(1) Edition of books required
(2) Correction in typing

DEPARTMENT OF HIGHER EDUCATION

RAJA MAHENDRA PRATAP SINGH STATE UNIVERSITY, ALIGARH

Syllabus for Fourth (First) to Sixth (Third) Year of Higher Education

(P.G.)

According to

National Education Policy-2020

Bachelor of Research / M.Sc. / P.G.D.R.

FOR

MATHEMATICS

SYLLABUS DEVELOPED BY				
S.N.	NAME	DESIGNATION	DEPARTMENT	COLLEGE / UNIVERSITY
1	DR. SHUBHNESH KUMAR GOYAL	Associate Professor	Mathematics	D.S.(P.G.) COLLEGE, ALIGARH
2	DR. Y.K. DWIVEDI	Associate Professor	Mathematics	GANJDUNDWARA COLLEGE, GANJJDUNDWARA
3	DR. VISHAL KUMAR YADAV	Assistant Professor	Mathematics	D.S.(P.G.) COLLEGE, ALIGARH

Project Correction

SEMESTER WISE TITLES OF THE PAPER IN PG MATHEMATICS COURSE					
YEAR	SEMESTER	COURSE CODE	PAPER TITLE	THEORY/PRACTICAL	CREDIT
BACHELOR OF RESEARCH (BoR) COURSE IN APPLIED MATHEMATICS					
4TH YEAR / 1ST YEAR	VII / I	B030701T	PROBABILITY AND STATISTICS	THEORY	5
		B030702T	ADVANCED PARTIAL DIFFERENTIAL EQUATION	THEORY	5
		B030703T	ADVANCED ABSTRACT ALGEBRA	THEORY	5
		B030704T	ADVANCED ORDINARY DIFFERENTIAL EQUATION	THEORY	5
			Minor Elective	THEORY	4
	VIII / II	B030801T	MEASURE THEORY	THEORY	4
		B030802T	FUNCTIONAL ANALYSIS	THEORY	4
		B030803T	HYDRO-STATICS AND HYDRO-DYNAMICS	THEORY	4
		B030804T	GRAPH THEORY	THEORY	4
		B030805P	COMPUTER MATHEMATICS WITH PROGRAMMING	PRACTICAL	4
		B030806R	**Research Project**		8
M.Sc. MATHEMATICS					
5TH YEAR / 2ND YEAR	IX/ III	B030901T	FLUID DYNAMICS	THEORY	4
		B030902T	FUZZY SETS AND FUZZY LOGICS	THEORY	4
		B030903T	INTEGRAL EQUATIONS & CALCULUS OF VARIATION	THEORY	4
		B030904T	ADVANCED LINEAR ALGEBRA	THEORY	4
		B030905P	PRACTICAL IN MATLAB/MATHEMATICA	PRACTICAL	4
	X / IV	B031001T	RIGID DYNAMICS	THEORY	5
		B031002T	TOPOLOGY	THEORY	5
		B031003T	OPERATIONS RESEARCH	THEORY	5
		B031004T B031005T B031006T B031007T	OPTIONAL ELECTIVE: Select one of the Course- Special Function Bio-Mathematics Theory of Relativity Advanced Numerical Analysis.	THEORY	5
		B031008R	**Research Project**		8
P.G.D.R. IN MATHEMATICS					
6TH YEAR / 3RD YR	XI / V	B031101T	MATHEMATICAL MODELLING	THEORY	6
		B031102T	COMPUTER MATHEMATICAL SOFTWARES	THEORY	6
		B031103T	RESEARCH METHODOLOGY	THEORY	4
	XII / VI	B031201R	RESEARCH PROJECT		

PROPOSED STRUCTURE OF PG MATHEMATICS SYLLABUS AS PER NEP 2020

GUIDELINES GENERAL OVERVIEW

BACHELOR OF RESEARCH

PROGRAMME	YEAR	SEMESTER (15Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS (HOURS) Per Semester	PAPER TITLE	UNIT (Periods Per Semester)	PREREQUISITE	ELECTIVE (For Other Faculty)
BACHELOR OF RESEARCH COURSE IN APPLIED MATHS	FOURTH YEAR	SEMESTER – VII	Paper-1 THEORY	5	5	5x 15= 75	PROBABILITY AND STATISTICS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15) UNITV (15)	B.Sc. Mathematics	M.A. (ECONOMICS, SOCIOLOGY, PSYCHOLOGY, POL.Sc., GEOGRAPHY, DSST, EDUCATION) /M.Com.
			Paper-2 THEORY	5	5	5x 15= 75	ADVANCED PARTIAL DIFFERENTIAL EQUATION	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	B.Sc. Mathematics	
			Paper-3 THEORY	5	5	5x 15= 75	ADVANCED ABSTRACT ALGEBRA	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	B.Sc. Mathematics	
			Paper-4 THEORY	5	5	5x 15= 75	ADVANCED ORDINARY DIFFERENTIAL EQUATION	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	B.Sc. Mathematics	
			Paper-5 THEORY	4	4	4x 15= 60	**Course selected by the other Faculty**	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	B.Sc. Mathematics	**Select a Course from any other Faculty of Four Credits.**
		SEMESTER – VIII	Paper-1 THEORY	4	4	4x 15= 60	MEASURE THEORY	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	B.Sc. Mathematics	
			Paper-2 THEORY	4	4	4x 15= 60	FUNCTIONAL ANALYSIS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	B.Sc. Mathematics	
			Paper-3 THEORY	4	4	4x 15= 60	HYDRO-STATICS AND HYDRO-DYNAMICS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	B.Sc. Mathematics	
			Paper-4 THEORY	4	4	4x 15= 60	GRAPH THEORY	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	B.Sc. Mathematics	
			Paper-5 PRACT.	4	4	2x4x 15 = 120	COMPUTER MATHEMATICS WITH PROGRAMMING	Unit I (15) UNIT II(15) UNIT III(45) UNIT IV(45)	B.Sc. Mathematics	
				8	**RESEARCH PROJECT**					

M.Sc. APPLIED MATHEMATICS

PROGRAMME	YEAR	SEMESTER (15Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS (HOURS) Per Semester	PAPER TITLE	UNIT (Periods Per Semester)	PREREQUISITE	ELECTIVE (For Other Faculty)
M.Sc. IN APPLIED MATHS	FIFTH YEAR	SEMESTER – IX	Paper-1 THEORY	4	4	4x 15= 60	FLUID DYNAMICS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	Bachelor of Research	
			Paper-2 THEORY	4	4	4x 15= 60	FUZZY SETS AND FUZZY LOGICS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	Bachelor of Research	
			Paper-3 THEORY	4	4	4x 15= 60	INTEGRAL EQUATIONS & CALCULAUS OF VARIATIONS	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15))	Bachelor of Research	
			Paper-4 THEORY	4	4	4x 15= 60	ADVANCED LINEAR ALGEBRA	Unit I (15) UNIT II(15) UNIT III(15) UNIT IV(15)	Bachelor of Research	
			Paper-5 PRACT.	4	4	2x4x 15 = 120	PRACTICAL IN MATLAB/MATHEMATICA	Unit I (30) UNIT II(30) UNIT III(30) UNIT IV(30)	Bachelor of Research	
		SEMESTER – X	Paper-1 THEORY	5	5	5x 15= 75	RIGID DYNAMICS	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	Bachelor of Research	
			Paper-2 THEORY	5	5	5x 15= 75	TOPOLOGY	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	Bachelor of Research	
			Paper-3 THEORY	5	5	5x 15= 75	OPERATIONS RESEARCH	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	Bachelor of Research	
			Paper-4 THEORY	5	5	5x 15= 75	OPTIONAL ELECTIVE: Select one of the Course-Special Function, Bio-Mathematics, Theory of Relativity, Advanced Numerical Analysis.	Unit I (20) UNIT II(20) UNIT III(18) UNIT IV(17)	Bachelor of Research	
				8	RESEARCH PROJECT					

POST GRADUATE DEGREE IN RESEARCH

PROGRAMME	YEAR	SEMESTER (15Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS(HOURS) Per Semester	PAPER TITLE	UNIT (Periods PerSemester)	PREREQUISITE	ELECTIVE (For Other Faculty)
POST GRADUATE DEGREE IN RESEACH COURSE IN APPLIED MATHS	SIXTH YEAR	SEMESTER – XI	Paper-1 THEORY	6	6	6x 15= 90	MATHEMATICAL MODELLING	Unit I (25) UNIT II(25) UNIT III(20) UNIT IV(20)	M.Sc.	
			Paper-2 THEORY	6	6	6x 15= 90	COMPUTER MATHEMATICAL SOFTWARES	Unit I (25) UNIT II(25) UNIT III(20) UNIT IV(20)	M.Sc.	
			Paper-3 THEORY	6	6	6x 15= 90	RESEARCH METHODOLOGY	Unit I (25) UNIT II(25) UNIT III(20) UNIT IV(20)	M.Sc.	
		SEMESTER – XII						RESERCH PROJECT		

RAJA MAHENDRA PRATAP SINGH STATE UNIVERSITY, ALIGARH

Detailed Syllabus For

BACHELOR OF RESEARCH

IN

APPLIED MATHEMATICS

BoR (SEMESTER-VII) PAPER-I PROBABILITY AND STATISTICS

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 7th
Subject: Mathematics		
Course Code: B030701T	Course Title: PROBABILITY AND STATISTICS	
Credits: 5 / 4	Core Compulsory / MINOR ELECTIVE FOR THE OTHER FACULTY	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

PROBABILITY AND STATISTICS

Unit	Topics	No. of Lectures
I	INTRODUCTION, MEASUREMENT OF CENTAL TENDANCY, DISPERSION, SKEWNESS, KURTOSIS AND MOMENT, THEORY OF PROBABILITY.	15
II	CORRELATION AND REGRESSIONS, RANDOM VARIABLES, MATHEMATICAL EXPECTATIONS, PROBABILITY AND COMMULATIVE DENSITY FUNCTION, MOMENT GENERATING AND COMMULATIVE FUNCTION.	15
III	DISCRETE AND CONTINUOUS PROBABILITY DISTRIBUTIONS: BINOMIAL, POISSONS, UNIFORM, GEOMETRIC, HYPERGEOMETRIC, GAMMA, BETA, EXPONENTIAL, NORMAL DISTRIBUTION.	15
IV	TEST OF SIGNIFICANCE BASED ON CHI-SQUARE.	15
V	THEORY OF SAMPLE, t, F AND Z – DISTRIBUTION.	15

Suggested Readings-

1. MATHEMATICAL STATISTICS BY J.N. KAPOOR
2. MATHEMATICAL STATISTICS BY O.P. GUPTA
3. MATHEMATICAL STATISTICS BY J.N. SHARMA
4. MATHEMATICAL STATISTICS BY K.P. GUPTA

This course can be opted as an elective by the students of following subjects: M.A. (SOCIOLOGY, POL. SC., ECONOMICS, PSYCHOLOGY, MIL. SC., GEOGRAPHY)/ M.COM.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VII) PAPER-II ADVANCED PARTIAL DIFFERETIAL EQUTIONS

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 7th
Subject: Mathematics		
Course Code: B030702T	Course Title: ADVANCED PARTIAL DIFFERETIAL EQUTIONS	
Credits: 5	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

ADVANCED PARTIAL DIFFERETIAL EQUTIONS

Unit	Topics	No. of Lectures
I	CLASSIFICATION FOR LINEAR PARTIAL DIFF. EQ. OF SECOND ORDER, CANONICAL FORM, CAUCHY'S PROBLEM OF FIRST AND SECOND ORDER PDE.	20
II	LINEAR HOMOGENEOUS BOUNDARY VALUE PROBLEM, EIGEN VALUES AND EIGEN FUNCTIONS, STURM-LIOUVILLE'S BOUNDARY VALUE PROBLEM, ORTHOGONALITY OF EIGEN FUNGTIONS, LAGRANGE'S IDENTITY, PROPERTIES OF EIGEN FUNCTIONS, PERIODIC FUNCTIONS.	20
III	NON-HOMOGENIOUS BOUNDARY VALUE PROBLEM, NON-HOMOGENIOUS STURM-LIOUVILLE'S BOUNDARY VALUE PROBLEM, METHOD OF SEPERATION OF VARIABLES, LAPLACE, WAVE AND DIFFUSION EQUATIONS.	18
IV	GREEN'S FUNCTIONS, PROCEEDURE OF CONSTUCTING THE GREEN'S FUNCTION AND SOLUTION OF BOUNDARY VALUE PROBLEM, PROPERTIES OF GREEN'S FUNCTION, DIRAC-DELTA FUNCTION, GREEN'S FUNCTION.	17

Suggested Readings-

1. ELEMENTS OF PARTIAL DIFF EQ BY IAN SNEDDON
2. LINEAR PDE FOR SCIENCTIST BY B. BOSTON
3. INTODUCTION OF PDE BY K.S. RAO
4. PARTIAL DIFF EQ BY M.D. RAISIGHANIA

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VII) PAPER-III ADVANCED ABSTRACT ALGEBRA

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 7th
Subject: Mathematics		
Course Code: B030702T	Course Title: ADVANCED ABSTRACT ALGEBRA	
Credits: 6	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		

ADVANCED ABSTRACT ALGEBRA

Unit	Topics	No. of Lectures
I	EXTERNAL & INTERNAL DIRECT PRODUCT AND RELATED RESULTS, STRUCTURE THEORY OF FINITE ABELIAN GROUP, RELATION BETWEEN SYLOW P-SUBGROUP AND FINITE ABELIAN GROUPS, THE DIHEDRAL GROUP.	25
II	COMPOSITION SERIES OF GROUPS, SOLVABLE GROUPS, NORMAL SERIES OF GROUPS, JORDAN HOLDER THEOREM FOR FINITE GROUPS AND ITS APPLICATIONS.	25
III	FINITE FIELD, SUBFIELD, FINITE EXTENSION, DEGREE OF EXTENSION, FINITELY GENERATED EXTENSIONS, SIMPLE EXTENSION AND ITS PROPERTIES, ALGEBRAIC AND TRANSCEDENTAL ELEMENTS, ALGEBRAIC EXTENSION.	20
IV	SPLITTING FIELDS AND UNIQUNESS, NORMAL EXTENSION, THE GROUP OF AUTOMORPHISM OF A FIELD AND FIXED FIELD, GALOIS EXTENSION.	20

Suggested Readings-

1. TOPICS IN ALGEBRA BY I.N. HERSTEIN
2. A COURSE OF ALGEBRA BY FRALEIGH
3. MODERN ALGEBRA BY R.S. AGGRWAL
4. ABSTRACT ALGEBRA BY J.N. SHARMA

This course can be opted as an elective by the students of following subjects: M.Sc. (C.S.)/ MCA /M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VII) PAPER-IV ADVANCED ORDINARY DIFFERETIAL EQUTIONS

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 7th
Subject: Mathematics		
Course Code: B030704T	Course Title: ADVANCED ORDINARY DIFFERETIAL EQUTIONS	
Credits: 5	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

ADVANCED ORDINARY DIFFERETIAL EQUTIONS

Unit	Topics	No. of Lectures
I	NONLINEAR ORDINARY DIFFERENTIAL EQ OF PARTICULAR FORM RICCATI EQUTIONS-GENERAL SOLUTION AND SOLUTION WHEN ONE, TWO OR THREE PARTICULAR SOLUTIONS ARE KNOWN.	20
II	TOTAL DIFFERENTIAL EQ, FORMS AND SOLUTIONS, GEOMETRICAL MEANING OF EQ CONTAINING THREE AND FOUR VARIABLES, TOTAL DIFFERENTIAL EQS OF SECOND DEGREE.	20
III	SERIES SOLUTION: RADIUS OF CONVERGENCE, CAUCHY-EULER'S EQUTION, SOLUTION NEAR A REGULAR POINT (METHOD OF FORBENIUS) FOR DIFFERENT CASES, PARTICULAR INTEGRAL AND THE POINT OF INFINITY.	18
IV	EXISTENCE AND UNIQUENESS OF SOLUTIONS TO FIRST ORDER EQ, SUCCESIVE APPROXIMATION, LIPCHITZ CONDITION, CONVERGENCE OF SUCCESIVE APPROXIMATIONS, NON-LOCAL EXISTENCE OF SOLUTIONS.	17

Suggested Readings-

1. ORDINARY DIFF. EQ. BY M.D. RAISINGHANIA
2. ORDINARY DIFF. EQ. BY D. SOMUSUNDARAM
3. ORDINARY DIFF. EQ. BY E.A. CODINGTON
4. ORDINARY DIFF. EQ. BY BIRKHOFF AND ROTA

This course can be opted as an elective by the students of following subjects: M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VIII) PAPER-I MEASURE THEORY

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 8th
Subject: Mathematics		
Course Code: B030801T	Course Title: MEASURE THEORY	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

MEASURE THEORY

Unit	Topics	No. of Lectures
I	LEBESGUE MEASURE: LEBESGUE AND OUTER MEASURE, LEBESGUE MEASURABLE SETS, LEBESGUE MEASURE, NON-MEASURABLE SETS, LEBESGUE MEASURABLE FUNCTIONS, BOREL LEBESGUE MEASURABILITY.	15
II	LEBESGUE INTEGRAL: REVISIT OF REIMANN INTEGRAL, LEBESGUE INTEGRAL OF SIMLPLE FUNCTIONS, BOUNDED FUNCTION AND NON-NEGATIVE FUNCTION OVER A SET IF FINITE MEASURE. GENERAL LEBESGUE INTEGRAL.	15
III	ABSTRACT MEASURE: RING, ALGEBRA, SIGMA-RING, SIGMA ALGEBRA, SET FUNCTIONS, MEASURE SPACE AND MEASURABLE SPACE, MEASURABLE FUNCTIONS, GENERAL INTEGRATIONS, EXISTENCE OF MEASURE, UNIQUENESS OF MEASURE.	15
IV	L^p-Space. JENSEN'S INEQUALITY, MINKOWSKI INEQUALITY, HOLDER'S INEQUALITY.	15

Suggested Readings-

1. MEASURE THEORY BY P.R. HALMOS
2. AN INTRODUCTION OF MEASURE THEORY BY INDER K. RANA
3. H.L. ROYDON, REAL ANALYSIS
4. W.RUDIN ,PRINCIPLE OF MATHEMATICAL ANALYSIS
5. P.K.JAIN AND V.P. GUPTA ,LEBESGUE MEASURE AND INTEGRATION

This course can be opted as an elective by the students of following subjects: M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VIII) PAPER-II FUNCTIONAL ANALYSIS

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 8th
Subject: Mathematics		
Course Code: B030802T	Course Title: FUNCTIONAL ANALYSIS	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

FUNCTIONAL ANALYSIS

Unit	Topics	No. of Lectures
I	BANACH SPACE, CONTINUITY IN NORMED LINEAR SPACE, SUBSPACE AND QUOTIENT SPACE OF BANACH SPACE, CONTINUOUS LINEAR TRANSFORMATION.	15
II	HANN-BANACH THEOREM, OPEN MAPPING THEOREM, CLOSED GRAPH THEOREM, UNIFORM BOUNDNESS THEOREM.	15
III	HILBERT SPACE, COMPLETION OF HILBERT SPACE, ORTHOGONALITY OF VECTORS, ORTHOGONAL COMPLEMENT AND PROJECTION THEOREM, ORTHONOMAL AND COMPLETE ORTHONORMAL SETS, CONJUGATE SPACE.	15
IV	HILBERT ADJOINT, SELF-ADJOINT, NORMAL AND UNITARY OPERATOR, ORTHOGONAL PROJECTION OPERATORS.	15

Suggested Readings-

1. FUNCTIONAL ANALYSIS BY P.K.JAIN AND O.P. AHUJA
2. FUNCTIONAL ANALYSIS BY J.N.SHARMA
3. FUNCTIONAL ANALYSIS BY K.P.GUPTA
4. FUNCTIONAL ANALYSIS BY B.D.GUPTA

This course can be opted as an elective by the students of following subjects: M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VIII) PAPER-III HYDRO-STATICS AND HYDRO-DYNAMICS

Programme: BoR **Class:M.Sc.**	**Year: Fourth**	**Semester: 8th**
Subject: Mathematics		
Course Code: B030803T	**Course Title: HYDRO-STATICS AND HYDRO-DYNAMICS**	
Credits: 4	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 33 (With 25 mandatories in External Examination)**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

HYDRO-STATICS AND HYDRO-DYNAMICS

Unit	Topics	No. of Lectures
I	FLUID PRESSURE, RESULTANT THRUST ON FLAT AND CURVED SURFACES	15
II	CENTRE OF PRESSURE, EQUALIBIRIUM OF FLOATING BODIES.	15
III	KINEMATICS: LAGRANGIAN AND EULER'S METHOD, STEADY AND UNSTEADY FLOW, STREAM LINES, PATH LINES, STREAK LINES, EQUATION OF CONTINUITY, VELOCITY POTENTIAL, IRROTATIONAL AND ROTATIONAL FLOWS.	15
IV	EULER'S EQUATION OF MOTION, BERNAULLI'S EQUATION OF MOTION, CONSERVATIVE FIELD OF FORCE, INTEGRATION OF EULER'S EQUATION, ENERGY EQUATION, CONCEPT OF SOURCE, SINK AND DOUBLETS, IMAGE OF SOURCE AND DOUBLET WITH REGARD TO A PLANE AND CIRCULAR BOUNDARY.	15

Suggested Readings-

1. HYDRO-DYNAMICS BY M.RAY
2. HYDRO-DYNAMICS. BY H.S. SHARMA
3. FLUID DYNAMICS BY M.D. RAISINGHANIA
4. FLUID DYNAMICS BY H.S. SHARMA
5. FLUID DYNAMICS BY M. RAY

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	**Class Tests**	10
2	**Online Quizzes/ Objective Tests**	5
3	**Presentation/** Research Orientation assignment	5
4	**Assignment**	5

BoR (SEMESTER-VIII) PAPER-IV GRAPH THEORY

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 8th
Subject: Mathematics		
Course Code: B030804T	Course Title: GRAPH THEORY	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

GRAPH THEORY

Unit	Topics	No. of Lectures
I	GRAPHS AND SIMPLE GRAPHS, GRAPH ISOMORPHISM, THE INCIDENCE AND ADJACENCE MATRICES, SUBGRAPH-VERTEX, DEGREE, PATH AND CONNECTIONS, CYCLES TREE-CUT EDGES, CUT VERTEX, CONNECTIVITY.	15
II	MATCHING AND COVERING IN BIPARTICLE GRAPHS, EDGE CHROMATIC NUMBER, VIZNG'S THEOREM.	15
III	CHROMATIC NUMBER, BOOK'S THEOREM, CHROMATIC POLYNOMIALS.	15
IV	PLANE AND PLANNER GRAPHS, DUAL GRAPHS, EULER'S FORMULA, FIREEDER'S THEOREM AND FOUR COLORS CONJECTIVES.	15

Suggested Readings-

1. INTRODUCTION TO GRAPH THEORY BY R.J. TRUDEAU
2. INTRODUCTION TO GRAPH THEORY BY DOUGALAS WEST
3. GRAPH THEORY WITH APPLICATIONS BY NARSINGH DEO
4. GRAPH THEORY WITH APPLICATIONS BY J.A. BONDY

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

BoR (SEMESTER-VIII) PAPER-V COMPUTER MATHEMATICS WITH PROGRAMMING

Programme: BoR Class:M.Sc.	Year: Fourth	Semester: 8th
Subject: Mathematics		
Course Code: B030805P	**Course Title:** COMPUTER MATHEMATICS WITH PROGRAMMING	
Credits: 4	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 33 (With 25 mandatories in External Examination)**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-4		

COMPUTER MATHEMATICS WITH PROGRAMMING

Unit	Topics	No. of Lectures
I	HISTORY AND SCOPE OF COMPUTER, CONTROL UNIT AND MEMORY UNIT OF COMPUTER, NUMBER SYSTEM: DECIMAL, BINARY, OCTAL, HEXA-DECIMAL NUMBERS AND THEIR OPERATIONS, ASCII CODE AND FLOATING-POINT REPRESENTATION.	15
II	ALGEBRA OF LOGICS, BOOLEAN ALGEBRA AND BOOLEAN EXPRESSIONS, CNF AND DNF.	15
III	ALGORITHMS AND FLOW CHARTS, INTRODUCTION OF FORTRAN PROGRAMMING.	30
IV	EXECUTION OF SIMPLE FORTRAN PROGRAMMES ON COMPUTER BASED ON- DO-LOOPS, NESTED DO-LOOPS, FUNCTION AND SUBROUTINE, ARRAY AND DIMENSION.	30

Suggested Readings-

1. MATHEMATICS FOR COMPUTER SCIENCE BY F.T. LEIGHTON, 2010.
2. CONCRETE MATHEMATICS BY DONALD KNUTH, 1988.
3. FOUNDATION OF MATHEMATICS FOR COMPUTER MATHEMATICS BY JOHNS VINCE, 2015.

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

RAJA MAHENDRA PRATAP SINGH

STATE UNIVERSITY, ALIGARH

Detailed Syllabus For

M.Sc.

in

APPLIED MATHEMATICS

M.Sc. (MATHS.) (SEMESTER-IX) PAPER-I FLUID DYNAMICS

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 9th
Subject: Mathematics		
Course Code: B030901T	Course Title: FLUID DYNAMICS	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

FLUID DYNAMICS

Unit	Topics	No. of Lectures
I	IRROTATIONAL MOTION: GENERAL MOTION OF FLUID ELEMENT, VORTICITY, FLOW AND CIRCULATION, STOKE'S THEOREM, KELVIN'S CIRCULATION THEOREM, BLASSIUS THEOREM WITH APPLICATIONS, KUTTA-JOUKOWSKI THEOREM.	15
II	VORTEX MOTION: VORTICITY AND CIRCULATION, COMPLEX POTENTIAL DUE TO A VORTEX, VORTEX STREET, KARMANN'S VORTEX STREET, VORTEX PAIR, PROPERTIES OF VORTEX.	15
III	FLUID WAVE: TYPES OF WAVES, STATIONARY WAVES, WAVE PROPAGATION ON COMMON SURFACE OF TWO FLUIDS, WAVE PROPAGATION ON A FINITE, INFINITE CANAL.	15
IV	STRESS ANALYSIS, SYMMETRY OF STRESS TENSOR, TRANSFORMATION OF STRESS COMPONENT, PRINCIPAL STRESSES AND PRINCIPAL DIRECTIONS, DISSIPATION OF ENERGY, NAVIER-STOKE'S EQUATIONS OF VISCOUS FLUID, LAMINAR FLOW BETWEEN PARLLEL PLATES, PLANE COUETTE FLOW, PLANE POISEULLE FLOW, HAGEN'S POISEULLE'S FLOW, STEADY FLOW BETWEEN CO-AXIAL CIRCULLAR PIPES, LAMINAR FLOW BETWEEN CONCENTRIC ROTATING CYLINDERS, LAMINAR FLOW BETWEEN TWO SLOWLY ROTATING SPHERES. BOUNDARY LAYER THEORY.	15

Suggested Readings-

1. FLUID DYNAMICS BY M.RAY
2. FLUID DYNAMICS BY H.S. SHARMA
3. FLUID DYNAMICS BY M.D. RAISINGHANIA
4. FLUID DYNAMICS BY R.K. GUPTA

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-IX) PAPER-II FUZZY SETS AND FUZZY LOGICS

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 9th
Subject: Mathematics		
Course Code: B030902T	Course Title: FUZZY SETS AND FUZZY LOGICS	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

FUZZY SETS AND FUZZY LOGICS

Unit	Topics	No. of Lectures
I	FUZZY SETS THEORY, OPERATIONS ON FUZZY SETS	15
II	FUZZY NUMBERS, FUZZY ARITHMATIC, FUZZY RELATIONS AND FUZZY GRAPH.	15
III	POSSIBILITY THEORY AND APPROXIMATE RESONING.	15
IV	FUZZY LOGIC, FUZZY SYSTEM, FUZZY RESONING AND DECISION MAKING IN FUZZY ENVIRONMENT.	15

Suggested Readings-

1. FUZZY SETS AND THEIR APPLICATIONS BY PUNDIR AND PUNDIR
2. FUZZY SETS AND FUZZY LOGIC BY GEORGE KILR, 1995.
3. FUZZY LOGIC BY F.M. MCNEILL, 1994.
4. FUZZY LOGIC WITH APPLICATIONS BY T.J. ROSS, 1995.

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-IX) PAPER-III

INTEGRAL EQUATIONS & CALCULAS OF VARIATIONS

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 9th
Subject: Mathematics		
Course Code: B030903T	Course Title: INTEGRAL EQUATIONS & CALCULAS OF VARIATIONS	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

INTEGRAL EQUATIONS & CALCULAS OF VARIATIONS

Unit	Topics	No. of Lectures
I	INTRODUCTION OF INTEGRAL EQUATIONS, SYMMETRIC KERNELS, SOLUTION OF INTEGRAL EQUATIONS WITH SEPRABLE KERNELS.	15
II	SOLUTION OF VOLTERRA & FREDOHLM INTEGRAL EQUATION OF SECOND KIND BY SUCCESIVE APPROXIMATIONS AND SUBSTITUTION METHOD.	15
III	SIGULAR INTEGRAL EQUATION, APPLICATION OF INTEGRAL EQUATIONS.	15
IV.	Calculus of Variations-Variational problems with fixed Boundaries, Euler's Equation for Functionals containing first order derivative and one independent variable, Extremals, Functionals dependent on higher order derivatives, Problems in Parametric Form.	15

Suggested Readings-

1.INTEGRAL EQUATIONS BY M.D. RAISIGHANIA
2. INTEGRAL EQUATIONS BY SHANTI SWARUP AND SHIV RAJ SINGH
3. INTEGRAL EQUATIONS BY PUNDIR AND PUNDIR
4.CALCULUS OF VARITINS BY M.D. RAISIGHANIA

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-IX) PAPER-IV ADVANCED LINEAR ALGRBRA

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 9th
Subject: Mathematics		
Course Code: B030904T	Course Title: ADVANCED LINEAR ALGRBRA	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

ADVANCED LINEAR ALGRBRA

Unit	Topics	No. of Lectures
I	RECALL OF VECTOR SPACES, BASIS DIMENSION AND RELATED PROPERTIES, LINEAR TRANSFORMATION, DUAL BASIS, DUAL SPACE, SECOND DUAL SPACE, DUAL TRANSFORMATION, ANNIHILATORS.	15
II	INNER PRODUCT SPACE, NORMED SPACE, CAUCHY SCHWARTZ INEQUALITY, PROJECTIONS, ORTHOGONAL PROJECTIONS, ORTHOGONAL COMPLEMENT, ORTHONORMALITY, MATRIX REPRESENTATION OF INNER PRODUCT, GRAHM-SCHMIDT PROCESS ORTHONOMALISATION PROCESS, BESSEL'S INEQUALITY, REISZ REPRESENTATION THEOREM, ORTHOGONAL TRANSFORMATION, INNER PRODUCT SPACE ISOMORPHISM.	15
III	ALGEBRA OF HOM(V,V), MINIMAL POLYNOMIAL, INVERTIBLE LINEAR TRANSFORMATIONS, CHARACTERISTIC POLYNOMIAL AND RELATED RESULTS, DIOGONALISATION OF MATRIX, INVARIENT SUBSPACE, CALEY-HAMILTON'S THEOREM.	15
IV	CANONICAL FORM, JORDAN FORM, BILINEAR FUNCTIONAL, SYMMETRIC AND SKEW-SYMMETRC BILINEAR FORM, RANK OF BILINEAR FORM, QUARDRATIC FORM, CLASSIFICATION OF REAL QUARDRATIC FORM.	15

Suggested Readings-

1. LINEAR ALGEBRA BY HOFFMAN AND KUNJE
2. LINEAR ALGEBRA BY V. KRISHNAMURTHY
3. TOPICS IN ALGEBRA: I.N. HERSTEIN
4. LINEAR ALGEBRA BY SHELDON ALEXER

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-IX) PAPER-V PRACTICAL IN MATLAB/MATHEMATICA

Programme: M.Sc. **Class:M.Sc.**	**Year: Fifth**	**Semester: 9th**
Subject: Mathematics		
Course Code: B030905P	**Course Title:** PRACTICAL IN MATLAB/MATHEMATICA	
Credits: 4	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 33 (With 25 mandatories in External Examination)**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-8		

PRACTICAL IN MATLAB/MATHEMATICA

Unit	Topics	No. of Lectures
I	GETTING STARTED, MATHS BASICS, SCRIPT M-FILE, FUNCTION M-FILE, LOOPS, INTERACTING WITH ALGEBRA AND ARITHMATIC	30
II	MATLAB GRAPHICS: PROBLEMS BASED ON GRAPHICS, CALCULUS & LINEAR ALGEBRA	30
III	M-BOOKS: ENABLING AND STARTING M-BOOKS, WORKING WITH M-BOOKS, M-BOOKS GRAPHICS.	30
IV	MATLAB PROGRAMMING: SIMULINK & GUI's, BRANCHING, LOOPS. PROGRAMMING APPLICATIONS: EXPONETIAL GROWTH & DECAY, LINEAR ECONOMIC MODEL, LINEAR PROGRAMMING PROBLEMS, NUMERICAL SOLUTION OF HEAT EQUATION.	30

Suggested Readings-

1. A GUIDE TO MATLAB BY B.R. HUNT, R.L. LIPSMAN & J.M. ROSENBERG, CAMBRIDGE UNIV. PRESS.
2. MATLAB FOR BEGINNERS BY PETER ISSA KATTAN, 2008.
3. MATLAB PROGRAMMING FOR ENGINEERS BY S.J. CHAPMAN, 1999.

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	**Class Tests**	10
2	**Online Quizzes/ Objective Tests**	5
3	**Presentation/** Research Orientation assignment	5
4	**Assignment**	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-1 RIGID DYNAMICS

Programme: M.Sc. **Class:M.Sc.**	**Year: Fifth**	**Semester: 10th**
Subject: Mathematics		
Course Code: B031001T	**Course Title: RIGID DYNAMICS**	
Credits: 5	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 33 (With 25 mandatories in External Examination)**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

RIGID DYNAMICS

Unit	Topics	No. of Lectures
I	MOMENT AND PRODUCT OF INERTIA OF A RIGID BODY, EQUI-MOMENTAL BODIES, MOMENTAL ELLIPSOID, PRINCIPAL AXES AND PRINCIPAL MOMENTS AT A POINT.	20
II	MOTION OF A BODY UNDER FINITE FORCES: MOTION ON AN INCLINED PLANE WITH FRICTION, SLIPPING OF RODS, MOTION OF ONE SYMMETRIC BODY ON OTHER, MOTION OF ONE SYMMETRIC BODY WITHIN THE OTHER BODY.	20
III	GENERALISED COORDINATES, DEGREE OF FREEDOM, LAGRANGE'S AND HAMILTON'S EQUATIONS OF MOTION.	18
IV	MOTION IN THREE-DIMENSIONAL SPACE, EULER'S DYNAMICAL EQUATION'S IN ABSENCE AND PRESENCE OF EXTERNAL FORCES, MOTION OF TOP.	17

Suggested Readings-

1. RIGID DYNAMICS BY P.P.GUPTA AND G.S.MALIK
2. RIGID DYNAMICS BY NAND AND TYAGI
3. RIGID DYNAMICS BY M.RAY
4. RIGID DYNAMICS BY P.K.GUPTA

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	**Class Tests**	10
2	**Online Quizzes/ Objective Tests**	5
3	**Presentation/** Research Orientation assignment	5
4	**Assignment**	5

Yadav

M.Sc. (MATHS.) (SEMESTER-X) PAPER-II TOPOLOGY

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 10th
Subject: Mathematics		
Course Code: B031002T	Course Title: TOPOLOGY	
Credits: 5	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

TOPOLOGY

Unit	Topics	No. of Lectures
I	TOPOLOGICAL SPACES, CONTINUITY AND HOMEOMORPHISM IN TOP-SPACE, OPEN AND CLOSED MAP, UNIFORM CONTINUITY, ISOMETRY IN TOP-SPACE.	20
II	SEPRATION AXIOMS: T0, T1, T2, T3 AND T4 SPACES WITH THEIR PROPERTIES.	20
III	COMPACTNESS AND CONNECTEDNESS IN TOPOLOGICAL SPACE	18
IV	PRODUCT SPACE AND QUOTIENT SPACE	17

Suggested Readings-

1. **TOPOLOGY BY B.D. GUPTA**
2. **INTRODUCTION TO TOPOLOGY BY BERT MENDELSON, 1975.**
3. **INTRODUCTION TO TOPOLOGY BY THEODORE GAMELIN, 1983.**
4. **GENERAL TOPOLOGY BY J.L. KELLEY, 1955.**

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-III OPERATIONS RESEARCH

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 10th
Subject: Mathematics		
Course Code: B031003T	Course Title: OPERATIONS RESEARCH	
Credits: 5	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

OPERATIONS RESEARCH

Unit	Topics	No. of Lectures
I	INTRODUCTION: NATURE AND SCOPE OF OPERATIONS RESEARCH, INVENTORY MANAGEMENT: DETERMINISTIC INVENTORY MODEL WITH AND WITHOUT SHORTAGE, PRODUCTION MODEL WITH AND WITHOUT SHORTAGE, EOQ PROBLEMS WITH PRICE BREAK, PROBILISTIC INVENTORY MODELS.	20
II	REPLACEMENT PROBLEM, SEQUENCING PROBLEM, INTEGER PROGRAMMING PROBLEM, DYNAMIC PROGRAMMING PROBLEM.	20
III	GAME THEORY: TWO PERSONS ZERO SUM GAME, GAME WITH AND WITHOUT SADDLE POINT, DOMINANCE RULE, APPROXIMATION METHOD, GRAPHICAL METHOD, LPP EQUIVALENT TO GAME PROBLEM, NON-LINEAR PROGRAMMING PROBLEM: GRAPHICAL METHOD, CONSTRAINED OPTIMIZATION, KUHN-TUCKER CONDITIONS, QUARDRATIC PROGRAMMING, BEALE'S METHOD AND WOLFE'S METHOD.	18
IV	WAITING LINE PROBLEMS: GENERAL CONCEPT, POISSON'S PROCESS, ERLANG PROCESS, STEADY STATE SOLUTIONS, M/M/1, M/M/N, M/M/1:N, M/M/N:N, M/Ek/1 WAITING LINE MODELS, NETWORK ANALYSIS: PERT & CRITICAL PATH METHOD.	17

Suggested Readings-

1. KANTI SWARUP ET.AL. "OPERATIONS RESEARCH", SULTAN CHAND PUB.
2. R.K. GUPTA ET.AL. "OPERATIONS RESEARCH", KRISHNA PUB.
3. S.D. SHARMA. "OPERATIONS RESEARCH", KEDAR NATH-RAM NATH PUB.
4. H.A. TAHA "OPERATIONS RESEARCH: AN INTRODUCTION"
5. FUNDAMENTAL OF QUEUING THEORY: GROSS AND HARRIS

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-IV(A) SPECIAL FUNCTIONS

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 10th
Subject: Mathematics		
Course Code: B031004T	Course Title: SPECIAL FUNCTIONS	
Credits: 5	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

SPECIAL FUNCTIONS

Unit	Topics	No. of Lectures
I	ORTHOGONAL SETS OF FUNCTIONS, CHEBYSHEV POLYNOMIALS.	20
II	HYPERGEOMETRIC FUNCTIONS: POCHHAMMER SYMBOL, GAUSS THEOREM, VANDERMONDES THEOREM, KUMMER'S THEOREM, DIXON THEOREM.	20
III	RECALL OF LEGENDRE'S POLYNOMIALS AND BESSEL FUNCTIONS, ASSOCIATED LEGENDRE'S FUNCTION WITH THEIR PROPERTIES.	18
IV	HERMITE'S POLYNOMIALS & LAGUERRE'S POLYNOMIALS WITH THEIR PROPERTIES	17

Suggested Readings-

1. SPECIAL FUNCTIONS BY M.D. RAISINGHANIA
2. SPECIAL FUNCTIONS BY GEORGE ANDREWS
3. SPECIAL FUNCTIONS BY W.W. BELL
4. SPECIAL FUNCTIONS AND THEIR APPLICATIONS BY N.N. LEBEDEV

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-IV(B) BIO-MATHEMATICS

Programme: M.Sc. **Class:M.Sc.**	**Year: Fifth**	**Semester: 10th**
Subject: Mathematics		
Course Code: B031005T	**Course Title: BIO-MATHEMATICS**	
Credits: 5	**Core Compulsory / Elective**	
Max. Marks: 25+75	**Min. Passing Marks: 33 (With 25 mandatories in External Examination)**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

BIO-MATHEMATICS

Unit	Topics	No. of Lectures
I	MATHEMATICAL ASPECTS OF POPULATION BIOLOGY, SINGLE -SPECIES MODEL (AGE & NONAGE STRUCTURED).	20
II	TWO SPECIES POPULATION MODELS, TWO DIMESIONAL MODELS AND COMPETITION MODELS.	20
III	MATHEMATICAL MODELS IN EPIDEMIOLOGY.	18
IV	BIOLOGICAL FLUID MECHANICS.	17

Suggested Readings-

1. **BIO-MATHEMATICS BY BHUPENDRA SINGH AND NEENU AGGRAWAL**
2. **MATHEMATICAL BIOLOGY BY J.D. MURRAY**
3. **CALCULUS FOR BIOLOGY AND MEDICINE BY CLAUDIA NEUHAUSER**
4. **ESSENTIAL MATHEMATICAL BIOLOGY BY NICOLAS F. BRITTON.**

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. CHEM.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	**Class Tests**	10
2	**Online Quizzes/ Objective Tests**	5
3	**Presentation/** Research Orientation assignment	5
4	**Assignment**	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-IV(C) THEORY OF RELATIVITY

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 10th
Subject: Mathematics		
Course Code: B031006T	Course Title: THEORY OF RELATIVITY	
Credits: 5	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

THEORY OF RELATIVITY

Unit	Topics	No. of Lectures
I	NEWTONIAN AND NON-NEWTONIAN MECHANICS, RELATIVISTIC KINEMATICS.	20
II	GEOMETRICAL REPRESENTATION OF SPACE AND TIME	20
III	RELATIVISTIC MECHANICS	18
IV	THEORY OF ELECTROMAGNETISM	17

Suggested Readings-

1. EINSTEIN'S THEORY OF RELATIVITY BY MAX BORN, 1993.
2. EINSTEIN'S GENERAL THEORY OF RELETIVITY BY OYVIND GRON

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

M.Sc. (MATHS.) (SEMESTER-X) PAPER-IV(D) ADVANCED NUMERICAL ANALYSIS

Programme: M.Sc. Class:M.Sc.	Year: Fifth	Semester: 10th
Subject: Mathematics		
Course Code: B031007T	Course Title: ADVANCED NUMERICAL ANALYSIS	
Credits: 5	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 5-0-0		

ADVANCED NUMERICAL ANALYSIS

Unit	Topics	No. of Lectures
I	NEWTON-RAPHSON METHOD FOR SOLVING NONLINEAR SIMULTANEOUS EQUATIONS WITH TWO AND THREE VARIABLES, MULTIPLE ROOTS OF TRANSCEDENTAL EQUATION.	20
II	CURVE FITTING, CUBIC SPLINES AND APPROXIMATIONS: LEAST SQUARE CURVE FITTING, DATA FITTING WITH CUBIC SPLINE, ECONOMIZATION OF POWER SERIES.	20
III	NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS: JACOBI'S METHOD, GAUSS-SEIDAL METHOD, SUCCESIVE OVER RELAXATION OR SOR-METHOD	18
IV	NUMERICAL SOLUTION OF INTEGRAL EQUATIONS: FINITE DIFFERENCE METHOD, CHEBYSHEV SERIES METHOD, CUBIC SPLINE METHOD, METHOD OF DEGENERATE KERNELS.	17

Suggested Readings-

1. INTRODUCTORY METHOD OF NUMERICAL ANALYSIS BY S.S. SHASTRI
2. NUMERICAL ANALYSIS BY JAIN & IYENGER
3. NUMERICAL ANALYSIS BY ISSACSON ANDH.B. KELLER

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc., MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

RAJA MAHENDRA PRATAP SINGH STATE UNIVERSITY, ALIGARH

Detailed Syllabus For

POST GRADUATE

DEGREE

OF

RESERCH

(P.G.D.R.)

in

MATHEMATICS

PGDR (MATHS.) (SEMESTER-XI) PAPER-I MATHEMATICAL MODELLING

Programme: M.Sc. Class:PGDR	Year: SIXTH	Semester: 11th
Subject: Mathematics		
Course Code: B031101T	Course Title: MATHEMATICAL MODELLING	
Credits: 6	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		

MATHEMATICAL MODELLING

Unit	Topics	No. of Lectures
I	Introduction of mathematical modeling, Classifications of models, Discrete change in financial and biological population systems – Difference equations and discrete dynamical systems, solutions and stability, Stages of modelling.	25
II	Building models, Getting started, Systems analysis, making assumptions, Flow diagrams, choosing mathematical equations, Equations from the literature, Analogies from physics, Data exploration, Solving equations, Analytically, numerically.	25
III	Studying models, Dimensionless form, Asymptotic behavior, Sensitivity analysis, Modelling model output, testing models, Testing the assumptions, Model structure, Prediction of previously unused data, Reasons for prediction errors, estimating model parameters, Comparing two models for the same system.	20
IV	Using models Predictions with estimates of precision, Decision support, Discussion, Description of a model, deciding when to model and when to stop.	20

Suggested Readings-

1. **Giordano, Fox, Horton, A First Course in Mathematical Modeling, 5th edition, Cengage, 2013.**
2. **J.N. KAPOOR, Mathematical Modelling, New Age International (P) Ltd, New Delhi.**

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

PGDR (MATHS.) (SEMESTER-XI) PAPER-II COMPUTER MATHEMATICAL SOFTWARES

Programme: M.Sc. Class:PGDR	Year: SIXTH	Semester: 11th
Subject: Mathematics		
Course Code: B031102T	Course Title: COMPUTER MATHEMATICAL SOFTWARES	
Credits: 6	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		

COMPUTER MATHEMATICAL SOFTWARES

Unit	Topics	No. of Lectures
I	INTRODUCTION TO COMPUTER: Desktop Computer, Desktop Work Stations, Client Server, Application Software, Networking, Different LAN and WAN Connections, UTP, ETHERNET, Network Interface Card, Wi-Fi Internet Based Services, Internet Service Provider, Internet Security, Web Search Engine, Net-Surfing using Advanced Search Techniques.	25
II	DATA ANALYSIS AND DISPLAY: MS-Excel, Facilities in MS-Excel for Data Analysis and Display, Introduction to Software for Scientific and Statistical Analysis (SPSS), Adobe Photoshop (Basic), Multimedia Digital Arts.	25
III	OPERATING SYSTEM: Different Operating System (Windows, Linux, Mac etc.), File Systems (MS-Office- Word, Excel), Power Point Presentation-Creation, Saving, Editing and Printing, LATEX.	20
IV	LANGUAGES AND SOFTWARES: Types and brief of Different Languages (FORTRAN and C), Awareness of Different Software's (MATLAB, ORIGIN, MATERIAL, STUDIO). MATLAB: Introduction, MATLAB Windows, input-Output, General Commands, File Type, Tutorial Lessons, Creating, Saving and Executing a Function File, Interactive Computations, Matrices and Vectors, Simple Programming in MATLAB. SPSS: Basic of SPSS, Creating and Editing of Charts and Data, Modifying Data Values, Sorting and Selecting Data Values, Chi Square and t-Test, Correlation and Regression, Nonparametric Test.	20

Suggested Readings-

1. MATHEMATICAL SOFTWARE TOOLS IN C++ BY MARC DUCAMP
2. THE MATHEMATICA GUIDE BOOK FOR SYMBOLICS BY MICHAEL TROTT
3. MATHEMATICAL SOFTWARES BY ICMC, ELSEVIER.

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

PGDR (MATHS.) (SEMESTER-XI) PAPER-III RESEARCH METHODOLOGY

Programme: M.Sc. Class:PGDR	Year: SIXTH	Semester: 11th
Subject: Mathematics		
Course Code: B031103T	Course Title: RESEARCH METHODOLOGY	
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 (With 25 mandatories in External Examination)	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		

RESEARCH METHODOLOGY

Unit	Topics	No. of Lectures
I	INTRODUCTION TO RESEARCH METHODOLOGY: Meaning of Research, Scientific Thinking, Research Fundamentals and Terminology, Objective of Research, Significance of Research, Criteria of good Research, Basic of selection of the broad areas of Research, Problems encountered by researcher in India.	15
II	IDENTIFUING THE RESEARCH PROBLEM: What is Research Problem, Selection, Formulation, Hypothesis and Techniques involved in defining the Problem, Basic principles of Research Design, Collection, analysis and Conclusion of Data, Different types of Errors and their Elimination and Interpretation. LITERATURE SURVEY: References, Abstraction of Research Paper, Impact Factor and Citation ETHICS: Intellectual Property and Intellectual Property Rights, Indian Patent System, Research Agreement, Ethical Theory and Applications, Problem of Plagiarism and related issues, international norms and Standard.	15
III	INTERPRETATION & REPORT WRITING: Meaning and necessity of Interpretation, Techniques and Precautions, Research papers and Reviews, Significance and layout of Research Report, Different Funding Agencies in India, Basic Knowledge of Organizing Conference, Symposia, Workshops, Exhibition etc.	15
IV	SCIENTIFIC TOOLS AND TECHNIQUES: Role of Mathematics/Computer Science/Statistics in Problem Solving, Nature and Concept of Mathematical/ Statistical Modeling, System Characterization: Think, Plan, Write, Revise.	15

Suggested Readings-

1. **RESEARCH METHODOLOGY BY C.R. KOTHARI.**
2. **RESEARCH DESIGN BY J.W. CRESWELL, 2013.**
3. **QUALITATIVE RESEARCH BY SHARAN MERRIAM, 2009.**

This course can be opted as an elective by the students of following subjects: M.Sc. PHYSICS/ M.Sc. (C.S.)/ M.Sc. CHEM/ MCA/M.STAT.

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment	5

RESEARCH PROJECT

Programme: BoR / M.Sc.	YEAR-1 & YEAR-2
Subject: Mathematics	
Course Title: RESEARCH PROJECT	
Credits: 8	Core Compulsory
Process of Evaluation	i. Each student will choose their project under a Mentor assign by the department during first and third semester and submit it in the end of the year of the course for the purpose of evaluation. ii. Two subject Experts (Internal & External assigned by the University) will evaluate the project in 50 marks each for the purpose of awarding Degree. iii. If both experts award passing marks then Degree will be awarded otherwise project work would be modified.

Programme Outcome:

i. It is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for the same.
ii. It is to develop enhanced quantitative skills and pursuing higher mathematics and research as well.
iii. Students will be able to develop solution-oriented approach towards various issues related to their environment.
iv. Scientific temper in general and mathematical temper in particular will be developed in students.
v. Student should have adequate exposure to many aspects of mathematical sciences.
vi. Student is equipped with mathematical modeling ability, critical mathematical thinking, and problem- solving skills etc.
vii. Student should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management etc

FORMAT OF PROJECT WORK

(i) The Project Work shall be an original piece of work characterized either by enunciation of a new theory or by fresh interpretation of known facts or theories.

(ii) The student shall submit three printed/typed copies of his/her thesis, mentioning the name of the candidate, supervisor etc.

(iii) The typing/printing of Work should be done on both sides of the paper (instead of single side printing) on A-4 size paper in font size "12" in "Times New Roman format".

(iv) The Project Work should be typed in 1 ½ space. But the bibliography/references should be typed in single space.

(v) Project Work will be accompanied separately by a declaration from the candidate countersigned bythe Mentor and Head of the Department in the following format:

Declaration

This is to certify that the material embodied in the present work entitled " ....."is based on my original work. It has not been submitted in part or full for any other diploma or degree of any University.

(Signature of the Candidate with date)

(Countersigned by the Mentor and Head of the Department with date)

Structure of the Project Work

- **Title page.** The title should be informative, contain keywords, and reveal the topic of the Project Work. Include the title, author, supervisor, place, and date.
- **Introduction:** State (1) the purpose of the investigation, (2) the problem being investigated, (3) the background (context and importance) of the problem (4) your project work and general approach.
- **Theory:** Develop the theoretical basis for your design or experimental work, including any governing equations.
- **Materials, Apparatus, and Procedures**: List and describe key materials and apparatus. Then describe the procedure in enough detail that others can duplicate it.
- **Results:** Present the results, usually with accompanying tables and graphs. Characterize the patterns and quality of the results and estimate their accuracy and precision.
- **Discussion:** Discuss the meaning of the results, stating clearly what their significance is. Compare the results with theoretical expectations and account for anything unexpected.
- **Conclusions:** Review the results in relation to the original problem statement. Assess the success of the study in light of the criteria of success you gave in the introduction.
- **Recommendations:** If applicable, recommend directions for future work.
- Be sure to list Acknowledgments, Appendixes, and Bibliography.