Syllabus for

M.A/M.SC. IN MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM

ACADEMIC SESSION :

W.E.F. 2020-2022

for

Binod Bihari Mahto Koyalanchal University, Dhanbad

Subject Code = MAT

Members of Board of studies for CBCS Syllabus of Mathematics under Binod Bihari Mahato Koyalanchal, University, Dhanbad.

1. Chairperson :-

Dr. R.K. Tiwary
Associate Professor & Head
University Department of Mathematics,
Binod Bihari Mahato Koyalanchal University, Dhanbad

2.Member:- **Dr. Shiv Prasad**
Assistant Professor
University Department of Mathematics,
Binod Bihari Mahato Koyalanchal University, Dhanbad

3. Expert Members **(i) Dr. R.K. Dwivedi**
Associate Professor
Head , University Department of Mathematics
V.B.U. Hazaribag.

(ii) Dr. C.S.P. Lungun
Associate Professor
Head , University Department of Mathematics
Ranchi University , Ranchi ..

4.Special Invitee: **(i) Dr. Vijoy Kumar (Rtd.)**
Associate Professor
Head , University Department of Mathematics
B.M.M.K.U. Dhanbd.

17/12/2020
DR. R.K. TIWARY
H.O.D.
P.G. Depart: of Mathematics
B.B.M...U. Dha... ..d

Session : 2020-2022

Contents

COURSE STRUCTURE

Semester Wise Examination/ Course Structure for Science Faculty

Semester	Paper Code	Paper Name	Full Marks	End Semester Marks	Mid Semester (Internal) Marks (written 20 marks)+Day to Day assessment includes extracurricular activities(5 marks)+Attendence(5marks)
I	MAT-F-101 (5 Credits, 60 Lectures + 15 Tutorials)	Foundation	100	70	30
	MAT-C-102 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-103 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-104 (5 Credits, 75 x 2 Lectures)	Core	100	70	30
II	MAT-S-205 (5 Credits, 60 Lectures + 15 Tutorials)	Skill Development Course (SEC)	100	70	30
	MAT-C-206 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-207 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-208 (5 Credits, 75 x 2 Lectures)	Core	100	70	30
III	MAT-C-309 (5 Credits, 60 Lectures + 15 Tutorials)	Open Elective	100	70	30
	MAT-C-310 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-311 (5 Credits, 60 Lectures + 15 Tutorials)	Core	100	70	30
	MAT-C-312 (5 Credits, 75 x 2 Lectures)	Core	100	70	30
IV	MAT-E-413A/ MAT-E-413B/ MAT-E-413C/ (5 Credits, 60 Lectures + 15 Tutorials)	Discipline Centric Elective theory A: B: C:	100	70	30

	MAT-E-414A/ MAT-E-414B/ MAT-E-414C/ (5 Credits, 60 Lectures + 15 Tutorials)	Discipline Centric Elective theory A: B: C:	100	70	30
	MAT-C-415 (5 Credits, 60 Lectures + 15 Tutorials) or MAT-E-415A/ MAT-E-415B/ MAT-E-415C/ (5 Credits, 75x2 Lectures)	Core or Discipline Centric Elective theory A: B: C:	100	70	30
	MAT-C-416* (5 Credits, 150Lectures)	Dissertation/ Project	100	70	30
		Total Marks	1600	1120	480

Note : Symbol of Paper: XYZ-F-101: The first three symbols in Roman Capital letters indicate the subject; the next symbol(s) denotes Foundation (F) , Core (C) , Discipline Centric elective (E), AECC/SEC(S), etc. Out of the next three digits, the first digit indicates the semester e.g.1,2,3,4, for semester I, II, III, IV, respectively , and the next two digits indicate proper number. The last letter T or P indicates Theory or Practical.

***Dissertation/Projects:** Evaluation of project dissertation work may be as per the following guidelines:

- **Mid-Semester/Internal Assessment Examination** – 30 marks (Annexure-1)
- **End Semester Examination:** Project model (if any) and the Project record notebook, Project Presentation and viva-voce=70 marks
  (Jointly conducted by One External * One Internal Examiners)

Overall project dissertation may be evaluated under the following heads :

- Motivation for the choice of topic
- Project dissertation design
- Methodology and Content depth
- Results and Discussion
- Future Scope & discussion
- Future Scope & References
- Participation in internship programme with reputed organization
- Application of Research technique in Data collection
- Report Presentation
- Presentation Style
- Viva-voce

Note:

(a) Each student must submit two copies of the dissertation work duly forwarded by the Head of the Department and duly signed by the supervisor concerned. The forwarded copies will be submitted to the concerned Department of University, for evaluation.
The paper will consist of

- Field work/ Lab work related to the project.
- Preparation of dissertation based on the work undertaken
- Presentation of project work in the seminar on the assigned topic & open viva there on .

(b) Each student shall have to complete a project work on any topic of his choice , but relevant to the frontier area of Science and Technology, or on a topic allotted by his/her Project Guide/Supervisor/Department in Semester–IV.This is compulsory and the candidates shall ensure that his project is on a relevant topic completed by him independently with the help and inputs from his/her guide/supervisor. Other guidelines pertaining to this paper shall be provided by the Department.

(c) Student alone or in a group of not more than five, shall undertake one Project approved by the Student Teacher/H.O.D. of the Department/College concerned. The progress of the Project shall be monitored by the faculty members at regular intervals .

(d) Student will select topics for the project work in consultation with a teacher of the Department. The Seminar will be held in the concerned Department of University.

The Dissertation/Project shall be presented with the following specifications:

(a) **Size of Paper** : A4 . dissertation/Project must be printed on one side of the paper.

(b) **Font Type** : Time New Roman/Arial for English and Kruti Devi 010 for Hindi.

(c) **Font Size**:Font size for English text is 12pt. in standard form and for Hindi is 14pt.

(d) **Font of Chapter Headings and Sub-Headings.:**

- Chapter headings may be written in all Capitals, bold text in point size 15 .
- Sub-heading are written with left margin alignment .
- First level sub-headings are written in normal sentence case using bold text in point size 14 .
- Second level sub-headings are point size 13

(e) **Spacing and paragraphing:**

- Printing shall be in standardized form with 1.5 line spacing
- Leave as triple spacing (2 empty lines) in base point size 12 before and after sub-headings and one empty line after all sub-headings.
- Use one empty line between left-justified paragraphs.

(f) **Margin**: Left margin should be 4cms and right and tope margin should be 2cms. Bottom margins should be 2.5cms. No ornamental bordering of sides is permitted.

(g) **Page Numbering** :Preliminary pages of the **Dissertation/Project**, i.e. those preceding in text are to be numbered in Roman numbered. Text should be numbered in Arabic beginning with Pg No. 1 on the first page or chapter 1.

(h) Preliminary sections of the **Dissertation/Project** should include, Declaration of Attendance, Certificate from Supervisor, Declaration by Candidate and Supervisor regarding Plagiarism, Acknowledgement, Table of Contents, List of Tables, List of Figures/diagrams, List of Abbreviations (if any) and an Abstract of the dissertation/Project.

(i) **Referencing and Citation Style:** Citation i.e. a way of giving credit to individuals for their creative and intellectual works that you utilized to support your research, differs by faculty in the style of ordering, punctuating and formatting of name, date, page, work etc.

The referencing of work and Citation style in the Dissertation/Project submitted in **Faculty of Science and Social Science** will be in **American Psychological Association (APA) style (6th edition)**, for **Faculty of Humanities** except for the Indian Languages, format shall be **Modern Language Association (MLA)(8th edition)** and for **Medical Science** , it shall be **Vancouver Style** .

SEMESTER-I

COMPULSORY FOUNDATION COURSE

(Credits: Theory-04, Tutorial-01)

MAT-F-101	MODERN ALGEBRA	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20 in 1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

Time-3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks.* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).

End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS:

UNIT I

Group: Normal and Subnormal series, Isomorphism theorems, Jordan-Holder Theorem, Solvable groups, Nilpotent groups.

Group action, orbit-stabilizer theorem, orbit decomposition, Sylow's theorems(proofs using group actions)

(2 QUESTIONS)

UNIT II

Cononical Forms- Similarity of linear transformations, Invariant subspaces, Eigen values and Eigen vectors, Reduction to diagonal and triangular forms, Nipotent transformations index of nilpotency. Invariants of nilpotent transformation. The primary decomposition theorem.

(2 QUESTIONS)

CORE COURSE
(Credits : Theory-04, Tutorial-01)

MAT-C-102	REAL ANALYSIS	Theory: 60 Hours; Tutorial:15 Hours

Marks: 30(MSE: 20[m]1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100 Pass Marks (MSE:17+ESE:28)=45

TIME-3 Hrs.

Instruction to faculty members and Question Seter for :

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SYLLABUS:

UNIT I

Definition and existence of Reiemann-Stieltjes integral, Properties of the Integral, Integration and differentiation,the fundamental theorem of Calculus (R-S Integral), Fourier series, Bessels inequality, Perseval theorem, Fourier series representation of functions.

(2 QUESTIONS)

UNIT II

Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's test for uniform convergence and continuity, uniform convergence.

(2 QUESTIONS)

UNIT III

Riemann-Stieltjes integration, uniform convergence and differentiation, Weicrstarss approximation theorem, Power Series, uniqueness theorem for power series, Abel's and Tauber's theorem.

(2 QUESTIONS)

UNIT IV

Functions of several variables, linear transformation, Derivatives in an open subset of R^n .Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Young theorem, Schwartz theorem, Taylor's theorem, Inverse function theorem, Implicit function theorem, Jacobians

References:

1. Walter Rudin, Principles of Mathematical Analysis (3rd edition) Mc. Graw-Hill. Kogakushu, 1976, Internations student edition.
2. T.M. Apostal, Mathematical Analysis, Narosa publishing House, New Delhi, 1985,
3. Shanti Narain, Real Analysis, S. Chand & Co. New Delhi.
4. Malik and Arora : Mathematical Analysis.

CORE COURSE

(Credits: Theory-04, Tutorial-01)

MAT-C-103	TOPOLOGY	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[m]1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :
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SYLLABUS:

UNIT I

Countable and uncountable sets. Infinite sets and the Axiom of Choice (statement onl.) Cardinal numbers Schroeder-Bernstein theorem. Cantor's theorem and continuum hypothesis . Zorn's lemma (statement only).

(2 QUESTIONS)

UNIT II

Definition and examples of topological spaces, closed sets, Closure. Dense subscts. Neighbourhoods, Interior, exterior and boundary. Accomulation points and derived sets. Bases and sub-base . Subspaces and relative topologies.

(2 QUESTIONS)

UNIT III

First and Second countable spaces. Lindelof's theorem, separable spaces, second countability and separability, separation axioms To, T_1, T_2, T_3, T_4: their Characterizations and basic properties. Urysohn's Lemma. Tietze extension theorem.

(2 QUESTIONS)

UNIT IV

Compactness, continuous functions and compact sets, Basic property of compactness. Compactness and finite intersection property Tychonoff's Theorem, connected and disconnected spaces and their basic properties, Connectedness and product spaces.

(2 QUESTIONS)

References :

- K.D. Joshi, Introduction to General ToplogyWiley Eastern Ltd. 1983
- J.L. Kelley, General Topology, Van Nostrand. Reinhold Co, New York 1995.
- W.J. Pervin. Foundation of General Topology. Academic Prress Inc. New HYork ,1964.
- K.K. Jha, Advanced General Topology ,Nav Bharat Prakashan, Delhi
- G.P. Simmons, Introduction to Topology and Modern Analysis, Mc Graw Hill Int. book company.
- J.R Munkres, Topology A first course, Prentice hall India Pvt. Ltd.
- S.Lipschutz, General Topology, Schaum's out line series.

CORE COURSE

(Credits: Theory-04, Tutorial-01)

MAT-C-104	COMPLEX ANALYSIS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20^{m}1 Hr. + 5 Attd. + 5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :

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SYLLABUS:

UNIT I

Complex integration, Cauchy-Goursat Theorem, Cauchy's Integral formula, Higher order derivatives, Morera's theorem, Cauchy's inequality and Liouville's theorem.

(2 QUESTIONS)

UNIT II

The fundamental theorem of algebra, Taylor's theorem, Maximum modulus principle, Schwarz lemma , Laurent's series.

(2 QUESTIONS)

UNIT III

Isolated singularities, Meromorphic functions. The argument principle Rouche's theorem Poles and Zeros. Fundamental theorem. Residues. Cauchy's residue theorem. Evaluation of integrals.

(2 QUESTIONS)

UNIT IV

Bilinear transformations, their properties and classification. Definition and examples of conformal mapping.

Analytic continuation. Uniqueness of direct analytic continuation Uniqueness of analytic continuation along a curve. Power series method of analytic continuation .

(2 QUESTIONS)

References :

- L.V. Ahlfors, complex Analysis . MC-Graw Hill, 1979
- S.Lang. Complex Analysis Addison Wesely, 1977.
- Walter Rudin,Real and complex Analysis, Mc Graw Hill Book Co. 1966
- E.C. Titchmarsh, the Theory of Functions, Oxford University Press , London.
- S. Ponnusamy, Foundation of complex Analysis , Narosa Publishing House 1997.
- E.T. Copson, Complex variable.
- Shanti Narayan , complex variables.
- Chrchill and Brown, Complex Variables and applications, McGraw-Hill Pub Company Murray R.Spiegel, complex variable, Schaum's out line special Indian edition TMH Education New Delhi.

SEMESTER-2

SKILL DEVELOPMENT COURSE (SEC)

(Credits: Theory-04, Tutorial-01)

MAT-S-205	BASIC COMPUTER AND PROGRAMMING INC THEORY-04 AND PRACTICAL-30	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20 1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :

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SYLLABUS: (Theory Paper : Full Marks : 40)

UNIT 1

Introduction to Computer , Number System: Decimal, Binay, Octal, Hexadecimal number systems, features and conversions, binary arithmetic

(1 QUESTIONS)

Algorithm and Flow chart.

UNIT II

C Programming : An overview of programming , Programming language classification, History of C, Features of CF, basic structure of C Programme, executing a Basic C program, compiling and linking .

(1 QUESTIONS)

Scalar data type- Declarations, Different types of integers, Different kinds of Integerconstants , Floating point types, Initialization, Mixing types Enumeration types, the void data type, Typedef, Pointers, Structure

(1 QUESTIONS)

UNIT III

Operators and expressions- introduction, arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operator , Bitwise operators, Arithmetic expressions, evalution of expression, precedence of arithmetic operators.

(1 QUESTIONS)

UNIT IV

Control flow- conditional branching, The switch statement, looping, nested loops, The "break" and "continue" statements, the go to statement, Infinite loops, Arrays and Pointers, Declaring an aray, Arrays and memory, initializing array, Multidimensional arrays.

(1 QUESTIONS)

- Programming in ANSI C, E Balaguruswamy, Second Edition , Tata- McGraw Hill Publication.
- Pundir & Pundir: Fundamental of Computer Sciences
- Bipin C . Desai : : Introduction to Detabase Management System.
- Balaswamy, Programming in C, TMH.
- V. Rajaraman, programming in C.TMH,
- Y.Kanitkar, programming in C
- S.Dey, programming in C.

SYLLABUS (Practical) : Full Marks – 30

Term work/Practical related to theory paper

Basic Program (Addition), Multiplication, Division , Subtraction of two nos Average, Simple Interest)

Progam related to If, Switch , break , Continue, loop, Array, Pointer, Structure And Function.

CORE COURSE

(Credits: Theory-04, Tutorial-01)

MAT-C-206	DIFFERENTIAL EQUATION AND SPECIAL FUNCTIONS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20^{m}1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

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SYLLABUS:

UNIT I

Introduction of generalized Hypergeometric function , Differential equation satisfied by pFq. Sclschut 'z' Theorem, whipples theorem Dixon's theorem. Integrals involving generalized Hypergeometric function, Contiguous function relations, Kummer's Theorem, Rammanujans theorem.

(2 QUESTIONS)

UNIT -II

Introduction of Hermite Polynomials. Recurrence relation. Orthogonal properties, expansion of polynomials generating function, Rodrigues formula for Hermite polynomials.

UNIT III

Introduction of Laguerre polymials , Recurrence relations, generating relating, Rodrigues formula and orthogonality. Expamry special results. Laguerre's assoiated diferential equation, More generating function.

(2 QUESTIONS)

UNIT IV

Introduction of Jacobi Polynomials generating function. Rodrigues formula and orthogonality. Introduction of Ellipite function. Properties, Weierstrass ellipite. Jacobion theta function zeros of theta function.

(2 QUESTIONS)

Reference :

- W.T. Reid. Ordinary Differential Equations, John Wiley & Sons. NY, (1971)
- E.A. Coddington and N.Levinson. Theory of Ordinary Differential Equations. Mc Graw-Hill, Ny (1955)
- Sneddon, I.N. (1961) Special Function of Mathematical Phvsics and Chemistry: Oliver and Boyd, Edinburgh.
- Morse. P.M. and H. Fash bach (1953) Methods of theoretical Physics. Part-I, Mc-Graw Hill Book, Conv. Lue.
- Labedev, N.N.(1963) Special function and their applications :Printice-Hall , Englewodd cliff. N.J.
- Bailey, W.N. (1963) Generalised Hyper geometric Cambridge Tracks in Mathematics and Mathematical Physics. Cambridge University, Press London.
- Bell. W.W. (1966) Special function for Scientific and Engineering ; D, Van Nontrand Conv. Ltd. London.
- Rainvile, E.D. (1960) Special function, Macmillan, New York.
- Pipes (1958) Applied Mathematics for Engineers, Physicists , Mc Graw Hill Book Company.
- Lance, E.L, Ordinary diffential equations.

CORE COURSE

(Credits: Theory-04, Tutorial-01)

MAT-C-207	DIFFERENTIAL GEOMETRY AND TENSOR CALCULUS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20 1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

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SYLLABUS:

UNIT I

Space curves-curvature and torsion. Serret- Frenet formula. Circular helix, the circle of curvature . Osculating sphere, Bertand curves.

(2 QUESTIONS)

UNIT II

Curves on a surface-parametric curves , fundamental magnitude , curvature of normal section. Principal directions and principal curvatures, lines of curvature, Rodrigue's formula, Dupin's theorem, theorem of Euler, Conjugate directions and Asymptotic lines.

(2 QUESTIONS)

UNIT III

One parameter family of surfaces – Evelope the edge of regression Developables associated with space curves, Geodesics-differential equation of Geodesic. Torsion of a Geodesic.

(2 QUESTIONS)

UNIT IV

Tensors, Tensor Algebra, Quotient theorem. Metric Tensor, Angle between two vectors

(2 QUESTIONS)

Reference :

- J.N. Sharma and A.R. Vasistha, Differential Geometry.
- C.E. Weatherburn , Differential geometry of three dimensions.
- P.P. Guprta & G.S. Malik . Three dimensional differential geometry.
- C.E. Weatherburn. Tensor calculus.
- R.S. Mishra , Tensor Calculus and Reinmanian Geometry

CORE COURSE

(Credits: Theory-04, Tutorial-01)

MAT-C-208	ANALYTICAL DYNAMICS AND GRAVITATION	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30[MSE: 20[in]1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

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Mid Semester Examination (MSE):
There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks .* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*
(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).
End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS:

UNIT I

Generalized coordinates Holonomic and Non-holonomic systems. Scleronomic and Rheonomic systems. Generalized Potential. Lagrange's equations of first kind. Lagrange's equations of second kind. Energy equation of conservative fields.

(2 QUESTIONS)

UNIT II

Hamilgon's variables, Hamilton canonical euations. Cyclic coordinates Routh's equations, Jacobi-Poisson Theorem. Canonical transformation and generating function.

Fundamental lemma of calculus of variations. Motivating problems of calculus of variations. Shortest distance. Minimum surface of revolution. Brachstochrone problem,

(2 QUESTIONS)

UNIT III

Hamilton's Principles, Principle of least action. Jacobi's equations. Hamilton-Jacobi equations. Jacobi Theorem. Lagrange brackets and Poisson brackets invariance of Langrange brackets and Poisson brackets under canonical transformations.

(2 QUESTIONS)

UNIT IV

Gravitation

Attraction and potential of rod, spherical shells and sphere. Laplace and Poisson equations. Work done by self attracting systems. Distributors for a given potential . Equipotential surface.

(2 QUESTIONS)

Reference :

- H. Goldstein, Classical Mechanics (2nd edition) , Narosa Publishing House, New Delhi.

SEMESTER-3

(Credits:Theory-04, Tutorial-01)

MAT-E-309	DIFFERENCE EQUATIONS OR NUMBER THEORY OR ADVANCED DISCRETE MATHEMATICS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[th] 1 Hr. + 5 Attd. + 5 signment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks .* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).

End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS: (DIFFERENCE EQUATIONS)

UNIT I

The Calculus of finite differences: Introduction of finite difference- Differences, Differences formulae and problems. Fundamental theorem of difference calculus, properties of the operators A and E, Relation between operator E of finite differences and differential coefficient D of differential calculus . One or more missing terms method I and II , Factorial notation methods of representing any polynomial . Recurrence relations, Leibnitz rule, effect of an error in a tabular value.

(2 QUESTIONS)

UNIT II

Difference equations: Introduction, definition of difference equation, solution of the differences equations, various types of linear difference equation, differential equation as limit of difference equations. Linearly independent functions. Homogenous difference equation with constart co-efficients. Homogenous linear difference equations with variable coefficients , existence and uniquencess theorem.

(2 QUESTIONS)

UNIT III

Linear difference equation with constant coefficient, method of undetermined coefficient and special operator method to find particular solution, Solution of Linear difference. Equation with constant coefficient using Variation of parameter, calculation of nth power of a matrix A, matrix method for the solution of system of linear difference equation, generating Function technique to solve linear difference equation, applications of difference equations, cobweb phenomenon.

(2 QUESTIONS)

UNIT IV

Numberical solution of partial differential equations: Boundary-value problem with boundary conditions. Laplace equations, wave equations. Heat equation

(2 QUESTIONS)

References"

- Calvin Ahlbrandt and Allan C. Peterson. Discrete Hamiltonian Systems, Difference Equations, Continued Fractions and Riccati Equations, Kluwer, Boston 1996.
- Kolman Busby and Ross, Discreate Mathematical structure, Pearsion education.
- S.Elaydi, Difference equation, springer.

OR

Syllabus (NUMBER THEORY)

UNIT I

Divisibility theory : Gretest Common divisor, Least common multiple, linear Diophantine equation, Fundamental theorem of arithmetic .

(2 QUESTIONS)

UNIT II

Congruences : Residue system, test of divisibility, linear congruencs, Chinese Ramainder theorem, polynomial congruences, application in solution of Diophantine equation, Fermat's Little theorem(FLT1), Eulers generalization of FLT1, Wilson's theorem.

(2 QUESTIONS)

UNIT III

Arithmetic functions (Eulers- $\emptyset, \sigma \; and \; \tau$) definitions, examples and their properties, perfect numbers, the Molus Inversion formula, properties of Molus function, convolution of arithmetic functions, group properties of artithmetic functions. Recurrence functions, Fibonacci numbers and their elementary properties .

(2 QUESTIONS)

UNIT IV

Quadratic Residues, Quadratic Reciproctly law, Euler's criterion, Legendre symbol and its properties, Gauss Lemma, Jacobi symbol and its properties.

Cryptography :some simple cryptosystem, Enciphering matrices, Idea of public key cryptography.

(2 QUESTIONS)

REFERENCES:

1. S.B. Malic, Basic number theory , Vikas publishing house.
2. Niven and Zuckerman, An introduction to the Theory of numbers, Wiley Publishers.
3. David Burton, Elementary Number Theory.
4. A course in Number Theory and Cryptography, N.Kobliz, Springer.
5. An Introduction to the Theory of Numbers(6^{th} edition)- I . Niven, H.S. Zuckerman and H.L. Montegomery, John Wiley and sons, Inc., New York, 2003
6. Elementary number Theory (4^{th} edition)- D.M. Burton, Universal Book Stall, new Delhi, 2002.
7. History of the Theory of Numbers (Vol. II, Diophantine Analysis)- L.E. Dickson, Chelsea Publishing Company, New York, 1971.
8. An Introduction to the Theory of Numbers (6^{th} edition)- G.H. Hardy and E.M. Wright, the English Language Society and Oxford University Press, 1998.
9. An Introduction to the theory of Numbers (3^{rd} edition)-I. Niven and H.S. Zuckerman, Wiley Easter Ltd., New Delhi, 1993.

OR

SYLLABUS: (ADVANCED DISCRETE MATHEMATICS)

UNIT

Language and grammars, Finite state machines with output, Finite state machines with no output. Finite state Machine, finite state automata, deterministic finite state automata (DFSA) non deterministic finite state automata (NDFSA), transition diagram.

(2 QUESTIONS)

UNIT II

Equivalence of DFSA and NDFSA, Moor machine, Mealy machine and Turning machine, Languages and regular expressions, language determined by finirte state automation , grammars.

(2 QUESTIONS)

UNIT III

Coloring: Vertex colouring, chromatic number, chromatic polynomial, Brooks theorem , edge colouring , chromatic index, map colouring , six colour theorem, Five colour theorem.

(2 QUESTIONS)

UNIT IV

Hamiltonian graph, Ore's theorem, Dirac' theorem, the Shortest path problem, dijkstra's algorithm. Hall's marriage theorem, transvalsal theory, Alternative proof of Hall's theorem using transversal theory, application of the Hall's theorem

(2 QUESTIONS)

References:

1. Graph theory – R.J Wilson.
2. Kolman Busby and Ross, Discreate mathematical structure, Pearsion education.
3. D.S.Malik and M.K. Sen: discrete mathematical structure:theory and application Thomson;
   Australia ; 2004
4. Edward R.Scheinerman: Mathematics A discrete Introduction; Thomson Asia Ltd.: Singapore; 2001

5. Discrete mathematical structure , R.P.Grimaldi, Pearson education \
6. J.P. Tremblay & R.Manohar, Discrete Mathematical Structures with Applications to computer Science . Mc Graw Hill Book Co. 1997.
7. J.L. Gersting , Mathematical Structures for computer Science. (3rd edition), Computer Science Press , New York.
8. Seymour Lepschutz. Finite Mathematics (International edition 1983), Mc Graw-Hill Book company, New York.
9. Narsinghdeo, Graph theory, PHI New Delhi.
10. Kolman Busby and Ross, discreate mathematical structure, pearsion education.
11. J.P.Tremblay & R. Manohar , Discrete Mathematics Structures with Applications to computer Science. Mc Graw Hill Book Co. 1997

CORE COURSE

(Credits:Theory-04, Tutorial-01)

MAT-C-310	FUNCTIONAL ANALYSIS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[th] 1 Hr. + 5 Attd. + 5 Asignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :
Mid Semester Examination (MSE):
There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks .* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*
(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).
End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS:

UNIT I

Normed linear spaces. Banach spaces and examples. Quotient space of normed linear spaces and its completeness, equivalent norms.

(2 QUESTIONS)

UNIT II

Bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples. Hahn-Banach theorem Open mapping and closed graph theorem, the natural imbedding of N in N** . Reflexive spaces.

(2 QUESTIONS)

UNIT III

Inner product spaces, Hilbert spaces, Orthonormal Sets, Bessel's Inequality Complete orthonormal sets and Parseval's Identity. Projection theorem . Rietz representation theorem Adjoint of an operator on a Hilbert space .

(2 QUESTIONS)

UNIT IV

Reflexivity of Hilbert spaces. Self-adjoint operators. Positive, normal and unitary operators. Linear transformation & linear functionals.

(2 QUESTIONS)

References

1. G.F. Simmons, Topology and modern analysis TMH.
2. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966
3. R.E. Edwards, Functional Analysis. Holt Rinehart and Winston, New York 1958.
4. C. Goffman and G.Pedrick. First Course in Functional Analysis, Prentice Hall of India. New Delhi, 1987
5. E.Kreyszig, Functional analysis with application, John wiley and sons.

CORE COURSE

(Credits:Theory-04, Tutorial-01)

MAT-C-311	PARTIAL DIFFERENTIAL EQUATION	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20^{m} 1 Hr. + 5 Attd. + 5 Asignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks .* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

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End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS:

UNIT I

Laplace equation- Fundamental solutions of two and three dimensional Laplace equation in Cartesian form. Properties of harmonic functions. Boundary value problems.

(2 QUESTIONS)

UNIT II

Heat equation –Derivation and fundamental solution of one dimensional Heat equation in Cartesian form. Application problems.

(2 QUESTIONS)

UNIT III

Wave equation- Derivation and fundamental solution of one dimensional wave euation in Cartesian form . Application problems.

(2 QUESTIONS)

UNIT VI

Solution of p.d.e. using Separation of variables, Fouriere transform and Laplace transform. Green's function and solutions of boundary value problems.

(2 QUESTIONS)

References:

1. L.C. Evans, Partial Differential Equations, Graduate Studies in Mathematics, Volume 19, AMS, 1998.
2. I.N Sneddon, Use of integrals Transforms McGraw Hill.
3. P.Prasad and R. Ravindran; Partial Differential equation.
4. K. Sankar Rio, Partial diffential eqution, new age.

CORE COURSE

(Credits:Theory-04, Tutorial-01)

MAT-C-312	FLUID MECHANICS	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[m] 1 Hr. + 5 Attd. + 5 Asignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

TIME- 3 Hrs.

Instruction to faculty members and Question Seter for :
Mid Semester Examination (MSE):
There will be Two groups of questions in written examination of 20 marks. ***Group A Is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks .* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*
(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).
End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

SYLLABUS:

UNIT I

Kinematics- Lagrangian and Eulerian methods. Equation of continuity in different coordinate system . Boundary surfaces. Stream lines. Path lines and streak lines. Velocity potential, Irrotational and rotational motions. Vortex lines.

(2 QUESTIONS)

UNIT II

Equation of Motion- Lagrange's and Euler's equations of motion. Bernoulli's theorem Equation of motion by flux method. Impulsive actions. Stream function Irrotational motion.

(2 QUESTIONS)

UNIT III

Complex velocity potential, Sources, sinks doublets and their images in two dimension. Conformal mapping. Milne-Thomson circle theorem.

(2 QUESTIONS)

UNIT IV

Two-dimensional Irrotational motion produced by motion of circular, co-axial and elliptic cylinders in an infinite mass of liquid. Theorem of Blasius. Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere. Equation of motion of a sphere

(2 QUESTIONS)

References:

- W.H.Besaint & A.S. Ramsey. A Treatise on Hydro mechanics, Part II, CBS Publishers, Delhi 1988.
- G.K. Batchelor, An Introduction of Fluid Mechanics. Foundation Books, New Delhi 1994.
- F. Chorlton, Textbook of Fluid Dynamics , C.B.S. Publishers. Delhi 1985
- Fluid mechanics – Bansal.
- Fluid dynamics, M.D. Raisinghania,S Chand publication.

SEMESTER-4

DISCIPLINE CENTRIC ELECTIVE

(Credits: Theory-04, Tutorial-01)

MAT-E-413A MAT-E-413B MAT-E-413C	A:FUZZY SETS AND THEIR APPLICATIONS B: ALGEBRAIC TOPOLOGY C: ALGEBRAIC CODING THEORY	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[in]1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

Time-3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A :is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks.* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).

End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

MAT-E-413A

FUZZY SETS AND THEIR APPLICATION

Syllabus :

UNIT I

Definitions level sets, Convex fuzzy sets, Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products. Algebraic products. Bounded sum and difference. T-norms and t-conorms. The Extension Principle. The Zadeh's extension principle. Image and inverse image of fuzzy sets . Fuzzy numbers. Elements of fuzzy arithmetic.

(2 QUESTIONS)

UNIT II

Fuzzy Relations and Fuzzy graphs- Fuzzy relations on fuzzy sets, Composition of fuzzy relations. Fuzzy relation equations. Fuzzy graph, Similarity relation.

(2 QUESTIONS)

UNIT III

Possibility Theory- Fuzzy measures. Evidence theory. Necessity measure, Possibility measure, Possibility distribution, Possibility theory and fuzzy sets, Possibility theory versus probability theory Fuzzy Logic . An overview of classical logic , Multivalued logics, Fuzzy propositions Fuzzy quantifiers, Linguistic variables and hedges, Inference from condition Fuzzy propositions. the compositional rule of inference.

(2 QUESTIONS)

UNIT IV

An Introduction to Fuzzy Control-Fuzzy controllers. Fuzzy rule base. Fuzzy inference engine Fuzzification. Defuzzification and the various defuzzification methods (the center of area, the center of maxima and the mean of maxima methods). Decision making in Fuzzy Environment-Individual decision making, Multiperson decision making Multicriteria decision making , Multistage decision making. Fuzzy ranking methods, Fuzzy linear programming.

(2 QUESTIONS)

Reverences:

- H.J.Zimmermann : Fuzzy set theory and its Applications. Allied Publishers Ltd. New Delhi 1991
- G.I. Klir and B. Yuan-Fuzzy Set and Fuzzy logic, Prentice- Hall of India , New Delhi, 1995.

Or.

MAT—E- 413 B (ALGEBRAIC TOPOLOGY)

SYLLABUS:

UNIT I

Fundamental group functo, homotopy of maps between topological spaces, homotopy equivalence , contractible and simply connected spaces, fundamental groups of S^1 and $S^1 \times S^1$ etc.

(2 QUESTIONS)

Calculation of fundamental group of S^n,N>1 using Van Kampen's theorem, fundamental groups of a topological group. Brouwer's fixed point theorem, fundamental theorem of algeb'a vector fields on planner sets, Frobenius theorem for 3 x 3 matrices.

(2 QUESTIONS)

UNIT II

Coverning spaces, unique path lifting theorem, covering homotopy theorems, group of covering transformations, criteria of lifting of maps in terms of fundamental groups, universal covering , its existence , special cases of manifolds and topological groups.

Singular homology, reduced homology, Eilenberg Steenrod axioms of homology (no proof for homotopy invariance axiom decision axiom and exact segnence axiom) and theory application relation between fundamental group and first homology.

(2 QUESTIONS)

UNIT III

Calculation of homology of S^n , Brouwer's fixed point theorem for $f : E^n > E^n$, application spheres, vector fields. Mayer- Vietoris sequence (without proof) & its application, Singular cohomology modules, Kronecker product , connecting homomorphism, contra-functoriality of singular cohomology , modules, naturality of connecting homomorphism, exact chomology sequence of pair, homotopy invariance, excision properties, cohomology of a point Mayer vietoris sequence and its application in computation of cohomology of S^n, RP^n, CP^n torus, compact surface of genus and non-orientable compact surface.

(2 QUESTIONS)

UNIT IV

Compact connected 2-monifolds, their orientability and non-orientability, examples connected sum, construction of projective space and Klein's bottle from a square, Klin's bottle as union of two Mobius strips, canonical of sphere, torus and projective plannes, Klin's bottle as union of two Mobius strips, triangulation of compact surfaces

Classification theorem for compact surfaces, connected sum of tours and projective plans as the connected sum of three projective planes. Euler characteristic as a topological invariant of compact surfaces, connected sum formula, 2- manofolds with boundary and their classifications, Euler characteristic of a bordered surface, models of compact bordered surfaces in R^3.

(2 QUESTIONS)

Roferoncos :

- James R. Munkres, Topology – A first Course , Prrentice hall of India Pvt, Ltd. New Delhi , 1978.

Or.

MAT—E- 413 C (ALGEBRAIC CODING THEORY)

SYLLABUS:

UNIT I

Coding theory, Introducting, examples, Important code parameters, Correcting and detecting errors, Sphere-packing bound, Gilbert-Varshamov bound, Sigleton bound

(2 QUESTIONS)

UNIT II

Linear codes: Vector spaces over finite fields, Linear codes, Binary linear, Hamming weight, Bases of linear codes, Generator matrix and parity check matrix

(2 QUESTIONS)

UNIT III

Equivalence of linear codes, Encoding with a linear code, Decoding of linear codes, cosets, Nearest neighbor decoding for linear codes, Syndrom decoding.

(2 QUESTIONS)

UNIT IV

Cyclic codes: Definitions, Generator and parity check polynomials, Generator and parity check, matrices, Decoding of cyclic codes, Burst-error-correcting codes, Read Solomon codes.

(1 QUESTION)

Some special cyclic codes:BCH codes, RS codes, Definitions, Parameters of BCH codes, Decoding of BCH codes, Reed-Muller Code, Maximum-distance Separable (MDS) Codes Generator and Parity-check matrics

Of MDS Code, Weight Distribution of MDS Code, MDS codes from RS codes, Code derived from Hadamard Matrices.

(1 QUESTION)

References:

1. R.Hill, Afirst course in codding theory, oxford university press.
2. F. Macwwilliams and N.Sloane, The Theory of error correcting codes, North Holland Publishing company, Amsterdom.
3. San Lining and Chaoing xing, Coding theory-A First Course.
4. Appliced Abstract Algebra-Lid and Pilz 2nd Ediction.
5. Todd K. Moon, Error Correction Coding, Wiley India.
6. Steven Roman, Coding and Information theory, Springer-Verlag.
7. Algebraic codign theory, E.r.Berlekamp
8. Error Correcting coding Theory, Man Young Rhee
9. Error-correcting codes, w.w.Peterson and E.J. Weldon, Jr.
10. Algebraic coding Theory, E.R. Berlekamp.

DISCIPLINE CENTRIC ELECTIVE
(Credits: Theory-04, Tutorial-01)

MAT-E-414A MAT-E-414B MAT-E-414C	A:MACHANICS OF SOLIDS B: OPERATIONS RESEARCH C: INFORMATION THEORY	Theory: 60 Hours; Tutorial:15 Hours
Marks: 30(MSE: 20[1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		Pass Marks (MSE:17+ESE:28)=45

Time-3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks.* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<xz90, 4 marks;90<Attd, 5 marks).

End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

MAT-E-414A : MECHANICS OF SOLIDS

SYLLABUS :

UNIT I

Analysis of Strain-Affine transformation . Infinite simal affine deformation, Geometrical interpretation of the components of stain, Strain quadric of Cauchy, Principal strains and invariants , General infinite simal deformation, Saint-Venant's equations of Compatibility, Finite deformations.

(2 QUESTIONS)

UNIT II

Analysis of Stress- Stress tensor, Equations of equilibrium, Transformation of coordinates, Stress qudric of Cauchy, Principal stress and invariants, Maximum normal and shear stresses.

(2 QUESTIONS)

UNIT III

Equations of Elasticity, Generalized Hooke's law, Homogeneous isotropic media, Elasticity moduli for isotropic media, Elasticity moduli for istropic media, Equilibrium and dynamic equations for an isotropic elastic solid, Strain energy function and its connection with Hooke's law. Uniquencess of solution Beltrami-Michell compatibility equations, Saint-Venant's principle. Torsion-torsion of cylindrical bars, Tortional rigidity. Torsion and stress functions. Lines of shearing stress. Simple problem-Plane strees. GFeneralized plane stress. Airy stress function. General solution of Biharmonic equation. Stresses and displacements in terms of complex potentials. Simple problems. Stress function appropriate to problems of plane stress problems of semi-infinite solids with displacements or stresses prescribed on the plance boundary .

(2 QUESTIONS)

UNIT IV

Waves-Propagation of waves in an istropic elastic solid medium. Waves of dilation and distortion. Plane waves. Elastic surface wages such as Rayleigh and Love waves.

Variational methods- theorems of minimum potential energy . theorem of minimum complementary energy. Reciprocal theorem of Betti and Rayleigh. Deflection of elastic string central line of a beam and elastic membrance. Torsion of cylinders. Variational problem related to biharmonic equation. Solution of Euler's equation by Ritz. Galerkin and Kantorovich method.

(2 QUESTIONS)

References :

- I.S.Sokolnikoff, Mathematical Theory of Elasticity. Tata McGraw-Hill Publishing Company Ltd., New Delhi 1977.
- A.E.Love. A Treatise on the Mathematical theory of Elasticity. Cambridge University Press, London 1963
- Y.C.Fung Foundations of Solid Mechanics, Prentice hall, New Delhi, 1965
- S. Timoshenko and N. Goodier, Theory of Elasticity, McGraw Hill, New York, 1970.

OR.

MAT—E- 414 B (OPERATIONS RESEARCH)

SYLLABUS:

UNIT I

Sequencing : Introduction , sequencing problem with n-jobs and two machines, optimal sequencing problems with n-jobs and three machine, Problems with n-jobs and m-machine, graphical solution.

(2 QUESTIONS)

UNIT II

Replacement Problems: Introduction, replacement of item that Deteriorate with time. Replacement of items whose maintenance costs change with time and the value of money remains same during the period. Replacement of items whose maintenance costs increase with time and the value of money also changes with time , replacement of items that fails completely, individual replacement policy , group replacement policy.

Queuing theory: Introduction, characteristics of queuing sytem, queue discipline, symbols etc Poisson process and exponential distribution, properties of Poisson process, classification of queues, definition of transient and steady state, model (M/M/L) (D/fl Fo), (M/M/1) (SIRO) (M/M/I)(MFIFO).

(2 QUESTIONS)

UNIT III

Non-Linear programming – Introduction, definitions of general non-linear programming problems, problems of constrained maxima and minima ; necessary and sufficient conditions for non-linear programming problems, Hessian-matrix, Lagrangian functions with Lagrangian multiplier. Constraints are not all equality constraints, sufficiency of saddle point problem, Kuhn-Tucker condition

(2 QUESTIONS)

UNIT IV

Non-linear programming techniques- Introduction of GMPP & GN I PP its sanction by Wolfe's method, Beale's method.

(2 QUESTIONS)

References :

- F.S.Hillier and G.J. Lieberman, Introduction to Operations Research (Sixth Edition). McGraw Hill International Edition, Industrial Engineering Series, 1995 (This books comes with a CD containing tutorial software)
- G.Hadley, Linear Programming, Narosa Publishing House, 1995,
- G. Haadly, Nonlinear and Dynamic Programming, Addisor-Wisely, Reading Mass
- Kanti Swarup, P.K.Gupta and man Mohan, Operations Research , Sultan Chand & sons, New Delhi
- S.S. Rao, Optimization theory and Applications . Wiley Eastern Ltd., New Delhi.
- Prem Kumar Gupta and D.S.Hira, Operations Research-An Introduction, S.Chand & company Ltd. New Delhi.
- H.A.Taha, Operations research, Prentice Hall India, 1997.

OR.
MAT—E- 414 C INFORMATION THEORY: (ALGEBRAIC TOPOLOGY)

SYLLABUS:

UNIT I

Measures of information , Axioms for a measure of uncertainty , The Shannon entiopy and its properties, joint and conditional entropies. Transformation and its properties.

Noiseless coding – ingredients of noiseless coding problem, Uniquely decipherable codes Necessary and sufficient condtion for the existence of instanneous codes, Construction of optimal codes.

(2 QUESTIONS)

UNIT II

Discrete memory less channel. Classification of channels, Information processed by a channel Calculation of channel capacity, Decoding schemes, The ideal observer, the fundamental theorem of Information theory and its strong and weak converses.

(2 QUESTIONS)

UNIT III

Continuous channels- The time-descrete Gaussian channel, Uncertainty of an absolutely continuous random variable, the converse to the codign theorem for time-discrete Gaussian channel. The time-continuous Gaussian channel. Band-limited channels.

(2 QUESTIONS)

UNIT IV

Information functions, the fundamental equation of information, information functions continuous at the origin, nonnegative bounded information functions, measurable information functions and entropy. Axiomatic characterizations of the Shannon entropy due to 'I'verberg and Leo. The general solution of the fundamental equation of information. Derivations and their role in the study of information functions.

The branching property, Some characterizations of the Shannon entropy based upon the branching property. Entropies with the sum property. The Shannon inequality . Sub additive additive entropies.

(2 QUESTIONS)

References :

- R.Ash. Information Theory, Inter science Publishers , new York 1965.
- F.M. Reza, An introduction to information theory. Mc Graw-Hill Book company inc. 1961.
- J. Aczel and Z Daroczy, On measures of information and their characterizations Academic press , New York .

DISCIPLINE CENTRIC ELECTIVE
(Credits: Theory-04, Tutorial-01)

MAT-E-415A **MAT-E-415B** **MAT-E-415C**	**A:INTEGRAL TRANSFORMS** **B: MATHEMATICS OF FINANCE AND INSURANCE.** **C: APPLIED STATISTICS**	**Theory: 60 Hours;** **Tutorial:15 Hours**
Marks: 30(MSE: 20=1 Hr. + 5 Attd. +5 Assignment)+70(ESE:3Hrs)=100		**Pass Marks (MSE:17+ESE:28)=45**

Time-3 Hrs.

Instruction to faculty members and Question Seter for :

Mid Semester Examination (MSE):

There will be Two groups of questions in written examination of 20 marks. ***Group A is compulsory*** *and will contain five questions of* ***multiple type questions*** *consisting of 1 mark each* ***Group B will contain descriptive type five*** *questions of five marks each, out of which any three are to be answered. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks.* ***"Best of Two"*** *shall be applicable for computation of marks for SIA.*

(Attendance Upto 75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;90<Attd, 5 marks).

End Semester Examination (ESE): *There will be two groups of questions . Group A is compulsory and will contain two questions. Question No. 1(A) will be multiple type questions consisting of six questions of 1 mark each . Question no. 1(B) will be two short answer type of 4 marks. Group B will contain descriptive type eight questions of fourteen marks each, out of which any four are to be answered.*

MAT-E-415A (INTEGRAL TRANSFORMS)

SYLLABUS :

UNIT I

Fundamental Formulae- The Laplace Transform-Definition Regionof convergence, abscissa of convergence, absolute convergence, Uniform convergence of Lapsace Transform , Complex Inversion formula.

The Stieltje transform-Elementary properties of the transform, Relation to the Laplace transform . complex Inversion formulae.

(2 QUESTIONS

UNIT II

The Fourier transform : Dirichlet's conditions, Definition of Fourier transform. Fourier Sine Transform, Fourier cosine transform , Inversion theorem for complex fourier transform Definition of convolution and convolution theorem for Fourier transforms, Parseval's identity of Fourier Transforms.

(2 QUESTIONS)

UNIT III.

The Mellin transform: Definition of Mellin transform and its properties, Mellin transforms of derivatives and certain integral expressions.

(2 QUESTIONS)

UNIT IV

Hankel Transform: Definition of Hankel transform and its elementary properties. Inversion formula for the Hankel transform, Hankel transform of derivatives, Parseval's theorem.

(2 QUESTIONS)

References:

1. The Laplace Transforms - D.V.Widder
2. Use of Integral Transforms- Sneddon

OR

MAT-E-415B (MATHEMATICS OF FINANCE AND INSURANCE)

SYLLABUS:

UNIT I

Prerequisite – Application of Mathematics and Finance & Insurnace Optional Paper BMG (304 (a & b) F)

Financial Derivatives- An Introduction: Types of Financial Derivatives – Forwards and Futures :Options and its kind : and SWAPS.

The Arbitrage Theorem and Introduction to portfolio Selection and Capital Maket Theory Static and Continuous – Time Model

(2 QUESTIONS)

UNIT II

Pricing by Arbitrage – A Single – Period Option Pricing Model:Multi Pricing

Model-Cox-Ross-Rubinstein Model : Bounds on Option Prices .

The Dynamics of Deriveitive prices -Stochastic Differential Equations (SDEs)- Major Models of SDEs. Lonear Constant Coefficient SDEs: Geometric SDEs: Square Root Process:Mean Reverting Process and Omstein-Uhlenbeck Process.

Martingale Measure and Risk-Neutral Probabilities: Pricing of Binomial Options with equivalent martingale measures.

(2 QUESTIONS)

UNIT III

The Black-Scholes Option Pricing Model – Using no arbitrage approach, limiting case of Binomial Option Pricing and Risk-Neutral probabilities. The American Option Pricing – Extended Trading Strategies; Analysis of Amerivan Put Options: early exercise premium and relation to free boundary problems. Concepts from Insurance: Introduction: The Claim Number Process : The Claim Size Process : Solvability of the Portfolio: Reinsurance and Ruin Problem, Premium and Ordering of Risks-Premium calculation Principles and Ordering Distributions.

(2 QUESTIONS)

UNIT IV

Distributions of Aggregate Claim Amount- Individual and Collective Model: Compound Distributions : Claim Number of Distributions: Recursive Computation Methods:Lundberg Bounds and Approximation by Compound Distributions, Risk Processes- Time-Dependent Risk

(2 QUESTIONS)

Models : Poisson Arrival Processes: Ruin Probabilities and Bounds Asymptotic and Approximation .Time Dependent Risk Models-Ruin Problems and Computation of Ruin Function : Dual Queuing Model: Risk Models in Continuous Time and Numerical Evalution of Ruin functions.

(2 QUESTIONS)

References:

- John C. Hull, Options, Futures and other derivatives, Prentice hall of India Pvt. Ltd.
- Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.

OR

MAT-E-415 C (APPLIED STATISTICS)

SYLLABUS:

UNIT I

Demand analysis price elasticity and demand, partial elasticity of demand , Lonting's method. Pigou's method, engle's curve and Engle's law, Paretv's law of Income distribution , curves of concentration.

(2 QUESTIONS)

UNIT II

Analysis of Variance, One way classification, statistical analysis of the mode ,Design experiment statically analysis of C.R.D.(Completely randomized design) least square estimates of effects exception of sum of squares, randomized block design (R.B.D)-statistical analysis of R.B.D. for one observation per experiment unit. Variance of estimates, expectation of sum of squares efficiency of R.B.D. relative to C.R.D.

(2 QUESTIONS)

UNIT III

Design of sample survey, principle steps in a simple survey sampling and non-sampling and non- sampling error. Types of sampling, selection of a simple random sample, simple random sampling, stratified random sampling.

Psychological and educational statistics – scaling of scores on a test , percentile scores, claming of rankings, scaling of normal probability curve scaling of rating in terms of normal curve realibility of test scars, error variane, index of reliability, parallel test method of determing test reliability.

(2 QUESTIONS)

UNIT IV

Vital Statistics – uses of vital statistics , Method of obtaining vital

Statistics measurement of population, measurement of mortality, crude death

rate (C.D.R.) specific death rate (SDR) specific rate . Life table or (Mortality

table) abrided life table, fertility measurement of population growth.

(2 QUESTIONS)

References :

- Fundmental of Applied statistics – S.C.Gupta & V.K.Kappor
- Statical Method - S.P.Gupta .
- An Introduction to Statistical Method - S.B.Gupta

CORE COURSE

(DESSERTATION / PROJECT ON ANY ONE OF SPECIAL PAPER)

(Credits: 05)

MAT-D-416	MSE : 30 MARKS + ESE: 70 MARKS =100 Marks	PASS MARKS: (MSE17+ESE28=45)

Time-3 Hrs.

Mid Semester Examination (BSE): There will be **Two** groups of questions in written examinations of **30 marks. Group A is compulsory** and will contain ten questions of **multiple type questions** consisting of 1 **mark each.** Group B **will contain** descriptive type eight questions of **Five** marks each, out of which any **four** are to be answered.

Board topics of the syllabus are as under:

Introduction of Research Methodology: Meaning of Research , Objective of Research, Research Methods.

Types of Research:Descriptive vs. Analytical Research, Applied Vs. Fundamental Research Problem, Hypothesis, Research Questions, Research Methodology.
Data Collection: Primary and Secondary Data, Sampling Method, Observation Method, Interview Method, Questionnaires, Case Study Method, Historical Method, Processing and Analysis of Data, Interpretation of Data/Results, Conclusions / Findings.

Research Writing :Synopsis, Article/Research Paper, Research Project, Thesis, Dissertation, Book , Book-Review, Case Review, Criteria of Good Research , Plagiarism.

Citation Style & Methods : MLA, APA, Foot Note, Text Note, End Note, Footnotes, Bibliography, References.

Reference Books:

a) Best and Kahn, Research Methodology, PHI Limited .
b) Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.

End Semester Examination (ESE)

DISSERTATION/PROJECT/ PAPER PRESENTATION

- Student alone or in a group of not more than fine, shall undertake one project, approved by the subject Teacher/ H.O.D. of the Department/ College Concerned . The progress of the project shall be monitored by the faculty members at regular intervals

OR

- **PROJECT ON ANY OF SPECIAL PAPER**

DISTRIBUTION OF CREDITS FOR P.G. PROGRAMME (SEMESTER-WISE) FOR POSTGRADUATE P.G.Voc./M.Sc./M.A./M.Com' PROGRAMME

Table B-1: Semester wise distribution of 80 Credits for Subjects with Practical Papers.

Semester	CC	FC	GE/DC	AE	Total credits
Semester I	15	05			20
Semester II	20				20
Semester III	15			05	20
Semester IV	5		15		20
	55	**05**	**15**	**05**	**80**

Table B-1: Semester wise distribution of 80 Credits for Subjects without Practical Papers

Semester	CC	FC	GE/DC	AE	Total credits
Semester I	15	05			20
Semester II	20				20
Semester III	15			05	20
Semester IV	10		10		20
	60	**05**	**10**	**05**	**80**

CC= Core Course; FC-Foundation Compulsory/Elective Course; GE=Generic Elective, SE-Skill Enhancement Course; DC-Discipline Centric Elective .

Session 2020-22

SAMPLE CALCULATION FOR SGPA &CGPA FOR POSTGRADUATE'P.G. Voc./M.Sc./M.A/M.Com' PROGRAMME

Table B-2: Sample Calculation for SGPA for M.Sc/M.A./M.Com Programme

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit X Grade)	SGPA (Credit Point/Credit)
Semester I					
FC	05	A	8	40	
C-1	05	B+	7	35	
C-2	05	B	6	30	
C-3/CP	05	B	6	30	
Total	20				6.60(135/20)
Semester II					
C-4	05	B	6	30	
C-5	05	C	5	25	
C-6	05	B+	7	35	
C-7/CP	05	A+	9	35	
Total	20			135	6.60(135/20)
Semester III					
EC-1	05	A+	9	45	
C-8	05	O	10	50	
C-9	05	A	8	50	
C-10/CP	05	A	8	40	
Total	20			175	8.75(175/20)
Semester IV					
EC-2/EC-2	05	B	6	30	
EC-3/EC-3	05	A+	9	45	
C11/EP	05	B	6	30	
Project	05	A+	9	45	
Total	20			150	7.50(150/20)
CGPA					
Grand Total	80			595	7.44(595/80)

Table B-3: Sample Calculation for CGPA for M.Sc/M.A./M.Com Programme

Semester I	Semester II	Semester III	Semester V
Credit :20;SGPA:6.60	Credit :20;SGPA:6.60	Credit :20;SGPA:8.75	Credit :20;SGPA: 7.50

Thus CGPA=(20 x 6.60+20 x 6.60+20 x 8.75+20x7.50) /80=7.36

Session 2020-22

DISTRIBUTION OF MARKS FOR EXAMINATIONS AND FORMAT OF QUESTION PAPERS

Distribution of Marks for Mid Semester Evaluation:

Tale No. 15: distribution of marks of theory Examinations of Mid Semester

Topic	Code	Full Marks	Pass Marks	Time	Group-A (Very short answer type Compulsory Questions) No.of Questions x Marks=P.14	Group-B (Descriptive Questions) No. of Questions x Marks-F.M	Total No. of Question to Set Group	
							Group A	Group B
Mid Sem*	T300	30 (20+5+5)	17	1 Hr.	5 x 1=5	3(out of 5) x 5=15	05	5

- There shall be 20 marks theory examination for mid sem, 05 marks for attendance / regular interactions & 05 marks for seminar/assignment/ term paper given by faculty concerned in classrooms.

Distribution of Marks for En d Semester theory Examinations

Tale No. 16: distribution of marks of theory Examinations of End Semester

Topic	Code	Full Marks	Pass Marks	Time	Group-A (Very short answer type Compulsory Questions) No.of Questions x Marks=P.14	Group-B (Descriptive Questions) No. of Questions x Marks-F.M	Total No. of Question to Set Group	
							Group A	Group B
End Sem	T30^0	50	-	3 Hrs	2 x 5=10	2(out of 3) x 20=40	2	5
	T70	70	28	3 Hrs.	Q.No.1(5x1)+1x5=10	4(Out of 6) x 15=60	2	6

Question No.1 in Group-A carries very short answer type questions of 1 marks

Note: There may be subdivisions in each question asked in Theory Examinations.

Session 2020-22

Format of question Paper of Mid-Semester Theory Examination

Binod Bihari Mahto Koyalanchal University, Dhanbad

Mid-Semester Examination xxxx (Session: xxxx-xx)

Subject/Code:

Full Marks: 20 Pass Marks: 08 Time: 1.5 Hours

General Instructions:

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

Answer any five questions of the following in which Q.1 is compulsory.

Group A

1. **Multiple Choice Questions** **(1x5=05)**
   - (i) .....
   - (ii) .....
   - (iii) .....
   - (iv) .....
   - (v) .....

Group B

(Descriptive answer type questions)

Answer any three of the following. (5x3=15)

2. .....
3. .....
4. .....
5. .....
6. .....

.....x.....

*Note: The Mid Semester Examination shall have three components, (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score of 5 marks and (c) Day to Day & Extracurricular activities of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.*

(Attendance Upto75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

Format of question Paper of End-Semester Theory Examination

Binod Bihari Mahto Koyalanchal University, Dhanbad

End-Semester Examination xxxx (Session: xxxx-xx)

Subject/Code:

Full Marks: 70 Pass Marks: 28 Time: 3Hours

General Instructions:

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

Answer any five questions of the following in which Q.1 is compulsory.

Group A

1. (A) Multiple Choice Questions (1x6=06)
   - (i) .....
   - (ii) .....
   - (iii) .....
   - (iv) .....
   - (v) .....
   - (vi) .....

   (B) Short answer type questions (4x2=08)
   - (a) .....
   - (b) .....

Group B

(Long answer type questions)

Answer any four of the following. (14x4=56)

2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....
9. Short notes type questions (7x2=14)
   - (a) .....
   - (b) .....
   - (c) .....
   - (d) .....