GULBARGA UNIVERSITY
KALABURAGI

FACULTY OF SCIENCE & TECHNOLOGY

Syllabus for

MASTER OF SCIENCE
IN
MATHEMATICS
(CBCS SCHEME)

(With effect from Academic Year 2017-18 And Onwards)

DEPARTMENT OF POST-GRADUATE STUDIES & RESEARCH IN MATHEMATICS

FIRST SEMESTER

Code	Paper Title	Marks			Lecture	Tutorial	Practical	Credit Value
		Sem. End	I. A.	Total	Hrs.	Hrs.	Hrs.	
Hard Core Papers								
HCT 1.1	Real Analysis	80	20	100	4	0	0	4
HCT 1.2	Algebra-I	80	20	100	4	0	0	4
HCT 1.3	Ordinary Differential Equations	80	20	100	4	0	0	4
HCT 1.4	Discrete Mathematics	80	20	100	4	0	0	4
HCT 1.5	General Topology	80	20	100	4	0	0	4
Soft Core Course (Any One)								
SCT 1.1	Operations Research	80	20	100	4	0	0	4
SCT 1.2	Fuzzy Sets and Fuzzy Systems	80	20	100	4	0	0	4

Total Number of Credits: 24

SECOND SEMESTER

Code	Paper Title	Marks			Lecture	Tutorial	Practical	Credit Value
		Sem. End	I. A.	Total	Hrs.	Hrs.	Hrs.	
Hard Core Papers								
HCT 2.1	Partial Differential Equations	80	20	100	4	0	0	4
HCT 2.2	Algebra-II	80	20	100	4	0	0	4
HCT 2.3	Programming in C	80	20	100	4	0	0	4
Soft Core Course (Any One)								
SCT 2.1	Complex Analysis	80	20	100	4	0	0	4
SCT 2.2	Fuzzy Logic and Applications	80	20	100	4	0	0	4
Open Elective								
OET 2.1	Operations Research-I	80	20	100	5	1	0	6
Practical								
HCP 2.3	Programming In C	40	10	50	0	0	2	2

Total Number of Credits: 24

M. Sc. Second Semester

Paper : HCT 2.1 Partial Differential Equations	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The course on PDE gives a really comprehensive introduction to all those parts of the theory of PDE that are needed in practical applications of that theory, whether in the physical sciences or in the different branches of engineering. The course is also set out excellently as a body of mathematical analysis of wide general interest. All the essential ideas of the subject are explained with great clarity. We can particularly admire the way in which ideas are first introduced in relatively simple cases and then gradually extended to more complicated cases and to more advanced applications.

1. Partial Differential Equations of First Order: Introduction, Classification of the First Order Partial Differential Equations, Solution of Partial Differential Equations of the First Order, Integral Surfaces Passing Through a Given Curve, Surfaces Orthogonal to a given System of Surfaces, Geometrical Proof of Lagrange's Differential Equation, Nonlinear Partial Differential Equations of the First Order, Compatible Systems of First Order Equations, Condition of Compatibility: Particular Case; Examples, Jacobi's Method; Examples, The method of characteristics for Semi linear, Quasilinear equations. (20 Hours)

2. Partial Differential Equations of the Second Order : Introduction, The Origin of Second Order Equations, Classification of Partial Differential Equations, Partial Differential Equation of Second Order with Variable Coefficients and its Different Types. (10Hours)

3. Wave, Laplace and Diffusion Equations: Introduction, One – dimensional Wave Equation in Rectangular Co-ordinates, Two - dimensional Wave Equation in Rectangular Co-ordinates, Laplace's Equation in Rectangular Co-ordinates, Diffusion Equation, Solution of a Linear Partial Differential Equation by Separation of Variables, Solution of One – dimensional Wave Equation by Separation of Variables, Solution of Two – dimensional Wave Equation by Separation of Variables, Solution of Two – dimensional Laplace's Equation by Separation of Variables in Rectangular Co-ordinates, Solution of the Diffusion Equation in Rectangular Co-ordinates. (14 Hours)

4. Reduction of Second Order Partial Differential Equation into its Canonical (or Normal) Form : Introduction, Classification of Linear Partial Differential Equation of Second Order in two Independent Variables, Reduction of Canonical (or Normal) Forms by Laplace Transformation, Working Method for Reducing a Hyperbolic Equation to its Canonical Form, Working Method for Reducing a Parabolic Equation to its Canonical Form, Working Method for Reducing a Elliptic Equation to its Canonical Form. (10 Hours)

5. Non – Linear Partial Differential Equations of Second Order: Introduction, Monge's Method of Integrating $Rr + Ss + Tt = V$, Working Method of the Equation $Rr + Ss + Tt = V$, Monge's Method of Integrating $Rr + Ss + Tt + U(rt - s^2) = V$, Working Method of the Equation $Rr + Ss + Tt + U(rt - s^2) =$

V , when the roots of the quadratic are identical , Working Method of the Equation Rr +Ss + Tt + U (rt – s^2) = V , when the roots are distinct. (10 Hours)

References:

1. Sneddon: Elements of PDE's, McGraw Hill Book Company Inc., (2006).
2. L. Debnath: Nonlinear PDE's for Scientists and Engineers, Birkhauser, Boston, (2007).
3. F. John: Partial Differential Equations, Springer, (1971)
4. A. K. Bhargava and A. B. Chandramouli: Differential Equations , Pragati Prakashan, Educational Publishers , (2012).
5. M. D. Raisinghania: Ordinary and Partial Differential Equations, S. Chand and Company Ltd., New Delhi, (2011).
6. F. Treves: Basic Linear Partial Differential Equations, Academic Press, (1975).
7. M. G. Smith: Introduction to the Theory of Partial Differential Equations, Van Nostrand, (1967)
8. Shankar Rao: Partial Differential Equations, PHI, (2006).

Paper : HCT 2.2 Algebra - II	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The main goal of classical algebra was to use algebraic manipulation to solve polynomial equations in one variable of degree at most four. It also developed methods for dealing with linear equations containing several variables, but little was known about the solution of non linear equations. The most useful mathematical tool in science, engineering and the social science is the method of solution of a system of linear equations together. All its allied Linear algebra.

1. Linear Algebra: Linear transformation, algebra of linear transformations, characteristics roots, interpretation in terms of matrices. (15 Hours)

2. Canonical Form: Triangular, Nilpotent, Jordan and rational, trace, transpose and the determinant of linear transformations. (10 Hours)

3. Functionals and Dual Spaces: inner product spaces, orthogonal sets, Hermitian, Unitary and normal transformation, bilinear, quadratic and Hermitian forms. (15 Hours)

4. Number Theory: Linear Diophantine equation, quadratic congruence's. (12 Hours)

5. Quadratic Residues: Sum of two squares, sum of more than two squares, Tau and sigma functions, Fibonacci sequence, finite continued fractions. (12 Hours)

References:

1. I. N. Herstein: Topics in Algebra, 2nd Ed. , Wiley Eastern Ltd. , New York, (1998).
2. S. Lang: Linear Algebra, Addison Wesley, (1972).
3. T. M. Apostol : Introduction to Analytic Number Theory, Springer Verlag, New York.
4. David M. Burton: Elementary Number Theory, 2 Ed. , Universal Book Stall 5, Ansari Road, New Delhi-110002.

Paper : HCT 2.3 Programming in C	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble : This paper introduces computer programming to a beginner using the programming language C. The version of C used is the one standardized by the American National Standards Institute (ANSI C). C has rapidly gained users due to its efficiency, rich data structure, variety of operators and affinity to UNIX operating system. C is a difficult language to learn if it is not methodically approached. Our attempt has been to introduce the basic aspects of C to enable the student to quickly start writing C programs.

1. Introduction: Introduction to Computers, Characteristics of Computers, Application Areas of Computer, Classification of Computers, Overview of Programming, Types of Programming Languages, Introduction to C , Features of C, Program Structure, Concept of Header File, Preprocessor, Character Set, Identifiers, Reserved Words, Constants and Variables, Data Type, Modifiers, Types of Statements, Declaration and Initialization, Comments. (12 Hours)

2. Type of I/O Statements: Formatted and Unformatted I/O Statements, Escape Sequences and Format Specifies. Types of Operators (unary, binary and ternary), Classification of Operators: Assignment, Arithmetic, Relational, Logical, Comma Operator, Size of Operator, Operator, Hierarchy and Associatively, Type Conversion (explicit and implicit), Library Functions. (16 Hours)

3. Control Statements: If, If Else, Switch Statements, Looping Statement (for, while, do while), Nested Loops, Infinite Looping, Break and Continue. (12 Hours)

4. Classification of Arrays: One, Two and Multidimensional Arrays, Function Definition, Arguments and Parameters, Category of Functions, Arrays iv Functions, Local and Global Variables, Static and Register Variables, Function Declaration, Parameter Passing Mechanisms, Recursion. (12 Hours)

5. Strings: Declaring and Initializing String Variables, Reading and Writing Strings, Two-Dimensional array of Characters, String Handling Functions, Implementation of String Functions. Pointer Declaration, Pointer Dereferencing, Operations on Pointers, Pointer Initialization, Pointers and Functions, Pointers and Arrays. (12 Hours)

References:

1. Brian W. Kernighan, Dennis M. Ritichie: The C Programming Language (2nd Ed.).
2. Peter Darnell and P. E. Marglis: C- Software Engineering Approach, Narosa Publication, New Delhi, (1993).
3. M. T. Somashekar: Programming in C, PHI, New Delhi, (2006).
4. Balguruswamy: Programming in ANSI C.
5. Yeshwant Kanetkar: Let US C.

Paper : SCT 2.1 Complex Analysis	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The study of complex analysis is beautiful from a mathematical point of view and it provides a powerful tool for solving several problems arising in real applications. Mathematicians, scientists and engineers often resort to the "complex plane" while explaining the real phenomena. Using complex analysis one can solve many problems that are either very difficult to solve or impossible to solve by other means. The present syllabus is designed for the post graduate students to understand the basic concepts of complex analysis and also to equip them with complex analysis tools to find the solutions of complex problems.

1. Analytic Function: (Recapitulation) Functions of Complex Variables, Mappings, Limits, Continuity, Derivatives,.C-.R.Equations,.Analytic. Functions. (5 Hours)

2. Complex Integration: Complex Valued Functions, Contours, Contour Integrals, Cauchy – Gourat Theorem, Cauchy integral Formula, Morera's Theorem, Louville's Theorem, Fundamental Theorem of Algebra. (15 Hours)

3. Power Series : Congruence of Sequences and Series, Power Series and Analytic Functions, Taylor Series, Laurent's Series, Absolute and Uniform Convergence, Integration and Differentiation of Power Series, Uniqueness of Series Representation, Zeros of an Analytic Function, Classification of Singularities. (14 Hours)

4. Residues and Poles : Residues, Cauchy Residue Theorem, Residue at Poles, Evaluation of Improper Integrals, Evaluation of Definite Integrals, The Argument Principle, Rouche's Theorem, Schwartz Lemma, Maximum Modules Principle. (15 Hours)

5. Spaces of Analytic Functions, Spaces of Meromorphic Functions, The Riemann Mapping Theorem, Weierstrass Factorization Theorem, Schwartz Reflection Principle. (15 Hours)

References:

1. R. V. Churchill, J. W. Brown: Complex Variables and Applications, 5th Ed., McGraw Hill Series.
2. B. Choudary: The Elements of Complex Analysis, 2nd Ed. , Wiley Eastern Ltd.

3. L. V. Alfors: Complex Analysis, McGraw Hill , Kogakusha , (1979).

4. J. S. Conway: Functions of One Complex Variable, Springer Verlag , New York, (1973).

5. R. V. Churchill, J. W. Brown and R. F. Verhey: Complex Variables and Applications, 3rd Ed., McGraw Hill, Kogakusha , (1968).

6. Ian Stewart and David Tall: Complex Analysis, Cambridge University Press,1Ed., (1963).

Paper : SCT 2.2 Fuzzy Logic and Applications	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Fuzzy logic has wide ranging applications in science and engineering. The goal of this paper is to introduce fuzzy logic and its applications to post graduate students in Mathematics so that they can develop a reasonably in-depth understanding of the principle and the practice of technology as well as a working of how to use the technology themselves.

1. Fuzzy Relations: Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy ordering relations, Fuzzy morphisms, Sup-I compositions of fuzzy relations, Inf- w_i compositions of Fuzzy relations. (14 Hours)

2. Fuzzy Relation Equations: Introduction, Problem partitioning, Solution method, Fuzzy relation equations based on Sup-I compositions and Inf- w_i compositions, approximate solutions. (10 Hours)

3. Fuzzy Logic: Classical logic an overview, multi valued logics, Fuzzy propositions, Fuzzy quantifiers, Linguistic hedges, inferences from conditional fuzzy propositions and qualified propositions and quantified propositions. (20 Hours)

4. Applications of Fuzzy Sets and Logic: Signal processing, image processing, hand written character recognition and visual image recognition, Communications systems, intelligent controller. other applications. (20 Hours)

References:

1. Groge J. Klor. and Yuan, Fuzzy sets and Fuzzy logic, Theory and Applications. PHI.

2. Georgo J. Klir and Tina A Fotger , Fuzzy sets uncertainty and information, PHI (1994).

3. Kaufmann, A,. Introduction to the theory of Fuzzy subsets-vol. Academic press (1975).

4. Driankov D, and others. An Introduction to Fuzzy control.

5. B. Kosko & others, Fuzzy logic with Engineering Applications. PHI

Paper : OET 2.1 Operations Research -I	
Teaching Hours: 5 Hrs/Week **Tutorial Hours:** 1Hr/Week	**Credits :** 06
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The subject of *Operations Research* has being growing theoretically and has a wide ranging applications in the field of life namely engineering, business, management, economics and medical sciences etc. In view of this, a course of Operations Research is introduced to the students of Science as a job-oriented course. The main aim of this paper is to introduce the fundamentals of operations research and its techniques used in different fields of interest and greater use of these tools in planning, scheduling, cost and job control for the efficient and economical conduct of industrial Endeavour

1. Linear Programming: Basic Concepts, Convex Sets, Open and Closed Half Spaces, Simplex, Formulation of Linear Problem (LPP), Feasible Solution, Basic Feasible Solution, Optimal Solution, Graphical Method, Simplex Method. (16Hours)

2. Transportation Problem (TP): Mathematical Formulation, Existence of Feasible Solutions, Transportation Table, Initial Basic Feasible Solution ; North-West Corner Rule, Row Minima Method , Column Minima Method , Matrix Minima Method, Vogel's Approximation Method (VAM). Transportation Algorithm, Degeneracy in TP, Unbalanced TP. (16 Hours)

3. Assignment Problem: Mathematical Formulation, Assignment Algorithm, Routing Problem, Traveling Salesman Problem. (12 Hours)

4. Networks: Network Minimization, Shortest Route Problem, Shortest Route Algorithms for Acyclic Networks, Maximal Flow Problem, Linear Programming Representation of Networks. (12 Hours)

5. Integer Programming: Methods of Integer Programming Problems; Cutting Method, Search Method, Gromory's Fractional Cut Algorithm Mixed Integer Programming Problem, Branch and Bound Methods. (08 Hours)

References:

1. Hamdy A. Taha: Operations Research, MacMillan, (1989).
2. Kanti Swarup, P. K. Gupta and Manmohan: Operations Research, S. Chand & Sons, (1980).
3. S. Kalavathy: Operations Research, Vikas, (2001).
4. S. D. Sharma: Operations Research.
5. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, (1987).

Paper : HCP 2.3 Programming in C	
Teaching Hours: 2 Hrs/Week	**Credits :** 02
Maximum Marks: 50 (SEE-40 + IA-10)	

List of Experiments

1. Dos Commands.
2. Windows Commands.
3. Finding Smallest and Largest of Three Numbers.
4. Searching for the Smallest in a List.
5. Sorting a List of Integers in Ascending / Descending Order.
6. Finding the Roots of Quadratic Equation.
7. Difference Table.
8. Interpolation.
9. Finding whether a year is leap year or not?To find whether a number is positive, negative or zero.
10. Matrix Multiplication.

M. Sc. Third Semester

Paper : HCT 3.1 Functional Analysis	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	