List of Elective Paper (MAT EC-01 & MAT EC-02)

1. **Fuzzy sets and their application**
2. **Mathematical Methods**
3. **Operational Research**
4. **Theory of Relativity**
5. **Galois Theory.**
6. **Advanced Topology**
7. **Banach Algebras**
8. **Commutative Algebra**
9. **Programming in C**

26/3/19
University Professor &
Head of the Deptt. of Mathematics
B.R.A.B.U., Muzaffarpur

1. Fuzzy set and their applications

Fuzzy Set Theory:

Unit 1 : Fuzzy Sets Versus Crisp sets, Basic definitions, types, properties and representations of Fuzzy sets, Convex Fuzzy sets, Basics operation on Fuzzy set, α- Cuts, Decompositions theorem, Complements, t- norm and t-conorms, Extension principles and Simple applications of Fuzzy sets.

Unit 2 : Fuzzy logics – An overview of classical logic, Multivalued logics, Fuzzy propositions, fuzzy quantifiers, Linguistic variable and hedges, inference from conditional fuzzy propositions the compositional rule of inference.

Unit 3 : Approximate Reasoning – An overview of fuzzy expert system, Fuzzy implication and their selection Multiconditional approximate reasoning the role of fuzzy relation equation.

Unit 4 : An introduction to Fuzzy control – Fuzzy controllers, Fuzzy rule base Fuzzy inference engine Fuzzification. Defuzzification and the various defuzzification method (The centre of maxima and the mean of maxima methods).

Unit 5 : Decision making in Fuzzy Environment – Individual decision making. Multiperson decision making, Multicriteria decision making, Multistage decision making, Fuzzy ranking methods, Fuzzy linear programming.

Unit 6 : Misc Application specially in social science, Biological Science and engineering reliability theory and mathematical statistics.

References :

1. G.J.Klir & B. Yuan :- Fuzzy sets and Fuzzy Logics.
2. H.J.Zimmermann, Fuzzy set theory and its Applications.
3. G.J.Klir and T.A.Folger:- Fuzzy Sets, Uncertainty and Information.
4. Pundir And Pundir:- Fuzzy Sets & their Application,

2. Mathematical Methods

Unit 1 : Orthogonalisation, Bessel's Inequality, Mean error minimization,completeness relation, Weierstrass approximation theorem, polynomials of Legendre, Hermite and Bessel, generating function, orthogonality, recurrence relation and Rodrigue's formula

Unit 2 : Partial Differential Equation and properties, concept of well posed problems, Reduction of P.D.E in two independent variables to the canonical forms, classification in to elliptic, hyperbolic and parabolic equations, Laplace's equations in cartesian, cylindrical and spherical co-ordinates, Equipotential surfaces, Interior and exterior Dirichlet problem, the Maximum- Minimum property, solutions and Uniqueness, Dirichlet's problem for a circle, fundamental properties of Harmonic function.

Unit 3 : Wave equation in one dimension and two dimension, vibrations of struck and plucked string with fixed ends, homogeneous rectangular and circular membranes, eigen vibrations, D'Alembert's solution of one dimensional wave equation. One dime -nsional Diffusion equation & solution of initial value problem by integral transform .

Unit 4 : Tensors- Transformations of Co-ordinates, contravariant and covariant vectors Symmetric and skew-symmetric tensors, addition and multiplication of tensors, Contraction and composition of tensors, Quotient law.

Unit 5 : Reciprocal symmetric tensors of the second order, Christoffel's symbols, covariant derivative of a contravariant vector, Co-variant derivative of a covariant vector, covariant derivatives of tensors, curl of a vector, Divergence of a covariant vector, Laplacian of a scalar invariant.

References

1. I. N. Sneddon:- Elements of Partial Differential Equations
2. R. Courant and D. Hilbert:- Methods of Mathematical Physics Vol I & Vol II
3. C.E. Weatherburn : - Riemannian Geometry and Tensor calculus
4. Smirnov and Tychonoff : - Partial Differential Equations.

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University Professor &
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B.R.A.B.U., Muzaffarpur

3. Operations Research

Unit 1: Queuing Theory- Poisson probability law, Distribution of inter-arrival time, Distribution of time between successive arrivals, Differential difference equation of M |M |1 : ∞ |FIFO , M |M |1 : N|FIFO , M |M |C : ∞ |FIFO , M |M |C : N|FIFO ,

Unit 2 : Information Theory: Description of communication system, Mathematical definition of information, Axiomatic approach to information, Measures of uncertainty, Entropy In two dimensions- property, conditional entropy.

Unit 3 : Channel capacity, Efficiency and redundancy, Encoding, Fano-encoding procedure, Necessary and sufficient condition, average length of encoded message.

Unit 4 : Replacement Model- introduction concepts of present value, replacement of items whose maintenance cost increase with time and value of money also changes, Replacement of items that fail completely, individual and group replacement policy.

Unit 5 : Sequencing – N jobs and 2 machines, N jobs and 3 machines, N jobs M machines.

References

1. H.A. Taha:- Operations Research – An Introduction
2. Kanti Swarup, P.K.Gupta and Man Mohan: Operations Research
3. P.K.Gupta and D.S. Hira:- Operations Research.

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University Professor &
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B.R.A.B.U., Muzaffarpur

4. Theory of Relativity

Unit 1 : General Theory of Relativity- Principle of equivalent and general covariance, Einstein field equations and its Newtonian approximation.

Unit 2 : Schwarz- Schild external solution and its isotropic form, Birkhoff theorem, planetary orbits and analogous of Kepler's laws in general relativity.

Unit 3 : Advance of perihelion of a planet, Bending of light rays in a gravitational field, Gravitational shift of spectral lines, Einstein theory.

Unit 4 : Energy Momentum of tensor of a perfect fluid, Schwarz- Schild internal solution, Energy Momentum tensor of a electromagnetic field, Einstein Maxwell equation, Reissner-Nordstrom Solution.

Unit 5 : Cosmology – Einstein modified field equation with cosmological term static cosmological models of Einstein and De-Sitter, their derivation properties and comparison with the actual universe.

References:

1. C.E. Weatherburn: An Introduction to Riemannian Geometry and the tensor calculus.
2. A.D.Eddington: The Mathematical theory of Relativity.
3. Goyal and Gupta:- Theory of Relativity
4. R.Adler, M.Bazin, M.Schiffer:- Introduction to General Relativity.
5. J.J.Synge:- Special theory of Relativity & General theory of Relativity.

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University Professor &
Head of the Deptt. of Mathematics
B.R.A.B.U., Muzaffarpur

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5. Galois Theory

Unit 1 : Rings, examples of ringd, ideals, prime and maximal ideals. Integral domains, Euclidean Domains, Principal Ideal Domains and Unique Factorizations Domains. Polynomial rings over UFD's.

Unit 2 : Fields, Characteristic and prime subfields, field extensions, finite, algebraic and finitely generated field extensions, algebraic closures..

Unit 3 : Spliting fields, normal extension, Multiple roots, Finite fields, separable Extension.

Unit 4 : Galois group, Fundamental Theorm of Galois Theory, Solvability by radicals, Galois theorem on solvability. Cyclic and abelian extensions. Classical ruler and Compass constructions.

References:

1. D.S. Dummit and R.M. Foote, Abstract Algebra
2. Joseph Rotman, Galois Theory
3. N.Jacobson, Basic Algebra I, IInd ed., Hindustan Publishing Co. 1984.
4. S.Lang, AlgebraI, III Edition, Addison Wesley, 2005.

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University Professor &
Head of the Deptt. of Mathematics
B.R.A.B.U., Muzaffarpur

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6. Advance Topology

Unit 1 : Countably compactspaces, sequentially compact spaces, totally bounded metric spaces.

Unit 2 : Lebesgue's covering lemma, spaces of continuous functions, Arzela-Ascoli Theorem, Weierstrass's approximation theorem.

Unit 3 : Stone Weierstrass's theorem, metrizable spaces and meztrization theorems, uniform spaces, topology of uniform spaces.

Unit 4 : Uniform continuity, uniform metrizable topological spaces, metrizable uniform spaces.

Unit 5 : Some properties of completely regular spaces, the Stone-Chech compactification..

References:

1. S.Willard: General Topology, Addison – Wesley 1970.
2. S.W.Davis: Topology, TMH 2006.
3. K.K.Jha: Advanced General Topology, Nav Bharat Prakashan, Patna.
4. G.F.Simmons: An introduction to Topology and Modern analysis.

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University Professor &
Head of the Dept. of Mathematics
B.R.A.B.U., Muzaffarpur

7. Banach Algebras

Unit 1 : Elementary properties and Examples of Banach Algebras, Ideal quotients, the spectrum of an element, dependence of specturem on algebra, Abelian Banach Algebras.

Unit 2 : Elementary properties of C*-Algebras and examples, Abelian Algebras and functional calculus, positive elements.

Unit 3 : Ideals and quotients, representations of C*-Algebras and the Gelfand-Naimark construction.

Unit 4 : Spectral measures and representations of Abelian C*-Algebras, Special theorem.

Unit 5 : Topologies on B(H), the double commutant rem and Abelian Von-Neumann Algebras.

References:

1. J.B.Conway: A course in Functional Analysis, Springer 1990.
2. R.V.Kadison and J.R.Ringrose: Fundamentals of the theory of Operator Algebras, AMS 1997.
3. G.Murphy: C*-Algebras and Operator theory, Academic Press 1990.

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University Professor &
Head of the Deptt. of Mathematics
B.R.A.B.U., Muzaffarpur

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8. Commutative Algebra

Unit 1 : Ring and ring homomorphisms, ideals, quotient rings, Zero divisors, Nilpotent elements units, prime ideals and maximal ideals, Nil Radical and Jacobson Radical, Operations on ideals, extension and contraction.

Unit 2 : Modules and module homormorphisms, sub-modules, quotient modules. Operations on sub-modules, Direct sum and products, Finitely generated modules, exact sequences.

Unit 3 : Tensor product of modules, restriction and extension of scalars, exactness properties of tensor product, Algebras, Tensor product of algebras.

Unit 4 : Local properties, extended and contracted ideals in ring of fractions, primary decompositions, integral dependence, the going-up theorem, integrally closed integral domains, the going-down theorem, chain conditions.

Unit 5 : Primary decompositions in Noetherian ring, Artin rings, discrete valuation rings, Dedekind domains, Fractional ideals.

References:

1. M.F. Atiyah and I.G. Macdonald: Introduction to Commutative Algebra- Addison-Wesley.
2. H.Matsumura: Commutative ring theory, Camb. Univ. Press
3. N.S.Gopala Krishnan- Commutative algebra
4. S.Lang: Algebra, Springer
5. D.P.Patil, Patil, Storch: Introduction to Algebraic Geometry and Commutative Algebra, Anshan Publishers.

9. Programming in C

Theory

1. Introduction to programming languages, C language and its features.
2. Understanding of Structure of Programme in C.
3. Basic data types, Library in C.
4. Operators and expression in C.
5. Functions used for input and output in C.
6. Conditional branching in C, use of If-then.
7. Looping in C, use of for loop, while loop, do-while loop, nested loops.
8. Algorithm and Flow Charts.

Practical

1. Some simple programmes use in C.
2. Leap – year.
3. Generate first n-primes
4. Roots of quadratic equations.
5. Convert a number to any given base.
6. Generate first n-perfect numbers.
7. Sine and Cosine by Taylors series.
8. Addition and multiplication of matrices
9. Transpose of a matrix.
10. Inverse of a matrix.

References:

1. Y.Kanitkar: Lets C.
2. Robert Lafore: C programming.
3. E.Balaguruswami: Programming in ANSI C.

SP Kharwar 26/3/19 Ashish 26.3.19 26/3/19

University Professor & Head of the Deptt. of Mathematics B.R.A.B.U., Muzaffarpur

D Kumar 26/3/19