulate and solve real system problem of game theory. (K2, K3, K4, K6)	
7	Course Description	Operations research (OR) have many applications in science, engineering, economics, and industry and thus the ability to solve OR problems are crucial for both researchers and practitioners. Being able to solve the real life problems and obtaining the right solution requires understanding and modelling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. The goal of this course is to teach students to formulate, analyze, and solve mathematical models that represent real-world problems.. In particular, we will cover linear programming.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A	Origin of OR, Historical Standpoint, Different Phases, characteristics, Scope and application of OR	CO1, CO2
	B	General linear programming Problem, Formulation of Linear programming problem .	CO1, CO2

	C	Existence of basic feasible solution and optimal solution of simple LPPs (few examples), graphical interpretation of optimality.	CO1, CO2
	Unit 2		
	A	Solution of a LPP by Simplex algorithm	CO1, CO3
	B	Two phase method and Big- M method.	CO1, CO3
	C	Degeneracy and its consequences including cases of cycling.	CO1, CO3
	Unit 3		
	A	Introduction to duality and formulation of dual LPP for different models through examples.	CO2, CO3
	B	Duality theorems and their illustrations.	CO2, CO3
	C	Dual simplex method.	CO2, CO3
	Unit 4		
	A	Special LPPs: Transportation programming problem.	CO2, CO4
	B	Assignment problems.	CO2, CO4
	C	Introduction to Game theory	CO2, CO4
	Unit 5		
	A	Game Theory: Introduction, Characteristics of Game Theory, Two person zero sum game.	CO5, CO6
	B	Dominance method, mixed strategies	CO5, CO6
	C	Algebraic and graphical methods	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book	**1.** Operation Research: Theory And Applications J K Sharma	
	Other References	1. Operations Research: An Introduction, 10th Edition Hamdy A. Taha, 2. Operations Research:KantiSwarup, P. K. Gupta, Man Mohan 3. Operations Research: P Rama Murthyz.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C315.1	3	3	2	2	2	3	2	2	1	1
C315.2	2	3	3	3	3	2	2	2	1	2
C315.3	2	3	2	2	2	2	1	1	2	2
C315.4	2	2	2	3	2	2	2	2	2	2
C315.5	2	2	1	2	2	3	2	2	1	1
C315.6	3	2	2	2	3	2	3	2	2	2

Abstract Algebra (MSM 307)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM 307
2	**Course Title**	ABSTRACT ALGEBRA
3	Credits	4
4	Contact Hours (L-T-P)	3-1- 0
	Course Code	Compulsory
5	Course Objective	To familiarise students with basic concepts of group, subgroup, cyclic group and permutation groups. The basic idea of cosets, normal subgroups, normalizer, centre, stabilizer and orbit. Concepts of homomorphism, isomorphism, automorphism and inner automorphism. The different algebraic structures ring, integral domain, field, ideal and quotient ring, prime and maximal ideal. The principal ideal domain, polynomial ring, division algorithm, Euclidean rings.
6	Course Outcomes	CO1: Describe the concept of group, subgroup, cyclic group and permutation groups. (K2) CO2: Explain the concept of cosets, normal subgroups, normalizer, centre, stabilizer and orbit. (K2, K4) CO3: Recognize and decide homomorphism group, isomorphic groups, automorphism and inner automorphism. (K1, K6) CO4: Define and discriminate Ring integral domain, field ideal and quotient ring, prime and maximal ideal. (K1, K6) CO5: Discuss about Principal ideal domainand evaluate polynomial

		ring. (K1,K2,K5) CO6:Explain Euclidean rings and develop division algorithm. (K2,K4, K6)			
7	Course Description	This course will cover basic concepts of group, subgroup, cyclic group and permutation groups. The basic idea of cosets, normal subgroups, normalizer, centre, stabilizer and orbit. Concepts of homomorphism, isomorphism, automorphism and inner automorphism. The different algebraic structures ring, integral domain, field, ideal and quotient ring, prime and maximal ideal. The principal ideal domain, polynomial ring, division algorithm, Euclidean rings.			
8	Outline syllabus				CO Mapping
	Unit 1	**Group theory-1**			
	A	Binary operations, Groups, subgroups			CO1
	B	Order of a group, cyclic group			CO1
	C	Group of permutations, cycles and alternating group.			CO1
	Unit 2	**Group theory-2**			
	A	Cosets, Normal subgroup, Normalizer			CO2
	B	Centre, stabilizer and orbits of groups			CO2
	C	Statement of Lagrange's theorem.			CO2
	Unit 3	**Group theory-3**			
	A	Homomorphism of groups, kernel of homomorphism			CO3
	B	Definition of isomorphism, automorphism,			CO3
	C	Inner automorphism, Factor group.			CO3
	Unit 4	**Ring Theory -1**			
	A	Rings, Integral Domains and Fields			CO4
	B	Ideal and quotient Rings			CO4
	C	Prime and maximal ideals			CO4
	Unit 5	**Ring Theory -2**			
	A	Principal ideal domains			CO5
	B	Polynomial Rings, Division algorithm			CO5, CO6
	C	Euclidean Rings, The ring Z[i]			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book	An introduction to MATLAB : Amos Gilat			
	Other References	1. Applied Numerical Methods with Matlab for engineering and Scientists by stevenchapra, Mcgraw Hill. 2. Getting started with Matlab: RudraPratap			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C307.1	3	3	2	2	2	3	2	2	1	2
C307.2	2	3	3	3	3	2	1	2	1	2
C307.3	2	3	2	2	2	2	2	1	2	2
C307.4	2	2	2	3	2	2	2	2	2	2
C307.5	3	2	2	3	2	2	2	2	2	2
C307.6	2	2	3	2	2	2	3	2	1	1

Partial differential Equations (MSM 311)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM 311
2	Course Title	PARTIAL DIFFERENTIAL EQUATIONS
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	Familiarise students with basic concepts of partial differential equations and introduce students to how to solve linear Partial Differential with different methods. Learn to solve first-order partial differential equations and formation of PDEs. Explore the methods to solve Linear homogeneous and non-homogeneous PDEs with constant coefficients. Students will also master the technique of separation of variables to solve PDEs and able to derive heat and wave equations.
6	Course Outcomes	CO1: Formulate the partial differential equations and to solve linear PDEs by using Lagrange's method. (K3, K5) CO2: Explain and use methods to solve Linear homogeneous PDE with constant coefficient. (K2, K3, K4) CO3: Describe the rules to find complimentary function and particular integral and apply in various cases. (K2, K4) CO4: Evaluate non- homogeneous linear PDE with constant coefficient. (K6) CO5: Explain the classification of PDEs of second order and solution

		of wave equation by using method of separation of variable. (K2, K3, K4) CO6: Explain and evaluate the solution of heat equation in one dimension in various cases and solution of Laplace equation. (K2, K4, K6)	
7	Course Description	This course is an introduce the basic concepts of partial differential equations and introduce students to how to solve linear Partial Differential with different methods. Learn to solve first-order partial differential equations and formation of PDEs. Explore the methods to solve Linear homogeneous and non-homogeneous PDEs with constant coefficients. Students will also master the technique of separation of variables to solve PDEs and able to derive heat and wave equations.	
8	Outline syllabus		CO Mapping
	Unit 1	**Linear PDEs of order one:**	
	A	Formation of partial differential equations (a) by elimination of arbitrary constants	CO1
	B	(b) by elimination of arbitrary function	CO1
	C	Lagrange's method to solve linear PDEs. .	CO1
	Unit 2	**Linear homogeneous PDE with constant coefficient:**	
	A	Rules for finding complementary function	CO2, CO3
	B	shortcut methods to find particular integral for standard form of functions	CO3
	C	few general methods for specific forms.	CO3
	Unit 3	**Linear non-homogeneous PDE with constant coefficient:**	
	A	Rules for finding complementary function,	CO4
	B	few shortcut methods to find particular integral for standard form of functions, and few general methods for specific forms	CO4
	C	equations reducible to PDEs with constant coefficients	CO4
	Unit 4	**Classification of PDEs, variable separable method and wave equation:**	
	A	Classification of PDEs of second order, Boundary value problems, the principle of superposition,	CO5
	B	method of separation of variables, its application to solve wave equation	CO5
	C	D'Alembert's solution of wave equation in various cases..	CO5
	Unit 5	**Heat equation and Laplace equation:**	
	A	Solution of heat equation in one dimension in various cases	CO6
	B	solution of Laplace equation in Cartesian coordinates	CO6

	C	its conversion into polar coordinates.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1) Ordinary and Partial Differential equations by M. D. Raisinghania, S Chand and Company Ltd. 2) Schaum's Outline series of Partial Differential equations.			
	Other References	1. Elements of Partial Differential Equations by Ian N. Sneddon, McGRA-HILL Book Company.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C311.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C311.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C311.3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
C311.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C311.5	**3**	**3**	**2**	**3**	**2**	**1**	**2**	**2**	**2**	**2**
C311.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

DISCRETE MATHEMATICS (MSM 312)

School: SBSR		**Batch : 2019- 2022**
Program: B. Sc. (H)		**Academic Year: 2021-22**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM 312
2	**Course Title**	**DISCRETE MATHEMATICS**
3	Credits	4

4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	This course is aimed to provide an advance understanding to the sets and propositions, relations and functions, permutation and combination, graphs, groups and rings.	
6	Course Outcomes	CO1: Discuss the concept of sets, un-countably infinite sets, principle of inclusion and exclusion, multisets, propositions, conditional propositions and evaluate normal forms, Mathematical induction.(K2,K3, K4,K5) CO2: Describe the concept functions, composition of function, invertible functions, discrete properties of binary relations and check the closure of relations. (K3, K6) CO 3: Explain the concept of POSET and lattices, Warshall's algorithm, Equivalence relations and partitions and evaluate Chains, and Anti-chains. Generating Functions, Recurrence relations and discuss linear recurrence relations with constant coefficient, homogeneous solution, total solutions, solutions by method of Generating function. (K2, K4,K5) CO 4: Illustrate the concept permutations and combinations: rule of sum and product, write the algorithms for generation of permutations and combination. (K3, K5,K6) CO 5: Discuss the concept graph, sub-graph, Walks, Path and circuits, Connected graphs, Disconnected graphs and component, evaluate the fundamental circuits, distance, diameters, radius and pendant vertices, rooted and binary trees (K1,K2,K5,K6) CO6: Demonstrate the understanding of Algebraic systems, Group and evaluate Semi-groups, Monoid, Subgroups, Isomorphism and Automorphism. (K2, K5)	
7	Course Description	This course is given the deep knowledge of sets and propositions, relations and functions, permutation and combination, graphs, groups and rings.	
8	Outline syllabus :		CO Mapping
	Unit 1	**Sets and Propositions -**	
	A	Sets, Un-countably infinite sets, Principle of inclusion and exclusion, multisets, propositions,	CO1
	B	Conditional propositions. Logical connectivity, Propositional, calculus,	CO1, CO2
	C	Universal and existential quantifiers, Normal forms,	CO2

		methods of proofs, Mathematical induction.	
	Unit 2	**Relations and Functions -**	
	A	Functions , Composition of function , invertible functions, Discrete properties of binary relations, closure of relations	CO3
	B	Warshall's algorithm, Equivalence relations and partitions, Ordered Sets and Lattices: Introduction, Ordered set,	CO3
	C	Hasse diagram of partially ordered set, Consistent enumeration, Isomorphic ordered set, Well ordered set, Lattices, Properties of lattices, Bounded lattices, Distributive lattices, and Complemented lattices. Chains, and Anti-chains.	CO3
	Unit 3	**Number Theory**	
	A	Counting: Basic counting principles, factorial notation, Binomial coefficients, Ordered and unordered partitions.	CO4
	B	Permutations and combinations : Rule of sum and Product, Permutations, Combination, Algorithms for Generation of Permutations and Combination,	CO4
	C	The Pigeonhole principle, Fundamental theorem of arithmetic, Congruence relation, Congruence Equations.	CO4
	Unit 4	**Recurrence Relations And Algebraic Structures**:	
	A	Discrete Numeric Functions and Generating functions,	CO5
	B	Simple Recurrence relation with constant coefficients	CO5
	C	Linear recurrence relations without constant coefficients, Asymptotic behavior of functions.	CO5
	Unit 5	**Algebraic Structures -**	
	A	Algebraic systems, Group, Semi-groups, Monoid, Subgroups.	CO6
	B	Cyclic group ,Permutation groups, Homomorphism,	CO6
	C	Isomorphism and Automorphism of groups.	CO6
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Liu C.L. and Mohapatra, D.P., " Elements of Discrete Mathematics" , SiE edition, TMH, 2008			
	Other References	1. Kenneth H.R.,' Discrete Mathematics and its Applications", Mc-graw hill. 2. Biggs N., "Discrete Mathematics", 3rd edition, Oxford University			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C312.1	3	3	2	2	2	2	2	2	1	1
C312.2	2	3	2	3	3	2	1	2	1	2
C312.3	2	3	2	2	2	2	2	1	2	2
C312.4	2	3	2	3	2	2	2	2	3	2
C312.5	3	3	2	2	2	1	2	2	2	2
C312.6	3	3	2	2	3	3	2	2	2	2

MATHEMATICAL LOGIC BUILDING- II (MSM 314)

School: SBSR		**Batch : 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: V**
1	Course Code	MSM 314
2	**Course Title**	**MATHEMATICAL LOGIC BUILDING- II**
3	Credits	2

4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	To make students familiar with the logical mathematics. The concept of time and work, distance problems, ages, volume and area, analytical reasoning, data interpretation, logical diagrams, resume writing.	
6	Course Outcomes	CO1: Explain and illustrate the concepts of time and work, pipes and cisterns, speed. (K2, K3, K4) CO2: Describe time and distance/trains, boat problems, averages and evaluate. (K1, K2, K3, K5) CO3: Describe problems on ages, explain and evaluate simple interest and compound interest, volume & surface area. . (K2, K3, K4,K5) CO4: Describe analytical reasoning, assumptions and explain the application of data sufficiency and data interpretation, mean, median, mode & standard deviation. (K2, K3, K4) CO5: Describe the eligibility criterion, cubes and dices, and evaluate line angles & triangles, different types of charts, logical Venn-diagram. (K2, K3, K6) CO6: Describe how to write resume, how to face interview and group discussion. (K1,K2)	
7	Course Description	This course is developing logical mathematics concept. The primary objective of the course is to develop the basic understanding of the concept of time and work, distance problems, ages, volume and area, analytical reasoning, data interpretation, logical diagrams, resume writing.	
8	Outline syllabus :		CO Mapping
	Unit 1		
	A	Time and Work, Pipes and Cisterns,	CO1
	B	Speed, Time and Distance/Trains	CO1, CO2
	C	Boat Problems, Averages.	CO2
	Unit 2		
	A	Problems on Ages	CO3
	B	Simple Interest and Compound Interest,	CO3

	C	Volume & Surface Area.			CO3
	Unit 3				
	A	Analytical Reasoning, Assumptions,			CO4
	B	Data Sufficiency and Data Interpretation,			CO4
	C	Mean, Median, Mode & Standard Deviation.			CO4
	Unit 4				
	A	Eligibility Criterion, Cubes and Dices,			CO5
	B	Line Angles & Triangles, Different Types of Charts,			CO5
	C	Logical Venn diagram.			CO5
	Unit 5				
	A	Resume Writing,			CO6
	B	Interview,			CO6
	C	Group Discussion			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Dr. R.S. Aggarwal, Quantitative aptitude, S. Chand Publication.			
	Other References	1. P.A. Anand, Quantitative aptitude, Wiley publication. 2. Dr. R.S. Aggarwal, A modern approach to verbal & non- verbal reasoning, S. Chand Publication. 3. R. V. Praveen, Quantitative aptitude & reasoning, PHI Publication.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C314.1	2	2	2	3	2	2	2	3	2	1
C314.2	2	2	3	3	2	2	2	2	1	2
C314.3	2	2	2	2	3	2	1	2	2	2
C314.4	2	2	2	3	2	2	2	2	2	2
C314.5	3	2	3	3	2	1	2	1	2	1
C314.6	3	2	2	2	2	2	2	1	2	2

Complex Analysis (MSM 301)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: VI**
1	Course Code	MSM 301
2	Course Title	Complex Analysis
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	1. This course is aimed to provide an introduction to the theories for functions of a complex variable. The concepts of analyticity, Cauchy-Riemann relations and harmonic functions, Complex integration and complex power series are presented. Discuss the classification of isolated singularities and examine the theory and illustrate the applications of the calculus of residues in the evaluation of integrals. 2. Students will study geometric properties of conformal mappings in the plane and their relations with analytic functions
6	Course Outcomes	CO1: Calculate continuity, differentiability, analyticity of a function and analyse the derivative of a function. (K3, K4) CO2: Evaluate a contour integral using parameterization, fundamental theorem of calculus and Cauchy's integral formula (K3, K6) CO 3: Develop the Taylor's and Laurent's series of a function and evaluate its circle or annulus of convergence; (K5, K6) CO 4:Caculate the residue of a function and use the residue theory to evaluate a contour integral or an integral over the real line (K3, K6)

		CO 5: Demonstrate the understanding of conformal mappings and Construct conformal mappings between many kinds of domain. (K2, K5) CO 6: Recognize and assess the applications of complex variables. (K1, K6)			
7	Course Description	This course is an introduce the theories for functions of a complex variable. The concepts of analyticity, Cauchy-Riemann relations and harmonic functions, Complex integration and complex power series are presented. Discuss the classification of isolated singularities and examine the theory and illustrate the applications of the calculus of residues in the evaluation of integrals.			
8	Outline syllabus				CO Mapping
	Unit 1				
	A	Complex functions and their limits, continuity, differentiability,			CO1
	B	Analytic function, The C-R equations and sufficient conditions for differentiability and analyticity			CO1
	C	Harmonic functions and harmonic conjugates.			CO1
	Unit 2				
	A	Cauchy's theorem (with proof), Cauchy's integral formula and its applications			CO2
	B	Taylor's series, Laurent expansion of functions			CO3
	C	Singularities and its types, residues.			CO4
	Unit 3				
	A	Residue theorem, applications of residue theorem			CO4
	B	Evaluation of real definite integrals			CO4
	C	Integration around the unit circle and evaluation of some infinite real integrals.			CO4
	Unit 4				
	A	Transformations or mappings, some standard transformations			CO5
	B	Bilinear transformation, fixed point of a transformation			CO5
	C	Conformal transformation, Jacobian of a transformation and few special conformal mappings.			CO5
	Unit 5				
	A	Application of complex conjugate functions			CO6
	B	Flow problems and modelling.			CO6
	C	Flow problems and modelling.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1) Churchill, Ruel V. and Brown, JamesWard, Complex Variables and Applications, fourth			

		edition, McGraw-Hill Book Co., New York, 1984. 2) Conway, John B., Functions of One Complex Variable, II, Graduate Texts inMathematics, 159, Springer-Verlag, New York, 1995.	
	Other References	1) Schaum's Outline of Complex Variables, 2ed by By Murray Spiegel, Seymour Lipschutz, John Schiller, Dennis Spellman 2) Ahlfors, Lars V., Complex Analysis: An Introduction to the Theory of Analytic Functions of One Complex Variable, third edition. International Series in Pure and Applied Mathematics, McGraw-Hill Book Co., New York, 1978.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C301.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C301.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C301.3	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**
C301.4	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**2**	**2**	**2**
C301.5	**3**	**2**	**2**	**3**	**3**	**1**	**2**	**2**	**2**	**1**
C301.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Graph Theory (MSM 308)

School: SBSR		**Batch : 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: VI**
1	Course Code	MSM308
2	Course Title	Graph Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course	The objective of the course is to explain basic concepts in combinatorial

	Objective	graph theory. Define how graphs serve as models for many standard problems. Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics. see the applications of graphs in science, business and industry.	
6	Course Outcomes	CO1: Demonstrate knowledge of the syllabus material. (K2) CO2: Write precise and accurate mathematical definitions of objects in graph theory. (K6) CO3: Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.(K3, K6) CO4: Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory. (K3, K6) CO5:Understand the application in engineering, biology, chemistry, physics. (K2) CO6:Write about graph theory in a coherent and technically accurate manner. (K6)	
7	Course Description	This course will cover the fundamental concepts of Graph Theory: simple graphs, digraphs, Eulerian and Hamiltonian graphs, trees, matchings, networks, paths and cycles, graph colorings, and planar graphs. Famous problems in Graph Theory include: Minimum Connector Problem (building roads at minimum cost), the Marriage Problem (matching men and women into compatible pairs), the Assignment Problem (filling n jobs in the best way), the Network Flow Problem (maximizing flow in a network), the Committee Scheduling Problem (using the fewest time slots), the Four Color Problem (coloring maps with four colors so that adjacent regions have different colors), and the Traveling Salesman Problem (visiting n cities with minimum cost).	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Graph Theory**	
	A	Graph, Subgraph, Various examples of graph and their subgraphs, Walks, Path and circuits, Connected graphs, Disconnected graphs and components	CO1, CO2,CO3
	B	Euler's graphs, various operation on graphs	CO1, CO2,CO3
	C	Hamiltonian Paths and circuits, Traveling salesman problem	CO1, CO2,CO3
	Unit 2	**Trees and its properties**	
	A	Trees and fundamental circuits, distance, diameters, radius and pendant vertices, rooted and binary trees, counting tree	CO1, CO2,CO4
	B	Spanning tree, Fundamental circuits, Finding all spanning trees of a graph	CO1, CO2,CO4
	C	weighted graph, algorithm of prism's, Kruskal's and Dijikistrra's algorithm.	CO1, CO2,CO4

	Unit 3	**Cut-set & Cut-Vertices**			
	A	Cut-sets and cut-vertex , some properties, all cut-sets in a graph, Fundamental circuits and cut-sets, connectivity and separability			CO1,CO2,CO5
	B	Network flows, Planar graph, Combinatorial and geometric dual			CO1, CO2,CO5
	C	Kuratowaski's graphs, Detection of planetary, Geometric dual, Some more criterion of planarity, Thickness and crossing			CO1, CO2,CO5
	Unit 4	**Vector Space of Graphs**			
	A	Vector space of graphs and vectors, bases vector, cut-set vector, circuit vector, circuit and cut-set verses sub-spaces, orthogonal vector and subspaces			CO1, CO2, CO3,CO5
	B	incidence matrix of graph, Sub matrix of A (G)			CO1, CO2, CO3,CO5
	C	Circuit matrix , Cut set matrix, Path matrix and relationship.			CO1, CO2, CO3,CO5
	Unit 5	**Coloring and Covering of Graphs**			
	A	Coloring and covering and partitioning of a graph, Chromatic number, chromatic partitioning, Chromatic polynomials, matching, Covering, 4-color problem			CO5,CO6
	B	Directed graphs, Some types of directed graphs, Directed Path and Connectedness, Euler's digraph, tree with directed edges, Fundamental circuits in digraphs, matrices A, B and C of digraphs adjacency matrices of a Digraph			CO6,CO5
	C	Enumeration, Types of enumeration, Counting of labelled and unlabelled trees, Statement of Poly's theorem.			CO6,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Deo. N., Graph Theory, PHI			
	Other References	1. Harary. F, Graph Theory, Narosa Publication. 2. Bondy and Murthy, Graph theory and Application. 3. Gross. J., Graph theory and Application., Chapman Hall/crc			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C308.1	3	3	2	2	2	3	2	2	1	1
C308.2	2	3	3	3	3	2	1	2	2	2
C308.3	2	3	2	2	2	2	2	2	2	2
C308.4	2	2	2	3	2	2	1	2	2	2
C308.5	3	2	2	3	2	2	2	2	2	3
C308.6	2	3	2	2	2	2	1	2	1	1

Applied Statistics (MSM 313)

School: SBSR		**Batch: 2018- 2021**
Program: B. Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: VI**
1	Course Code.	MSM313
2	Course Title	APPLIED STATISTICS
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course status	Compulsory
5	Course Objectives	Familiarise students with index numbers methods. Understand the competing merits of different approaches to index number problems and methods for dealing with quality change and new goods. Recognize trend and seasonality in time series data, and estimate/remove these components. Explain process variation and the need to identify special cause variation. Construct 4 attribute charts (p, np, c and u); including calculates control limits, using control constant table, etc.
6	Course Outcomes	CO1: Demonstrate knowledge and understanding of index numbers theory and methods and be able to provide practical solutions to general aggregation problems. (K2, K3) CO2: Demonstrate knowledge and understanding of the competing merits of different approaches to index number problems and methods for dealing with quality change, and be able to choose appropriate methods for use in constructing an index number. (K2, K3) CO3: Demonstrate advanced understanding of the concepts of time

		series and their application to health, climate, finance and other areas. (K2, K3) CO4: Apply ideas to real time series data and interpret outcomes of analyses. Describe why Statistical Process Control is needed when manufacturing a product. (K2, K3) CO5:Apply the basic tools of statistics and Shewhart rules to interpret a control chart and analyze the chart and find out "out of control" state. (K3, K4, K5) CO6: Understand and evaluate the difference between variable and attribute charts. (K2, K6)
7	Course Description	The aim of this module is to provide an understanding of the modern theory and practice of index numbers as a means of making price and quantity comparisons and time Series consist of values of a variable recorded in an order over a period of time. Such data arise in just about every area of science and the humanities, including econometrics and finance, engineering, medicine, genetics, sociology, environmental science. In the section of Statistical Process Control, often referred to as SPC, is a set of tools used for continuous improvement and quality control of an active manufacturing process. A comprehensive coverage of modern quality control techniques to include the design of statistical process control systems, acceptance sampling, and process improvement.
8	Outline syllabus:	
UNIT 1	**Index Numbers**	CO Mapping
A	Introduction, Basic Problems in the construction of Index Numbers.	CO1
B	Construction of Index Numbers.	CO1
C	Measurement Criterion of a good Index Number.	CO1
UNIT 2	**Uses of Index Numbers**	
A	Errors in the construction of Index Numbers.	CO2
B	Uses and Limitations of Index Numbers.	CO2
C	Chain Index, Base Shifting, Splicing and Deflating, Cost of Living Index.	CO2
UNIT 3	**Time Series Analysis**	
A	Economic time series, different components.	CO3
B	Illustration, additive and multiplicative models.	CO3, CO4
C	Determination of trend, seasonal and cyclical fluctuations.	CO4
UNIT 4	**Statistical process and product control**	
A	Quality of a product and need for quality control.	CO4

B	Basic concept of process control, process capability and product control.			CO4
C	General theory of control charts.			CO4, CO5
UNIT 5	**Quality Control Process**			
A	Causes of variation in quality.			CO6
B	Control limits, sub grouping summary of out of control criteria.			CO6
C	Charts for attributes: p chart, np chart, c-chart, Charts for variables: R, $(\overline{X}, R)$, $(\overline{X}, \sigma)$ charts.			CO5, CO6
	Mode of Examination	Theory		
	Weightage distribution	CA	MTE	ETE
		30%	20%	50%
	Text books	1. Gupta, S.C., Kapoor, V. K. (2007): Fundamentals of Applied Statistics, 4thEdition, Sultan Chand & Sons**.** 2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.		
	Other references	3. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd. 4. Karmel, P.H. and Polasek, M. (2012): Applied Statistics for Economists, 4th edition. Khosla Publishing House by arrangement with Pitman. 5. Mukhopadhyay P. (1999): Applied Statistics, Books and Allied (P) Ltd. 6. Montogomery, D. C. (2009): Introduction to Statistical Quality Control, 6thEdition, Wiley India Pvt. Ltd.		

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C313.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C313.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**
C313.3	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**3**
C313.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C313.5	**3**	**3**	**2**	**3**	**2**	**1**	**2**	**2**	**2**	**2**
C313.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

METRICS SPACES (MSM 316)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc. (H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: VI**
1	Course Code	MSM316
2	Course Title	METRICS SPACES
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	Familiarise students with basic concepts of metric spaces. Give an idea of the Metric space of the real line; subsets of the real line and limit points of sets. Have an understanding of a basis and sub-basis of a Metric space. Discuss a continuous function between two metric spaces and a homeomorphism between them. Know connectedness and compactness and appreciate these concepts in the context of properties of a continuous function.
6	Course Outcomes	CO1: Explain the concept of a metric and metric spaces and open balls and open sets. (K2, K4) CO2: Apply the concept of convergence of a sequence in metric spaces and Cauchy sequences. (K3) CO3: Explain and use open spheres and close spheres, neighbourhood of a point, open sets, interior points, Limit points, Closed sets and closure of a set, Boundary points, diameter of a set, Subspace of a metric space. (K2, K3, K4) CO4: Explain convergent and Cauchy sequences, Complete metric space and evaluate Dense subsets and separable spaces, Nowhere dense sets, Continuous functions. (K2, K4,K5) CO5: Describe the Compact spaces, Sequential compactness and Bolzano-Weierstrass property, Finite Intersection property. (K1, K2) CO6: Understand and evaluate disconnected and connected sets, connected subsets of R, continuous functions and connected sets. (K2, K6)
7	Course Description	This course will cover the basic concepts of metric spaces. Give an idea of the Metric space of the real line; subsets of the real line and limit points of sets. Have an understanding of a basis and sub-basis of a Metric space. Discuss a continuous function between two metric spaces and a homeomorphism between them. Know connectedness and compactness and appreciate these concepts in the context of properties of a continuous function.
8	Outline syllabus	CO Mapping

	Unit 1				
	A	Metric spaces, open balls, Euclidean space $\mathbb{R}^n$.			CO1, CO2
	B	Convergence of sequences;			CO1, CO2
	C	Continuity			CO1, CO2
	Unit 2				
	A	Definition and example of a metric space. Open and closed spheres, properties, examples.			CO1, CO3
	B	neighbourhood of a point, open sets, interior points, Limit points, Closed sets and closure of a set,			CO1, CO3
	C	Boundary points, diameter of a set, Subspace of a metric space.			CO1, CO3
	Unit 3				
	A	Convergent and Cauchy sequences,			CO1,CO4
	B	Complete metric space, Dense subsets and separable spaces,			CO1,CO4
	C	Nowhere dense sets, Continuous functions.			CO1,CO4
	Unit 4				
	A	Compact spaces, Sequential compactness			CO1, CO2, CO4
	B	Bolzano-Weierstrass property,			CO1, CO2, CO4
	C	Finite Intersection property.			CO1, CO2, CO4
	Unit 5				
	A	Disconnected and connected sets,			CO6,CO5
	B	connected subsets of R,			CO6,CO5
	C	Continuous functions and connected sets.			CO6,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text books	1. G.F. Simmons: Introduction to Topology and Modern Analysis, McGraw Hill, 1963.			
	Other references	1. E.T. Copson: Metric Spaces, Cambridge University Press, 1968. 2. P.K. Jain and Khalil Ahmad: Metric Spaces, Second Edition, Narosa Publishing House, New Delhi, 2003. 3. B. K. Tyagi: First Course in Metric Spaces, Cambridge University Press, 2010.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C316.1	3	3	2	2	2	3	2	2	1	1
C316.2	2	3	3	3	3	2	1	2	2	2
C316.3	2	3	2	1	2	2	2	1	2	2
C316.4	2	2	2	3	2	2	1	2	2	2
C316.5	3	2	2	3	2	2	2	2	2	1
C316.6	3	3	2	2	3	3	2	2	2	2

Syllabus of MSM 250 (Practical)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc.(H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: III**
1	Course Code	MSM 250
2	Course Title	Statistics Lab I
3	Credits	2
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course Objective	1. To familiarize the student in introducing and exploring MS excel. 2.To enable the student on how to approach for solving statistical problems using excel tools. 3. To prepare the students to use excel in their project works. 4.To provide a foundation in use of this MS office for real time applications.
6	Course Outcomes	CO1: Understand the procedures,Analyzing and Visualizing Data with Excel. (K2) CO2: Discuss and develop the basic understanding of creating formulas and how cells are referenced by rows and columns within Excel. (K2, K5, K6) CO3: Discuss and construct table and graph of data with excel. (K2, K5, K6) CO4: Discuss and calculate basic statistical parameters (mean, measures of dispersion, correlation coefficient, indexes). (K2, K5,

		K6) CO5: Discuss and calculate correlationbetween two variables with excel. (K2, K5, K6) CO6: Discuss, predict and estimate the variable by regression analysis with excel. (K2, K5, K6)			
7	Course Description	Enable students for using the computer program MS Excel, apply basic statistical techniques and methods for grouping, tabular and graphical display, analysis and interpretation of Statistical data.			
8	Outline syllabus				CO Mapping
	Unit 1	**Lab. Experiment 1:**			
		Exploring Data in Excel			CO1, CO2
	Unit 2	**Lab. Experiment 2:**			
		Create Charts			CO1, CO3
	Unit 3	**Lab. Experiment 3:**			
		Calculate Descriptive Statistics			CO1, CO4
	Unit 4	**Lab. Experiment 4:**			
		Calculate Correlation			CO1,CO5
	Unit 5	**Lab. Experiment 5:**			
		Perform Regression			CO1, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*				
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C250.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C250.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C250.3	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**
C250.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C250.5	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**
C250.6	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**3**

Syllabus of MSM 251 (Practical)

School: SBSR		**Batch: 2018- 2021**	
Program: B.Sc.(H)		**Academic Year: 2019-20**	
Branch: Mathematics		**Semester: III**	
1	Course Code	MSM-251	
2	Course Title	Mathematics Lab I	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	The goal of this course is to introduce students to the fundamental mathematical concepts for MATLAB. The course will cover the syntax and semantics of MATLAB including control structures, comments, variables, functions etc. Once the foundations of the language have been established students will explore different types of scientific programming problems including curve fitting, ODE solving etc	
6	Course Outcomes	CO1: Describe the fundamentals of MATLAB and use MATLAB for interactive computations. (K2, K3) CO2: Demonstrate with strings and matrices and their uses. (K2, K3) CO3: Illustrate basic flow controls (if-else, for, while). (K3) CO4: Create plots and export this for use in reports and presentations. (K3, K5) CO5: Develop program scripts and functions using the MATLAB development environment. (K4, K5)	
7	Course Description	The course will give the fundamental knowledge and practical abilities in MATLAB required to effectively utilize this tool in technical numerical computations and visualisation in other courses. Syntax and interactive computations, programming in MATLAB using scripts and functions, rudimentary algebra and analysis. One- and two-dimensional graphical presentations. Examples on engineering applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based** MATLAB as a calculator.	**CO1**
		Creating an Array in MATLAB	CO1
	Unit 2	**Practical related to --** Mathematical Operations with Arrays	**CO3**
	Unit 3	**Practical related to---** How to make scripts files in MATLAB and do some examples.	**CO5**
	Unit 4	**Practical related to---** Make some function files in MATLAB. Basic two-dimensional and three-dimensional plotting,	**CO4, CO5**

		change in axes and annotation in a figure.			
	Unit 5	**Practical related to---** If-End statement, If-Else-End statement, nested If-Else-End statement Solving a system of linear equations, curve fitting with polynomials using inbuilt functions such as polyfit.			**CO2,CO5**
	Mode of examination	Practical &Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book	- An introduction to MATLAB : Amos Gilat			
	Other References	3. Applied Numerical Methods with Matlab for engineering and Scientists by stevenchapra, Mcgraw Hill. 4. Getting started with Matlab: RudraPratap			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C251.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C251.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C251.3	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**
C251.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C251.5	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**

Syllabus of MSM 253 (Practical)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc.(H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 253
2	Course Title	Statistics Lab II
3	Credits	2
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course	1.Introduce basic statistical concepts, logics and analytical tools MS

	Objective	excel. 2.Provide students with a general understanding of descriptive and inferential statistics and the opportunity to apply them to examine business and economic data. 3.Equip students with the skills to apply statistical concepts and analytical tools to analyze and handle real-world business issues. 4.Train students for presenting and exchanging statistical findings and views.	
6	Course Outcomes	CO1: Understand, discuss andsummaries of recorded data with excel.(K2) CO2: Discuss,explain and identifies the importance of diagrammatic presentation of data. (K2, K5, K6) CO3: Discuss and Explain statistical concepts and use the analytical tools of descriptive statistics with excel. (K2, K5, K6) CO4: Discuss, calculate and understands the nature of curve. (K2, K5, K6) CO5: Discuss, calculate and interpret the correlation between two or more variables with excel. (K2, K5, K6) CO6: Develop a deeper understanding of the linear regression model and its limitations. (K2, K5, K6)	
7	Course Description	This course provides students with basic statistical concepts and analytical tools, and the opportunity to apply them to analyze real-world problem data. Main topics include sampling methods, descriptive statistics, probability & probability distributions, sampling distributions andconfidence interval estimation, hypothesis testing, simple linear regression and correlation, time series analysis and applications in quality and production management.	
8	Outline syllabus		CO Mapping
	Unit 1	**Lab. Experiment 1:**	
		Graphical representation of data.	CO1, CO2
	Unit 2	**Lab. Experiment 2:**	
		Problems based on measures of central tendency, measures of dispersion, combined mean and variance and coefficient of variation.	CO1, CO3
	Unit 3	**Lab. Experiment 3:**	
		Problems based on moments, skewness and kurtosis. Fitting of polynomials, exponential curves.	CO1, CO4
	Unit 4	**Lab. Experiment 4:**	
		Find Karl Pearson correlation coefficient, rank correlation with and without ties, Partial and multiple correlations, correlation coefficient for a bivariate frequency distribution.	CO1,CO5
	Unit 5	**Lab. Experiment 5:**	
		Lines of regression, angle between lines and	CO1, CO6

		estimated values of variables. Planes of regression and variances of residuals for raw data.			
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*				
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C253.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C253.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C253.3	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**
C253.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C253.5	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**
C253.6	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**3**

Syllabus of MSM 254 (Practical)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc.(H)		**Academic Year: 2019-20**
Branch: Mathematics		**Semester: IV**
1	Course Code	MSM 254
2	Course Title	Mathematics Lab II
3	Credits	2
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course Objective	1. To familiarize the student in introducing and exploring MATLAB software. 2. To enable the student on how to approach for solving problems using MATLAB tools. 3. To prepare the students to use MATLAB in their project works. 4To provide a foundation in use of this software for real time applications.

6	Course Outcomes	CO1: Understand the procedures, algorithms, and concepts require to solve specific problems. (K2) CO2: Discuss and develop the algorithms to solve system of linear equations and measure the accuracy. (K2, K5, K6) CO3: Discuss and develop the algorithms to solve finite differences and interpolation and measure the accuracy. (K2, K5, K6) CO4: Discuss and develop the algorithms to solve system of transcendental equations and measure the accuracy. (K2, K5, K6) CO5: Discuss and develop the algorithms to solve divided differences and measure the accuracy. (K2, K5, K6) CO6: Discuss and develop the algorithms to solve numerical differentiation and integration and measure the accuracy. (K2, K5, K6)			
7	Course Description	This course teaches computer programming to those with little to no previous experience. It uses the programming system and language called MATLAB to do so because it is easy to learn, versatile and very useful for engineers and other professionals. MATLAB is a special-purpose language that is an excellent choice for writing moderate-size programs that solve problems involving the manipulation of numbers.			
8	Outline syllabus				CO Mapping
	Unit 1	**Lab. Experiment 1:**			
		Solution of system of linear equations:			CO1, CO2
	Unit 2	**Lab. Experiment 2:**			
		System of Transcendental equations			CO1, CO3
	Unit 3	**Lab. Experiment 3:**			
		Finite differences and interpolation:			CO1, CO4
	Unit 4	**Lab. Experiment 4:**			
		Divided differences:			CO1,CO5
	Unit 5	**Lab. Experiment 5:**			
		Numerical differentiation and integration			CO1, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	Amos Gilot			
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C254.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C254.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**

C254.3	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**
C254.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C254.5	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
C254.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Syllabus of MSM 355 (Practical)

School: SBSR		**Batch: 2018- 2021**	
Program: B.Sc.(H)		**Academic Year: 2020-21**	
Branch: Mathematics		**Semester: VI**	
1	Course Code	MSM 355	
2	Course Title	Mathematics Lab III	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	To create understanding of the excel and enable the students how to solve LPP, transportation problem, assignment problem in excel.	
6	Course Outcomes	CO1: Understand the procedures installation of the software LaTeX. (K2) CO2: Discuss and explain Latex basic syntax and write equations, matrix, and tables. (K2, K4, K6) CO3: Explain and write page layout, equation references citation tables of contents list of figures etc. (K2, K4, K6) CO4: Describe how to write Geometry, Hyperref, amsmath, amssymb, algorithms in Latex. (K1, K2, K6) CO5: Discuss the classes and explain how to write article, book, report, beamer, slides. IEEtran.. (K2,K4, K6) CO6: Write resume, question paper, research paper, project in Latex . (K2, K5, K6)	
7	Course Description	This course teaches the LaTeXTo and describes how to write resume, write question paper, and write articles / research papers.	
8	Outline syllabus		CO Mapping
	Unit 1	**Lab. Experiment 1:**	
		Installation of the software LaTeX	CO1, CO2
		Understanding Latex compilation: Basic Syntex, Writing equations, Matrix, Tables	
	Unit 2	**Lab. Experiment 2:**	
		Page Layout – Titles, Abstract Chapters, Sections, References, Equation references, citation. List making environments Table of contents, Generating new commands, Figure handlingnumbering, List of figures, List of tables,	CO3

		Generating index.			
	Unit 3	**Lab. Experiment 3:**			
		Packages: Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing.			CO4
	Unit 4	**Lab. Experiment 4:**			
		Classes: article, book, report, beamer, slides. IEEtran.			CO5
	Unit 5	**Lab. Experiment 5:**			
		Applications to: Writing resume Writing question paper Writing articles/ research papers			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	LATEX for Beginners			
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C356.1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
C356.2	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**
C356.3	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**
C356.4	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
C356.5	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
C356.6	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**

Syllabus of MSM 355 (Practical)

School: SBSR		**Batch: 2018- 2021**
Program: B.Sc.(H)		**Academic Year: 2020-21**
Branch: Mathematics		**Semester: VI**
1	Course Code	MSM 356
2	Course Title	Mathematics Lab III
3	Credits	2

4	Contact Hours (L-T-P)	0-0-3			
	Course Status	Compulsory			
5	Course Objective	To create understanding of the LaTeXand enable the students how to write resume, write question paper, write articles/ research papers.			
6	Course Outcomes	CO1: Understand the procedures installation of the software LaTeX. (K2) CO2: Discuss and explain Latex basic syntax and write equations, matrix, and tables. (K2, K4, K6) CO3: Explain and write page layout, equation references citation tables of contents list of figures etc. (K2, K4, K6) CO4: Describe how to write Geometry, Hyperref, amsmath, amssymb, algorithms in Latex. (K1, K2, K6) CO5: Discuss the classes and explain how to write article, book, report, beamer, slides. IEEtran.. (K2,K4, K6) CO6: Write resume, question paper, research paper, project in Latex. (K2, K5, K6)			
7	Course Description	This course teaches the LaTeXTo and describes how to write resume, write question paper, and write articles / research papers.			
8	Outline syllabus				CO Mapping
	Unit 1	**Lab. Experiment 1:**			
		Installation of the software LaTeX			CO1, CO2
		Understanding Latex compilation: Basic Syntex, Writing equations, Matrix, Tables			
	Unit 2	**Lab. Experiment 2:**			
		Page Layout – Titles, Abstract Chapters, Sections, References, Equation references, citation. List making environments Table of contents, Generating new commands, Figure handlingnumbering, List of figures, List of tables, Generating index.			CO3
	Unit 3	**Lab. Experiment 3:**			
		Packages: Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing.			CO4
	Unit 4	**Lab. Experiment 4:**			
		Classes: article, book, report, beamer, slides. IEEtran.			CO5
	Unit 5	**Lab. Experiment 5:**			
		Applications to: Writing resume, Writing question paper Writing articles/ research papers			CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	LATEX for Beginners			
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C356.1	3	3	2	2	2	3	2	2	1	1
C356.2	2	3	3	3	3	2	1	2	1	2
C356.3	2	2	2	3	2	2	3	2	2	2
C356.4	2	3	2	3	2	2	2	2	3	2
C356.5	3	3	2	3	2	3	3	2	2	2
C356.6	3	3	2	2	3	3	2	2	2	2

Syllabus of Project I

School: SBSR		**Batch : 2018- 2021**	
Program: B.Sc. (H)		**Academic Year: 2020-21**	
Branch: Mathematics		**Semester: V**	
1	Course Code	MSM 353	
2	Course Title	Project I	
3	Credits	3	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory/Elective	
5	Course Objective	1.Deep knowledge of a specific area of specialization. 2.Develop communication skills especially in project writing and oral presentation. Develop some time management skills.	
6	Course Outcomes	**CO1:** Explain the concept of research within the subject, as regards approaching a question, collecting and analysing background material and presenting research questions and conclusions. (K2, K4) **CO2:** Construct and develop a deeper interest in mathematics and taste for research. (K5, K6) **CO3:** Select and recommend the activities that support their professional goals. (K4, K6) **CO4:** Develop effective project organizational skills. (K5)	
7	Course Description	Maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for future learning.	

8	Outline syllabus				CO Achievement
	Unit 1	**Introduction**			**CO1**
	Unit 2	**Case study**			**CO1,CO2**
	Unit 3	**Conceptual**			**CO2,CO3**
	Unit 4	**Development**			**CO3**
	Unit 5	**Finalisation**			**CO3,CO4**
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C353.1	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
C353.2	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**
C353.3	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**
C353.4	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**

Syllabus of Project II

School: SBSR		**Batch : 2018- 2021**	
Program: B.Sc.		**Current Academic Year: 2020-21**	
Branch: Mathematics		**Semester: VI**	
1	Course Code	MSM 354	
2	Course Title	Project II	
3	Credits	3	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory/Elective	
5	Course Objective	1.Deep knowledge of a specific area of specialization. 2.Develop communication skills especially in project writing and oral presentation. Develop some time management skills.	

6	Course Outcomes	**CO1:** Explain the concept of research within the subject, as regards approaching a question, collecting and analysing background material and presenting research questions and conclusions. (K2, K4) **CO2:** Construct and develop a deeper interest in mathematics and taste for research. (K5, K6) **CO3:** Select and recommend the activities that support their professional goals. (K4, K6) **CO4:** Develop effective project organizational skills. (K5)	
7	Course Description	Maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for future learning.	
8	Outline syllabus		CO Achievement
	Unit 1	**Introduction**	**CO1**
	Unit 2	**Case study**	**CO1,CO2**
	Unit 3	**Conceptual**	**CO2,CO3**
	Unit 4	**Development**	**CO3**
	Unit 5	**Finalisation**	**CO3,CO4**
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 60% / MTE: 0% / ETE: 40%	
	Text book/s*	-	
	Other References		

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C354.1	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
C354.2	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**
C354.3	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**
C354.4	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**

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