M.Sc./M.A. Course (Fourth Semester)
PAPER-III (B)
Cosmology (II)

Max Marks – 80

Unit-I: Cosmology-physical universe, Mach's principle, Einstein modified field equations with cosmological term.

Unit-II: Static Cosmological models of Einstein and De-Sitter, their derivation, properties and comparison with the actual universe.

Unit-III: Hubble's law. Cosmological principles. Weyl's postulate. Derivation of Robertson-Walker metric. Hubble and deceleration parameters. Redshift. Redshift versus distance relation. Angular size versus redshift relation and source counts in Robertson-Walker space-time.

Unit-IV: Friedmann models. Fundamental equations of dynamical cosmology. Critical density. Closed and open Universes. Age of the Universe. Matter dominated era of the Universe.

Unit-V: Einstein-deSitter model. Particle and even horizons. Eddington-Lamaitre models with I-term. Perfect cosmological principle. Steady state cosmology.

REFERENCES:

1. J. V. Narlikar, General Relativity and Cosmologyi Ths Macmillan Company of India Urnited, 1978.
2. S. Weinberg, Gravitation and Cosmology: Principles and applications of the general theory of relativity, John Wiley & Sons, Inc. 1972.
3. J. V. Narlikar, Introduction to Cosmology, Cambridge University Press, 1993.
4. L. D. Landau and E.M. Lilshitz, The classical theory of Fields, Pergamon Press, 1980.

Dr. shabnamKhan. (Dr Rakesh Tiwari) (Dr. Asha Rani Das)

M.Sc./M.A. Course (Fourth Semester)
PAPER-III (C)
Fuzzy Set Theory & Its Applications (II)

Max Marks – 80

Unit-I Fuzzy Logic-An overview of classical logic, Multivalued logics, Fuzzy propositions. Fuzzy quantifiers. Linguistic variables and hedges. Inference from conditional fuzzy propositions, the compositional rule of inference.

Unit-II Approximate Reasoning-An overview of Fuzzy expert system. Fuzzy implications and their selection. Multiconditional approximate reasoning. The role of fuzzy relation equation.

Unit-III An introduction to Fuzzy Control-Fuzzy controllers. Fuzzy rule base. Fuzzy inference engine. Fuzzification.

Unit-IV Defuzzification and the various defuzzitication methods (the centre of area, the centre of maxima, and the mean of maxima methods).

Unit-V Decision Making in Fuzzy Environment-Individual decision making. Multiperson decision making. Multicriteria decision making. Multistage decision making. Fuzzy ranking methods. Fuzzy linear programming.

REFERENCES :

1. H. J. Zimmemann, Fuzzy set theory and its Applications, Allied Publishers Ltd. New Delhi, 1991.
2. G. J. Klir and B. Yuan- Fuzzy sets and fuzzy logic, Prentice-Hall ol India, New Delhi, 1995.

Dr. Shabnam Khan. (Dr. Asha Rani Das)

M.Sc./M.A. Course (Fourth Semester)
PAPER-III (D)
Mathematical Biology (II)

Max. Marks - 80

UNIT-I

Tumor Modelling: Phenomenological Models, Nutrients: the Diffusion-limited Stage, Moving Boundary Problems, Growth Promoters and Inhibitors, Vascularisation, Metastasis, Immune System Response.

UNIT-II

Growth and Control of Brain Tumors : Basic Mathematical Model of Glioma Growth and Invasion, Tumour Spread *In Vitro*: Parameter Estimation, Tumour Invasion in the Rat Brain, Tumour Invasion in the Human Brain, Modelling Tumour Resection in Homogeneous Tissue, Analytical Solution for Tumour Recurrence After Resection, Modelling Surgical Resection with Brain Tissue Heterogeneity, Modelling the Effect of Chemotherapy on Tumour Growth, Modelling Tumour Polyclonality and Cell Mutation.

UNIT-III

Dynamics of Infectious Diseases: Historical Aside on Epidemics, Simple Epidemic Models and Practical Applications, Modelling Venereal Diseases, Multi-Group Model for Gonorrhea and Its Control, Bovine Tuberculosis Infection in Badgers and Cattle, Modelling Control Strategies for Bovine Tuberculosis in Badgers and Cattle.

UNIT-IV

Modelling of Immunodeficiency Virus: AIDS: Modelling the Transmission Dynamics of the Human Immunodeficiency Virus (HIV), HIV: Modelling Combination Drug Therapy, Delay Model for HIV Infection with Drug Therapy, Modelling the Population Dynamics of Acquired Immunity to Parasite Infection, Age- Dependent Epidemic Model and Threshold Criterion, Simple Drug Use Epidemic Model and Threshold Analysis.

UNIT-V

Geographic Spread and Control of Epidemics: Simple Model for the Spatial Spread of an Epidemic, Spread of the Black Death in Europe, Brief History of Rabies, Spatial Spread of Rabies Among Foxes: Background and Simple Model, Three- Species (*SIR*) Model. Control Strategy Based on Wave Propagation into a Nonepidemic Region: Estimate of Width of a Rabies Barrier, Analytic Approximation for the Width of the Rabies, Effect of Fox Immunity on the Spatial Spread of Rabies.

Dr. shabnamKhan. (Dr. Asha Rani Das)

Recommended Books

1. Jeffrey R. Chasnov, Mathematical Biology, Lecture Notes for MATH(365), The Hong Kong University of Science and Technology (2010)
2. Nicholas F. Britton, Essential Mathematical Biology, Springer-Verlag (2003)
3. J. D. Murray, Mathematical Biology I. An Introduction, Springer-Verlag (2002) 3rd Edition.
4. J. D. Murray, Mathematical Biology II. Spatial Models and Biomedical Application, Springer-Verlag (2003) 3rd Edition.

Dr. shabnamKhan. Neelam Sharma (Dr. Rakesh Tiwari) (Dr. Asha Rani Das)

M.Sc./M.A. Course (Fourth Semester)
PAPER –IV (A)
Operations Research (II)

Max. Marks. 80

Unit-I Dynamic Programming - Deterministic and Probabilistic Dynamic programming. Integer Programming- Branch and Bound Technique.

Unit-II Game Theory-Two-Person, Zero-Sum Games. Games with Mixed Strategies. Graphical, Solution. Solution by Linear Programming.

Unit-III Integer Programming-Branch and Bound Technique.

Unit-IV Queuing system: Deterministic Queuing system, probability distribution in Queuing, **c**lassification of Queuing models, Poission Queuing system ((M/M/I):(∞/FIFO), (M/M/I): (SIRO), (M/M/I): (N/FIFO). Inventory control: The concept of EOQ, Deterministic inventory problem with no shortages.

Unit-V Nonlinear Programming-One and Multi-Variable Unconstrained Optimization. Kuhn-Tucker Conditions for Constrained Optimization. Quadratic Programming.

References:

1. F.S. Hillier and G.J. Ueberman. Introduction to Operations Res Bareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995. (This book comes with a CD containing tutorial software).
2. G. Hadley, Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network flows, John Wiley & Sons, New York, 1990.
5. H. A. Taha, Operations Research-An introduction, Macmillan Publishing Co., Inc., New York.
6. K. Swarup, P.K. Gupta and Man Mohan, Operations Research, S. Chand & Sons, New Delhi.

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M.Sc. /M.A. Course (Fourth Semester)
PAPER-IV (B)
Wavelets (II)

Max Marks – 80

Unit-I Characterizations in the theory of wavelets-The basic equations and some of its applications.

Unit-II Characaterizations of MRA wavelets, low-pass filters and scaling functions. Non- existence of smooth wavelets in $H^2(R)$.

Unit-III Frames - The reconstruction formula and the Batian-Low theorem for frames. Frames from translations and dilations. Smooth frames for $H^2(R)$.

Unit-IV Discrete transforms and algorithms-The discrete and the fast Fourier transforms. The discrete and the fast cosine transforms.

Unit-IV The discrete version of the local sine and cosine bases. Decomposition and reconstruction algorithms for wavelets.

REFERENCES:

1. Eugenic Hern Bndez and Guido Weiss, A First Course on Wavelets, CRC Press, New York, 1996.
2. C. K. Chui, An Introduction to Wavelets, Academic Press, 1992.
3. I. Daubechies, Ten Lectures on Wavelets, CBS-NSF Regional Conferences in Applied Mathematics, 61, SIAM, I 1992.
4. Y. Meyer, Wavelets, algorithms and applications (Tran. by R.D. Rayan, SIAM, 1993.
5. M. V. Wickerhauser, Adapted wavelet analysis from theory to software, Wellesley, MA, A.K. Peters, 1994.

Dr. shabnamKhan. Neelam Sharma (Dr. Rakesh Tiwari) (Dr. Asha Rani Das)

M.Sc. /M.A. Course (Fourth Semester)

PAPER –V (A)

Programming in C (with ANSI features)

(II) Theory and Practical

Max. Marks. 100

(Theory-70 +Practical-30)

Unit-I Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables. The register Specifier. ANSI rules for the syntax and Semantics of the storage-class keywords.

Unit-II Pointers Pointer Arithmetic. Passing Pointers as Function Arguments. Accessing Array Elements through Pointers. Passing Arrays as Function Arguments. Sorting Algorithms. Strings. Multidimensional Arrays. Arrays of Pointers. Pointers to Pointers.

Unit-III Functions-Passing Arguments. Declarations and Calls. Pointers to Functions. Recursion. The main Function. Complex Declarations. The C Preprocessor-Macro Substitution. Conditional Compilation. Include Facility. Line Control.

Unit-IV Structures and Unions-Structures. Dynamic Memory Allocation. Linked Lists. Unions, enum Declarations.

Unit-V Input and Output-Streams, Buffering. The <Stdio.h> Header File. 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 Input/Output.

Dr. shabnamKhan. Neelam Sharma (Dr Rakesh Tiwari) (Dr. Asha Rani Das)

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, 2nd Edition, Prentice Hall, 1984.
3. Brian W. Kernighan & Dennis M. Ritchie, The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.

Practical Examination Scheme

Max. Marks – 30	Time Duration – 3 Hrs.
Practical (two)	20 Marks (10 marks each)
Viva	05 Marks
Sessional	05 Marks

Practical List
M.sc. Mathematics (IVth Sem.)
Programing in 'C' (paper- 5)

1. Wap to swap numbers using pointer?
2. Wap to add four digit numbers by using variables ?
3. Wap to find the roots of a quadrate equation?
4. Wap in C which reads a 3x2 matrix and then calculate the sum of each row and store in ID array.
5. Wap in C to read matrix A (3x4) and calculate its multiplication.
6. Wap to store any 10 number in array and pass as function argument to calculate its. Sum.
7. Wap to find the sum of square of add numbers below 100.
8. Wap for sorting the 11 elements which are neither ascending nor descending order.
9. Wap to find factorial of a number using recursion.
10. Wap to find factorial of number using recursion.
11. Wap to find the square root as a Macro.
12. Wap to red matrix of size MxN from the keyboard and display the same on the screen using function.
13. Wap to delete a node in single link list using pointer.
14. Wap to traversing in Circular link list using pointer.
15. Wap using function for DMA.
16. Wap for creating a link of a set integer numbers.
17. Wap to read and write operation in Random Access File.
18. Wap to create a file 'data' containing a series of integers and all even numbers present in the file.
19. Wap to explain opening nd closing of file.
20. Wap to generate a data file containing emp_id, emp_name and emp__telno of an institution.

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M.Sc./M.A. Course (Fourth Semester)
PAPER-V (B)
Graph Theory-II

Max. Marks - 80

Unit-I: Ramsey Theory: Perpectness-preserving operations, Forbidden Subgraph orientations, Ramsey numbers and Ramsey graphs.

Unit-II: Groups: Permutation groups, The automorphism group, graphs with given group, symmetry concepts, pseudo-similarity and stability, spectral studies of the Automorphism group.

Unit-III: Polynomials and Graph Enumeration: The colour polynomials, The chromatic polynomial, The bivariate colouring polynomials.

Unit-IV: Graph Enumeration: Co-chromatic (co-dichromatic) graphs and chromatically unique graphs, Graph Enumeration.

Unit-V: Digraphs & Networks: Digraphs, Types of connectedness, Flows in Networks, Menger's and Konig's Theorem, Degree sequences.

REFERENCES:

1. K. R. Parthasarathy, Basic graph theory, Tata Mc graw Hill publishing company limited, 1994.
2. R. J. Wilson, Introduction to graph theory, Longman Harlow, 1985.
3. John Clark, Derek Allon Holton, A first look at graph Theory, World Scientific Singapore, 1991.
4. Frank Hararary, Graph Theory Narosa, New Delhi, 1995.
5. Ronald Gould and Benjamin Cummins, Graph Theory, California.
6. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, Prentice-Hall of India Private Limited, New Delhi, 2002.

Dr. shabnamKhan. (Dr. Asha Rani Das)

M.Sc. /M.A. Course (Fourth Semester)
PAPER-V (C)
Algebraic Number Theory (II)

Max Marks – 80

UNIT-I

Extensions: Decomposition and ramification, Unramified extensions, Tamely ramified extensions.

UNIT-II

The Different and Discriminant: Complementary modules, The different and ramification, The discriminant.

UNIT-III

Cyclotomic Fields): Roots of unity, Quadratic fields, Gauss sums, Relations in ideal classes, Fermat's last theorem.

UNIT-IV

The Structure of Units: Dirichlet's Unit Theorem, Units in Real Quadratic Fields, Pell's equation.

UNIT-V

Zeta Functions: The Riemann Zeta Function, Dedekind Zeta Function

References:

1. Serge Lange: Algebraic Number Theory, Springer-Verlag, 1986.
2. Jean-Pierre Serre: Local Fields, Springer-Verlag, 1979
3. M. Ram Murty, Jody Esmonde: Problems in Algebraic Number Theory (2nd ed.), Springer, 2005.
4. H. P. F. Swinnerton-Dyer: A Brief Guide to Algebraic Number Theory, Cambridge University Press, 2001
5. A. Frohlich , M.J. Taylor: Algebraic Number Theory, Cambridge University Press, 1991.
6. Ian Stewart, David Tall: Algebraic Number Theory and Fermat's Last Theorem (3rd ed.), A K Peters, Natick, Massachusetts, 2002.
7. Ethan D. Bolker: Elementary Number Theory, An Algebraic Approach, W. A. Benjamin, Inc., New York, 1970
8. Jurgen Neukirch: Algebraic Number Theory, Springer-Verlag, 1999
9. William Stein: Algebraic Number Theory, a Computational Approach, Cambridge University Press, 1991.

Dr. shabnamKhan. (Dr. Asha Rani Das)

Books Recommended:

1. Peter A. Darnell and Philip E. Margolis, C.A. Software Engineering Approach, Narosa Publishing House (Springer International Students Edition) 1993.
2. Samual P. Harkison and Gly L. Steele Jr., C : A Reference Manual, 2nd Edition, Prentice Hall, 1984.
3. Brain W. Kernighan & Dennis M. Ritchie, The C Programme Language, 2dn Edition (ANSI Features), Prentice Hall 1989.

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