MAHARSHI DAYANAND UNIVERSITY, ROHTAK
DEPARTMENT OF MATHEMATICS

Scheme of Examination-Semester System
for
M.Sc. Mathematics with Computer Science(Semester-I & II)

(*w.e.f. Session 2014-15*)

SEMESTER-I

Paper No.	Title of the Paper	Hours/ week	Internal Assess-ment	Theory	Practi-cals	Total
12MMCS-101	Advanced Abstract Algebra-I	4	20	80	-	100
12MMCS-102	Real Analysis-I	4	20	80	-	100
12MMCS-103	Topology-I	4	20	80	-	100
12MMCS-104	Integral Equations and Calculus of Variations	4	20	80	-	100
12MMCS-105	Programming in C (ANSI Features)	4	20	80	-	100
12MMCS-106	Operating Systems and UNIX	4	20	80	-	100
12MMCS-107	Practicals	4 hours per week per student in a group of 15 students	20	-	80	100

Note 1: The marks of internal assessment of each paper shall be splited as under :

A) One class test of 10 marks. The class test will be held in the middle of the semester.

B) Assignment & Presentation : 5 marks

C) Attendance : 5 marks

65% but upto 75% : 1 marks

More than 75% but upto 85% : 2 marks

More than 85% but upto 90% : 3 marks

More than 90% but upto 95% : 4 marks

Above 95% : 5 marks

Note 2: The syllabus of each paper will be divided into **four** units of **two** questions each. The question paper will consist of **five** units. Each of the first four units will contain two questions and the students shall be asked to attempt **one** question from each unit. Unit five of each question paper shall contain **eight to ten** short answer type questions without any internal choice and it shall be covering the entire syllabus. As such unit five shall be **compulsory**.

Note 3: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorial classes shall be held for each theory paper in groups of 8 students for half-hour per week.

Syllabus- 1st SEMESTER

12MMCS 101 : Advanced Abstract Algebra-I

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Groups : Zassenhaus lemma, Normal and subnormal series, Composition series, Jordan-Holder theorem, Solvable series, Derived series, Solvable groups, Solvability of S_n – the symmetric group of degree $n \geq 2$.

Unit - II (2 Questions)

Nilpotent group: Central series, Nilpotent groups and their properties, Equivalent conditions for a finite group to be nilpotent, Upper and lower central series, Sylow-p sub groups, Sylow theorems with simple applications. Description of group of order p^2 and pq, where p and q are distinct primes(In general survey of groups upto order 15).

Unit - III (2 Questions)

Field theory, Extension of fields, algebraic and transcendental extensions. Splitting fields, Separable and inseparable extensions, Algebraically closed fields, Perfect fields.

Unit - IV (2 Questions)

Finite fields, Automorphism of extensions, Fixed fields, Galois extensions, Normal extensions and their properties, Fundamental theorem of Galois theory, Insolvability of the general polynomial of degree $n \geq 5$ by radicals.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. I.N.Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition, 1997.
3. P.M. Cohn, Algebra, Vols. I, II & III, John Wiley & Sons, 1982, 1989, 1991.
4. N. Jacobson, Basic Algebra, Vol. I & II, W.H Freeman, 1980 (also published by Hindustan Publishing Company).
5. S. Lang, Algebra, 3rd Editioin, Addison-Wesley, 1993.

6. I.S. Luther and I.B.S.Passi, Algebra, Vol. I-Groups, Vol. II-Rings, Narosa Publishing House (Vol. I – 1996, Vol. II –1990).
7. D.S. Malik, J.N. Mordenson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw Hill, International Edition, 1997.
8. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.

12MMCS 102 : Real Analysis -I

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Riemann-Stieltjes integral, its existence and properties, Integration and differentiation, The fundamental theorem of calculus, Integration of vector-valued functions, Rectifiable curves.

Unit - II (2 Questions)

Set functions, Intuitive idea of measure, Elementary properties of measure, Measurable sets and their fundamental properties. Lebesgue measure of a set of real numbers, Algebra of measurable sets, Borel set, Equivalent formulation of measurable sets in terms of open, Closed, F_σ and G_δ sets, Non measurable sets.

Unit - III (2 Questions)

Measurable functions and their equivalent formulations. Properties of measurable functions. Approximation of a measurable function by a sequence of simple functions, Measurable functions as nearly continuous functions, Egoroff's theorem, Lusin's theorem, Convergence in measure and F. Riesz theorem. Almost uniform convergence.

Unit - IV (2 Questions)

Shortcomings of Riemann Integral, Lebesgue Integral of a bounded function over a set of finite measure and its properties. Lebesgue integral as a generalization of Riemann integral, Bounded convergence theorem, Lebesgue theorem regarding points of discontinuities of Riemann integrable functions, Integral of non-negative functions, Fatou's Lemma, Monotone convergence theorem, General Lebesgue Integral, Lebesgue convergence theorem.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Walter Rudin, Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International Student Edition.
2. H.L. Royden, Real Analysis, Macmillan Pub. Co., Inc. 4th Edition, New York, 1993.
3. P. K. Jain and V. P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published, New Delhi, 1986.
4. G.De Barra, Measure Theory and Integration, Wiley Eastern Ltd., 1981.
5. R.R. Goldberg, Methods of Real Analysis, Oxford & IBH Pub. Co. Pvt. Ltd.
6. R. G. Bartle, The Elements of Real Analysis, Wiley International Edition.

12MMCS 103 : Topology - I

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Statements only of (Axiom of choice, Zorn's lemma, Well ordering theorem and Continnum hypothesis).

Definition and examples of topological spaces, Neighbourhoods, Interior point and interior of a set , Closed set as a complement of an open set , Adherent point and limit point of a set, Closure of a set, Derived set, Properties of Closure operator, Boundary of a set , Dense subsets, Interior, Exterior and boundary operators.

Base and subbase for a topology, Neighbourhood system of a point and its properties, Base for Neighbourhood system.

Relative(Induced) topology, Alternative methods of defining a topology in terms of neighbourhood system and Kuratowski closure operator.

Comparison of topologies on a set, Intersection and union of topologies on a set.

Unit - II (2 Questions)

Continuous functions, Open and closed functions , Homeomorphism.

Tychonoff product topology, Projection maps, Characterization of Product topology as smallest topology, Continuity of a function from a space into a product of spaces.

Connectedness and its characterization, Connected subsets and their properties, Continuity and connectedness, Connectedness and product spaces, Components, Locally connected spaces, Locally connected and product spaces.

Unit - III (2 Questions)

First countable, second countable and separable spaces, hereditary and topological property, Countability of a collection of disjoint open sets in separable and second countable spaces, Product space as first axiom space, Lindelof theorem. T_0, T_1, T_2 (Hausdorff) separation axioms, their characterization and basic properties.

Unit - IV (2 Questions)

Compact spaces and subsets, Compactness in terms of finite intersection property, Continuity and compact sets, Basic properties of compactness, Closedness of compact subset and a continuous map from a compact space into a Hausdorff and its consequence. Sequentially and countably compact sets, Local compactness, Compactness and product space, Tychonoff product theorem and one point compactification. Quotient topology, Continuity of function with domain- a space having quotient topology, Hausdorffness of quotient space.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.
2. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd.
3. J. L. Kelly, General Topology, Affiliated East West Press Pvt. Ltd., New Delhi.
4. J. R. Munkres, Toplogy, Pearson Education Asia, 2002.
5. W.J. Pervin, Foundations of General Topology, Academic Press Inc. New York, 1964.

12MMCS 104 : Integral Equations and Calculus of Variations

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Linear integral equations, Some basic identities, Initial value problems reduced to Volterra integral equations, Methods of successive substitution and successive approximation to solve Volterra integral equations of second kind, Iterated kernels and Neumann series for Volterra equations. Resolvent kernel as a series in λ, Laplace transform method for a difference kernel, Solution of a Volterra integral equation of the first kind.

Unit - II (2 Questions)

Boundary value problems reduced to Fredholm integral equations, Methods of successive approximation and successive substitution to solve Fredholm equations of second kind, Iterated kernels and Neumann series for Fredholm equations. Resolvent kernel as a sum of series. Fredholm resolvent kernel as a ratio of two series. Fredholm equations with separable kernels, Approximation of a kernel by a separable kernel, Fredholm Alternative, Non homogenous Fredholm equations with degenerate kernels.

Unit - III (2 Questions)

Green's function, Use of method of variation of parameters to construct the Green's function for a nonhomogeneous linear second order boundary value problem, Basic four properties of the Green's function, Orthogonal series representation of Green's function, Alternate procedure for construction of the Green's function by using its basic four properties. Reduction of a boundary value problem to a Fredholm integral equation with kernel as Green's function. Hilbert-Schmidt theory for symmetric kernels.

Unit - IV (2 Questions)

Motivating problems of calculus of variations, Shortest distance, Minimum surface of revolution, Branchistochrone problem, Isoperimetric problem,
Geodesic. Fundamental lemma of calculus of variations, Euler's equation for one dependant function and its generalization to 'n' dependant functions and to higher

order derivatives, Conditional extremum under geometric constraints and under integral constraints.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Jerri, A.J., Introduction to Integral Equations with Applications, A Wiley-Interscience Pub.
2. Kanwal, R.P., Linear Integral Equations, Theory and Techniques, Academic Press, New York.
3. Gelfand, J.M. and Fomin, S.V., Calculus of Variations, Prentice Hall, New Jersy, 1963.
4. Weinstock , Calculus of Variations, McGraw Hall.
5. Abdul-Majid wazwaz, A first course in Integral Equations, World Scientific Pub.
6. David, P. and David, S.G. Stirling, Integral Equations, Cambridge University Press.
7. Tricomi, F.G., Integral Equations, Dover Pub., New York.

12MMCS 105 : Programming in C (ANSI Features)

Max. Marks : 60
Time : 3 hours

Unit - I (2 Questions)

An overview of Programming, Programming Language, Classification. Basic structure of a C Program, C language preliminaries.

Operators and Expressions, Two's compliment notation, Bit - Manipulation Operators, Bitwise Assignment Operators, Memory Operators.

Unit - II (2 Questions)

Arrays and Pointers, Encryption and Decryption. Pointer Arithmetic, Passing Pointers as Function Arguments, Accessing Array Elements through Pointers, Passing Arrays as Function Arguments. Multidimensional Arrays. Arrays of Pointers, Pointers to Pointers.

Unit - III (2 Questions)

Storage Classes –Fixed vs. Automatic Duration. Scope. Global Variables. Definitions and Allusions. The register Specifier. ANSI rules for the Syntax and Semantics of the Storage-Class Keywords. Dynamic Memory Allocation.

Structures and Unions. *enum* declarations. Passing Arguments to a Function, Declarations and Calls, Automatic Argument Conversions, Prototyping. Pointers to Functions.

Unit - IV (2 Questions)

The C Preprocessors, Macro Substitution. Include Facility. Conditional Compilation. Line Control.

Input and Output -Streams. Buffering. Error Handling. Opening and Closing a File. Reading and Writing Data. Selecting an I/O Method. Unbuffered I/O. Random Access. The Standard Library for I/O.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Peter A. Darnell and Philip E. Margolis, C : A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Samuel P. Harkison and Gly L. Steele Jr., C : A Reference Manual, Second Edition, Prentice Hall, 1984.
3. Brian W. Kernighan & Dennis M. Ritchie, The C Programme Language, Second Edition (ANSI features) , Prentice Hall 1989.
4. Balagurusamy E : Programming in ANSI C, Third Edition, Tata McGraw-Hill Publishing Co. Ltd.
5. Byron, S. Gottfried : Theory and Problems of Programming with C, Second Edition (Schaum's Outline Series), Tata McGraw-Hill Publishing Co. Ltd.
6. Venugopal K. R. and Prasad S. R.: Programming with C , Tata McGraw-Hill Publishing Co. Ltd.

12MMCS-106 : Operating System and Unix

Max Marks : 80
Time : 3 Hours

Unit I (2 Questions)

Operating systems overview : Operating systems as an extended machine and resource manager, Operating systems classification; Operating systems and system calls; Operating systems architecture.

Process management functions : Process model, Hierarchies and implementation; Process states and transitions; Multi-programming, Multi-tasking, Multi-threading; Level of schedulers and scheduling algorithms.

Unit II (2 Questions)

Memory management function : Memory management of single user operating systems partition, Swapping, Paging, Segmentation, Virtual memory.

Device management function : I/O devices and controllers, Interrupt handlers, Device independent I/O software, User-space I/O software.

Unit III (2 Questions)

File management functions: File naming structure, Types, Access mechanisms, Attributes and operations, Hierarchical directory systems, Directory structures and directory operations, File space allocations, File sharing, File locking, Symbolic links, File protection and security.

Current programming : Sequential and concurrent process, Bernsteins condition; Time-dependency and critical code unit, Mutual exclusion problem, Classical process co-ordination problems, Deadlock handling, Inter-process communication.

Unit IV (2 Questions)

UNIX Operating System: Overview of UNIX operating system. Implementation of basic functions and commands in UNIX operating system.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer

type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Milan Milankovic, Operating System, McGraw Hill.
2. Peterson and Solserchatz, Operating System Concepts, Addison Wesley.
3. Achyut S. Godbole, Operating System, Tata McGraw Hill.
4. H.M.I. Deitel, An Introduction to Operating Systems, Addison Wesley.
5. Ritchie. Operating System, BPB Publication.
6. Steven, Advanced Programming in UNIX Environment, Addison Wesley.

12MMCS-107 : Practicals

Max. Marks : 80
Time 4 hours

The practical examination will be based upon Papers 12MMCS-105 and 12MMCS-106.

i) Viva-voce and practical record : 30 marks

ii) Written practical work : 50 marks

The examiner shall set a question paper consisting of **four** questions and the students will be required to attempt any **two** questions. They will write these programs in Answer-books, run the same on computers and take printouts.

SEMESTER-II

Paper No.	Title of the Paper	Hours/ week	Internal Assess-ment	Theory	Practi-cals	Total
12MMCS-201	Advanced Abstract Algebra-II	4	20	80	-	100
12MMCS-202	Real Analysis-II	4	20	80	-	100
12MMCS-203	Topology-II	4	20	80	-	100
12MMCS-204	Ordinary Differential Equations	4	20	80	-	100
12MMCS-205	Data and File Structure	4	20	80	-	100
12MMCS-206	Data Communication, Networking and Internet	4	20	80	-	100
12MMCS-207	Practicals	4 hours per week per student in a group of 15 students	20	-	80	100

Note 1: The marks of internal assessment of each paper shall be split as under :

A) One class test of 10 marks. The class test will be held in the middle of the semester.

B) Assignment & Presentation : 5 marks

C) Attendance : 5 marks

65% but upto 75% : 1 marks

More than 75% but upto 85% : 2 marks

More than 85% but upto 90% : 3 marks

More than 90% but upto 95% : 4 marks

Above 95% : 5 marks

Note 2: The syllabus of each paper will be divided into **four** units of **two** questions each. The question paper will consist of **five** units. Each of the first four units will contain two questions and the students shall be asked to attempt **one** question from each unit. Unit five of each question paper shall contain **eight to ten** short answer type questions without any internal choice and it shall be covering the entire syllabus. As such unit five shall be **compulsory**.

Note 3: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorial classes shall be held for each theory paper in groups of 8 students for half-hour per week.

Syllabus– 2nd SEMESTER

12MMCS 201 : Advanced Abstract Algebra-II

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Cyclic modules, Simple and semi-simple modules, Schur's lemma, Free modules, Fundamental structure theorem of finitely generated modules over principal ideal domain and its applications to finitely generated abelian groups.

Unit - II (2 Questions)

Neotherian and Artinian modules and rings with simple properties and examples, Nil and Nilpotent ideals in Neotherian and Artinian rings, Hilbert Basis theorem.

Unit - III (2 Questions)

$Hom_R(R,R)$, Opposite rings, Wedderburn – Artin theorem, Maschk's theorem, Equivalent statement for left Artinian rings having non-zero nilpotent ideals, Uniform modules, Primary modules and Neother- Lasker theorem.

Unit - IV (2 Questions)

Canonical forms : Similarity of linear transformations, Invariant subspaces, Reduction to triangular form, Nilpotent transformations, Index of nilpotency, Invariants of nilpotent transformations, The primary decomposition theorem, Rational canonical forms, Jordan blocks and Jordan forms.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be compulsory.

Books Recommended :

1. I.N.Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition, 1997.
3. M. Artin, Algebra, Prentice-Hall of India, 1991.
4. P.M. Cohn, Algebra, Vols. I, II & III, John Wiley & Sons, 1982, 1989, 1991.

5. I.S. Luther and I.B.S.Passi, Algebra, Vol. I-Groups, Vol. II-Rings, Narosa Publishing House (Vol. I – 1996, Vol. II –1990).
6. D.S. Malik, J.N. Mordenson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw Hill, International Edition, 1997.
7. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt., New Dlehi, 2000.
8. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
9. T.Y Lam, Lectures on Modules and Rings, GTM Vol. 189, Springer-Verlag, 1999.

12MMCS 202 : Real Analysis -II

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Rearrangements of terms of a series, Riemann's theorem. Sequence and series of functions, Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weirstrass's M test, Abel's and Dirichlet's tests for uniform convergence, Uniform convergence and continuity, Uniform convergence and differentiation, Weierstrass approximation theorem.

Unit - II (2 Questions)

Power series, its uniform convergence and uniqueness theorem, Abel's theorem, Tauber's theorem.

Functions of several variables, Linear Transformations, Euclidean space R^n, Open balls and open sets in R^n, Derivatives in an open subset of R^n, Chain Rule, Partial derivatives, Continuously Differentiable Mapping, Young's and Schwarz's theorems.

Unit - III (2 Questions)

Taylor's theorem. Higher order differentials, Explicit and implicit functions. Implicit function theorem, Inverse function theorem. Change of variables, Extreme values of explicit functions, Stationary values of implicit functions. Lagrange's multipliers method. Jacobian and its properties, Differential forms, Stoke's Theorem.

Unit - IV (2 Questions)

Vitali's covering lemma, Differentiation of monotonic functions, Function of bounded variation and its representation as difference of monotonic functions, Differentiation of indefinite integral, Fundamental theorem of calculus, Absolutely continuous functions and their properties.

L^p spaces, Convex functions, Jensen's inequalities, Measure space, Generalized Fatou's lemma, Measure and outer measure, Extension of a measure, Caratheodory extension theorem.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Limited, New Delhi.
2. T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi.
3. H.L. Royden, Real Analysis, Macmillan Pub. Co., Inc. 4th Edition, New York, 1993.
4. G. De Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
5. R.R. Goldberg, Methods of Real Analysis, Oxford & IBH Pub. Co. Pvt. Ltd.
6. R. G. Bartle, The Elements of Real Analysis, Wiley International Edition.

12MMCS 203 : Topology -II

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Regular, Normal, T_3 and T_4 separation axioms, their characterization and basic properties, Urysohn's lemma and Tietze extension theorem, Regularity and normality of a compact Hausdorff space, Complete regularity, Complete normality, $T_{3\frac{1}{2}}$ and T_5 spaces, their characterization and basic properties.

Unit - II (2 Questions)

Nets : Nets in topological spaces, Convergence of nets, Hausdorffness and nets, Subnet and cluster points, Compactness and nets,

Filters : Definition and examples, Collection of all filters on a set as a poset, Finer filter, Methods of generating filters and finer filters, ultra filter and its characterizations, Ultra filter principle, Image of filter under a function, Limit point and limit of a filter, Continuity in terms of convergence of filters, Hausdorffness and filters, Convergence of filter in a product space, Compactness and filter convergence, Canonical way of converting nets to filters and vice versa, Stone-Cech compactification.

Unit - III (2 Questions)

Covering of a space, Local finiteness, Paracompact spaces, Michaell theorem on characterization of paracompactness in regular spaces, Paracompactness as normal space, A. H. Stone theorem, Nagata- Smirnov Metrization theorem.

Unit - IV (2 Questions)

Embedding and metrization : Embedding lemma and Tychonoff embedding theorem, Metrizable spaces, Urysohn's metrization theorem.

Homotopy and Equivalence of paths, Fundamental groups, Simply connected spaces, Covering spaces, Fundamental group of circle and fundamental theorem of algebra.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.
2. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd.
3. J. L. Kelly, General Topology, Springer Verlag, New York, 1991.
4. J. R. Munkres, Toplogy, Pearson Education Asia, 2002.
5. W.J. Pervin, Foundations of General Topology, Academic Press Inc. New York, 1964.

12MMCS 204 : Ordinary Differential Equations

Max. Marks : 80
Time : 3 hours

Unit - I (2 Questions)

Preliminaries : Initial value problem and equivalent integral equation.

ε-approximate solution, Cauchy-Euler construction of an ε-approximate solution, Equicontinuous family of functions, Ascoli-Arzela lemma, Cauchy-Peano existence theorem.

Uniqueness of solutions, Lipschitz condition, Picard-Lindelof existence and uniqueness theorem for $\frac{dy}{dt}$ = f(t,y), Dependence of solutions on initial conditions and parameters, Solution of initial-value problems by Picard method.

Unit - II (2 Questions)

Sturm-Liouville BVPs, Sturms separation and comparison theorems, Lagrange's identity and Green's formula for second order differential equations, Properties of eigenvalues and eigenfunctions, Pruffer transformation, Adjoint systems, Self-adjoint equations of second order.

Linear systems, Matrix method for homogeneous first order system of linear differential equations, Fundamental set and fundamental matrix, Wronskian of a system, Method of variation of constants for a nonhomogeneous system with constant coefficients, nth order differential equation equivalent to a first order system.

Unit - III (2 Questions)

Nonlinear differential system, Plane autonomous systems and critical points, Classification of critical points – rotation points, foci, nodes, saddle points. Stability, Asymptotical stability and unstability of critical points,

Unit - IV (2 Questions)

Almost linear systems, Liapunov function and Liapunov's method to determine stability for nonlinear systems, Periodic solutions and Floquet theory for periodic systems, Limit cycles, Bendixson non-existence theorem, Poincare-Bendixson theorem (Statement only), Index of a critical point.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Coddington, E.A. and Levinson, N.,, Theory of Ordinary Differential Equations, Tata McGraw Hill, 2000.
2. Ross, S.L., Differential Equations, John Wiley and Sons Inc., New York, 1984.
3. Deo, S.G., Lakshmikantham, V. and Raghavendra, V., Textbook of Ordinary Differential Equations, Tata McGraw Hill, 2006.
4. Boyce, W.E. and Diprima, R.C., Elementary Differential Equations and Boundary Value Problems, John Wiley and Sons, Inc., New York, 1986, 4th edition.
5. Goldberg, J. and Potter, M.C., Differential Equations – A System Approach, Prentice Hall, 1998
6. Simmons, G.F., Differential Equations, Tata McGraw Hill, New Delhi, 1993.
7. Hartman, P., Ordinary Differential Equations, John Wiley & Sons, 1978.
8. Somsundram, D., Ordinary Differential Equations, A First Course, Narosa Pub. Co., 2001.

12MMCS-205 : Data and File Structure

Max. Marks : 80
Time : 3 hours

Unit I (2 Questions)

Linear data structure. Arrays, Multi-dimensional arrays, Sequential allocation, Address calculations, Sparse arrays and its applications.

Linked lists: Simple Lists, Circular lists, Doubly linked lists.

Unit II (2 Questions)

Stacks, Operations on stacks, Applications of stacks.

Queues, Operations on queue. Applications of queue, Circular queue, Deque, Priority queue.

Unit III (2 Questions)

Trees : Tree terminology, Binary tree, Memory representation of binary tree, Tree traversal algorithms, Binary search tree(BST), AVL tree, Threaded tree, B-Tree and B+ tree.

Graph : Graph terminology, Representation of graphs, Graph traversal, Weighted graph

Unit IV (2 Questions)

File structures : Concepts of fields, Records and files.

File organization : Serial and sequential file organizations, Direct/Random file organization, Indexed sequential file organization. Inverted-lists and multi-lists organization. Hashing functions and collision handling methods.

Sorting : Internal and external sorting. Search and merging techniques.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

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1. Samuel P. Harkison and Gly L. Steele Jr., C : A Reference Manual, Second Edition, Prentice Hall, 1984.
2. Brian W. Kernighan & Dennis M. Ritchie, The C Programme Language, Second Edition (ANSI features) , Prentice Hall 1989.
3. Balagurusamy E : Programming in ANSI C, Third Edition, Tata McGraw-Hill Publishing Co. Ltd.
4. Byron, S. Gottfried : Theory and Problems of Programming with C, Second Edition (Schaum's Outline Series), Tata McGraw-Hill Publishing Co. Ltd.
5. Loomis, Data Structure and File Management, Prentice Hall India Ltd.
6. Schaume's Outline Series, Data Structures, Tata McGraw Hill.
7. Tannenbaum, Data Structure Using C, Tata McGraw-Hill.

12MMCS-206 : Data Communication, Networking and Internet

Max. Marks : 80
Time : 3 hours

Unit I (2 Questions)

Data communication : Concept of data , Signal, Channel, Band-width, Bit rate and band rate; Analog and digital communications; Asynchronous and synchronous transmission; Data encoding techniques; Modulation techniques, Multiplexing.

Unit II (2 Questions)

Computer networks : Definition, Need for computer networks, Advantages of networks, Hardware and software requirements.

Reference models : OSI reference model, TCP/IP reference model

Unit III (2 Questions)

Types of network : LAN, MAN, WAN, Value added network and their features, Network topologies.

Switching techniques: Circuit switching, Message switching and Packet switching.

Transmission media : Magnetic media, Twisted pair, Co-axial cable, Radio transmission, Line of sight transmission, Communication satellite, Wireless transmission.

Unit IV (2 Questions)

Internetworking : Internet architecture, Bridges, Switches, Routers and Gateways.

E-mail architecture, User agent (UA), MTA, Message format, Message transfer, e-mail privacy, FTP, Newsgroups, Remote logins, Chat groups, Search engines.

Note : The question paper will consist of **five** units. Each of the first four units will contain **two** questions from unit **I , II , III , IV** respectively and the students shall be asked to attempt **one** question from each unit. Unit five will contain **eight to ten** short answer

type questions without any internal choice covering the entire syllabus and shall be **compulsory**.

Books Recommended :

1. Behrou A. Forouan, Data Communication & Networking, Tata Mc-Graw Hill
2. Andrew S. Tanenbaum, Computer Networks,
3. Nasib S. Gill, Essentials of computer and Network Technology, Khanna Book Publishing.
4. Dr. M Jain & Satish Jain, Data Communication & Networking, BPB Pub.
5. Hemant Kapila, Data Communication & Networking, S. Dinesh & Co.
6. Learning guide to Internet, BPB
7. Internet Complete, Sybex

12MMCS-207 : Practicals

Max. Marks : 80
Time 4 hours

The practical examination will be based upon Papers 12MMCS-205 and 12MMCS-206.

i) Viva-voce and practical record : 30 marks

ii) Written practical work : 50 marks

The examiner shall set a question paper consisting of **four** questions and the students will be required to attempt any **two** questions. They will write these programs in Answer-books, run the same on computers and take printouts.