

**UNIVERSITY DEPARTMENT OF  
MATHEMATICS**

**SIDO KANHU MURMU UNIVERSITY, DUMKA**

**CBCS PATTERN SYLLABUS**

**W.E.F. SESSION: 2020-2022**



**M. Sc / M. A. MATHEMATICS**

**UNIVERSITY DEPARTMENT OF MATHEMATICS, SIDO KANHU MURMU UNIVERSITY,  
DUMKA**

**CBCS PATTERN SYLLABUS (P.G. LEVEL) W.E.F SESSION: 2020-2022**

Semester-wise distribution of Courses, Credits, Lectures and Marks:

<b>Semester-I</b>						
Course Code	Title	Credits	Lectures/Week		Max. Marks	
			Lecture	Tutorials	Univ. Exam	Sessional
FCMATH 01	Foundation Course In Modern Algebra	5	5(L)	1(T)	70	30
CCMATH 02 (CC= Core Course)	Real Analysis	5	5(L)	1(T)	70	30
CCMATH 03	Complex Analysis	5	5(L)	1(T)	70	30
CCMATH 04	Metric and Topology	5	5(L)	1(T)	70	30
<b>Total</b>		<b>20</b>	<b>20</b>	<b>4</b>	<b>280</b>	<b>120</b>

(Dr.S.N.Adhikary)  
**Head, Univ. Deptt.  
of Mathematics &  
Chairman**

(Dr. M. R. Hassan)  
**Head, Dept. of Maths.  
S.M.College, Bhagalpur  
T.M.Bhagalpur Univ. Bihar  
External Expert**

(Dr.N.K.Singh)  
**Member**

(Dr.D.N.Garain)  
**Member**

(Dr. Ziaul Hoque)  
**Member**

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Semester-wise distribution of Courses, Credits, Lectures and Marks:

<b>Semester-II</b>						
Course Code	Title	Credits	Lectures/Week		Max. Marks	
			Lecture	Tutorials	Univ. Exam	Sessional
ECMATH 05 (Skill Enhancement Course)	Computer C++ and MAT LAB	5	5(L)	1(T)	70	30 (Practical)
CCMATH 06	ODE, PDE and Integral Equation	5	5(L)	1(T)	70	30
CCMATH 07	Analytical Dynamics & Calculus of Variation	5	5(L)	1(T)	70	30
CCMATH 08	Numerical Analysis & Theory of Numbers	5	5(L)	1(T)	70	30
Total		20	20	4	280	120

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Semester-wise distribution of Courses, Credits, Lectures and Marks:

Semester-III						
Course Code	Title	Credits	Lectures/Week		Max. Marks	
			Lecture	Tutorials	Univ. Exam	Sessional
OEC 09 (For Phy/Chem/Bot/ Zool Students)	Tensor Calculus & Integral Transform	5	5(L)	1(T)	70	30
CCMATH 10	Measures Theory & Functional Analysis	5	5(L)	1(T)	70	30
ECMATH 11(A) 11(B)	Any one of the following: A. Advanced Discrete Maths B. Optimization Technique	5	5(L)	1(T)	70	30
ECMATH 12(A) 12(B)	Any one of the following: A. Fluid Dynamics B. Probability & Statistics	5	5(L)	1(T)	70	30
Total		20	20	4	280	120

Note: OEC means OPEN ELECTIVE COURSE

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Semester-wise distribution of Courses, Credits, Lectures and Marks:

<b>Semester-IV</b>						
Course Code	Title	Credits	Lectures/Week		Max. Marks	
			Lecture	Tutorials	Univ. Exam	Sessional
ECMATH 13	Special Function & Integral Transform	5	5(L)	1(T)	70	30
ECMATH 14(A) 14(B) 14(C)	Any one of the following: A. Space Dynamic B. Advanced Functional Analysis C. Fuzzy Set Theory	5	5(L)	1(T)	70	30
ECMATH 15(A) 15(B) 15(C)	Any one of the following: A. Relativity & Cosmology B. Advanced Topology C. Mathematics of Finance & Insurance	5	5(L)	1(T)	70	30
Math 16	DISSERTATION PROJECT on Any one of the Special Paper	5	10		80 (Written)	20 (Viva)
<b>Total</b>		<b>20</b>	<b>25</b>	<b>3</b>	<b>290</b>	<b>110</b>

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**CBCS PATTERN SYLLABUS**

**W.E.F. SESSION: 2020-2022**



**M. Sc / M. A. MATHEMATICS**

**SEMESTER – I**

**(DETAILS DESCRIPTION)**

**UNIVERSITY DEPARTMENT OF MATHEMATICS, SIDO KANHU MURMU  
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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - I**

COURSE CODE – FCMATH 01

TITLE – FOUNDATION COURSE IN MODERN ALGEBRA

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions be set, out of which candidates are required to answer 5 Questions. Question No- 1 is Compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I. GROUP :**

Cayley's Theorem, class equation, maximal subgroups, Composition series of a group and Jordan – Holder Theorem, Solvable groups, Commutator subgroups of a group, Direct product, External and internal Direct products, Cauchy's Theorem on abelian groups, Cauchy's Theorem, Sylow's Theorem.

(2 Questions )

**UNIT – II. RING :**

Ring, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain,

Euclidean domain, Polynomial rings and irreducibility criteria, Fields, Finite fields, Field extension, Galois

Theory.

(2 Questions )

**UNIT – III. VECTOR SPACE :**

Vector Spaces, subspaces, linear dependence, basis, Dimension, Algebra of linear transformations, matrix

representation of linear transformations, change of basis, canonical forms, diagonal forms, triangular form, Jordan form.

( 2 Questions )

**UNIT – IV MODULES :**

Modules, submodules, Direct sum of submodules, Homomorphism of modules, Quotient modules, cyclic modules, Fundamental Theorem on finitely generated modules over Euclidean rings.

(2 Questions )

**REFERENCES :**

- Basic Algebra : P. B. Bhattacharya, S. K. Jain and S. R. Nagpal  
Modern Algebra : A. R. Vasistha  
Topics in Algebra : I. N. Herstein (Willey Eastorbltd )  
Algebra : M. Artin( Prentice Hall – India )  
Algebra : P. M. Cohn (Johnwiley& sons )



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**CBCS PATTERN SYLLABUS (P. G. LEVRL) W.E.F. SESSION: 2020-2022**

**SEM - I**

COURSE CODE – CCMATH 02, (CC = Core Course)

TITLE – REAL ANALYSIS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Question will be set, out of which candidates are required to answer 5 Questions. Question No- 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Real number system as a complete ordered field, Archimedean property, Supremum, infimum, Bolzano Weisstrass Theorem, Heine Borel Theorem, Continuity, Uniform Continuity, Differentiability, Mean Value Theorem.

(2 Questions )

**UNIT – II**

Sequence and series of functions, Pointwise and Uniform convergence, Cauchy criterion uniform convergence, Weierstrass M-test, Abel's and Dirichlet's test for uniform convergence, Uniform convergence and differentiation, Weierstrass approximation Theorem.

(2 Questions )

**UNIT – III Riemann ( Stieltjes ) Integral :**

Partition, Refinement, Riemann Integral, Riemann – Stieltjes Integral, Riemann sum associated with Partition P, Fundamental Theorem of Integral calculus, First meanvalue Theorem, Riemann criterion, Darboux Theorem, Lebesgue – Vitali Theorem, Improper Riemann Integral, Euler Theorem, Types of Improper Integrals and Their Convergence, divergence, absolute convergence, Conditional convergence conditions.

(2 Questions )

**UNIT – IV**

Function of Several real Variables , Notion of neighbourhood of a point in the Euclidean Space, Inner limit, simultaneous limit and Repeated limit and Continuity, Differentiation for real functions of Several real Variables and of Vector Valued functions, partial derivative, derivative as a linear transformation. (2 Questions)

**REFERENCES :**

Mathematical Analysis	:	S. C. Malik &SabitaArora
Mathematical Analysis	:	Apostol
Real Analysis	:	J. N. Sharma
Mathematical Analysis	:	Walter Rudin

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - I**

COURSE CODE – CCMATH 03

TITLE – COMPLEX ANALYSIS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Analytic function, conjugate and harmonic function, Cauchy – Riemann equation ( in both forms ), NASC for a

Function to be analytic, construction of an analytic function, Relevant problems.

Complex Integration, Complex line integral, Cauchy's Goursat Theorem, Cauchy's integral formula, Higher order derivatives, Morera's Theorem, Cauchy's inequality and Liouville's Theorem, Poisson's integral formula.

Mobius Transformation, path, Smooth path, Piecewise Smooth, Angle between paths, Angle preservation property, Conformal mappings, Linear fractional transformation, Mobius-Transformation, Translation, Inversion, Dilation, Rotation, cross ratio, Symmetric points, Orientation and related Theorems, Symmetric principle, Orientation principle,  
( 2 Questions )

**UNIT – II**

Power Series representation of an analytic function, Absolute convergence of a power series, Radius of Convergence and sum function of a power series, Taylor's Theorem, Laurent's Theorem, Relevant problems.

(2 Questions )

**UNIT – III**

Zero of a function, order of zero, Singularities of an analytic function, Types of Singularities, poles and zeros, Limiting point of zeros and poles, Riemann's Theorem on removable Singularities, Weierstrass's Theorem, Relevant problems.

Calculus of Residue at a pole, Residue at infinity, Cauchy's Residue Theorem, Computation of residue at finite Pole, Jordan's Lemma, Evaluation of real definite integrals by contour integration,

Integration round unit circle, Evaluation of integral, Evaluation of integral of type  $\int_{-\infty}^{\infty} f(x)dx$  when no pole of  $f(z)$  lies on the real line.

(2 Questions )

#### UNIT – IV

Integrals of the form  $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx dx$  or  $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx dx$  when  $m > 0$ .

Indenting the contours having poles on real axis, Integration involving many Valued functions, Quadrant and Sector contours.

( 2 Questions )

#### REFERENCES :

- |                                   |   |  |
|-----------------------------------|---|--|
| Introduction to Complex Analysis  | : | H. A. Priestly ( Clarendon press, Oxford, 1990 ) |
| Functions of one Complex Variable | : | J. B. Conway ( Narosa publishing House, 1980 )   |
| Real & Complex Analysis           | : | Walter Rudin ( MC Graw Hill Book Co. 1966 )      |
| Foundations of Complex Analysis   | : | S. Ponnusamy ( Narosa publishing House, 1997 )   |
| Complex Function Theory           | : | D. Sarason ( Hindustan Agency, Delhi – 1994 )    |
| Complex Variable                  | : | J. N. Sharma                                     |
| Complex Variable                  | : | Goel & Gupta                                     |

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CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022

SEM - I

COURSE CODE – CCMATH 04

TITLE – METRIC AND TOPOLOGY

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

UNIT – I. **Metric Space :**

Convergent and Cauchy sequences, complete metric spaces.

Cantor Intersection Theorem, Baire's Category theorem, contraction mapping, Banach fixed point Theorem, Continuity, Completeness and Connectedness.

(2 Questions )

UNIT – II **Topological Space. :**

Definition and examples of topological spaces, open sets, closed sets, neighbourhood, Limit points, Derived sets, Closure and Interior of a set, comparison of topologies. Subspaces, Base and subbase, Continuity and Homeomorphism.

(2 Questions)

UNIT – III

Notion of Compactness and Connectedness.

(2 Questions)

UNIT – IV

Separation axioms (  $T_0$ ,  $T_1$ ,  $T_2$ ,  $T_3$ , &  $T_4$  )

(2 Questions )

**REFERENCES :**

- |                                   |   |                                  |
|-----------------------------------|---|----------------------------------|
| Introduction to Modern & Topology | : | G. F. Simmons                    |
| Advanced General Topology         | : | Dr. K. K. Jha                    |
| Topology                          | : | J. N. Sharma                     |
| Topology                          | : | Munkers                          |
| Introduction to General Topology  | : | K. D. Joshi (Wiley Eastern Ltd ) |
| General Topology                  | : | Kelley                           |

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**M. Sc / M. A. MATHEMATICS**

**SEMESTER – II**

**( DETAILS DESCRIPTION )**

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - II**

COURSE CODE – ECMATH 05

TITLE – COMPUTER C++ AND MAT LAB

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No- 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT- I**

OOP Paradigm: Comparison of Programming paradigms, Characteristics of Object– Oriented Programming Languages, Object – based programming languages C++, Brief History of C++, Structure of a C++ program, Difference between C and C++, - cin, cout, new, delete operators, ANSI/ISO Standard C++, Comments, Working with Variables and const Qualifiers. Enumeration, Arrays and Pointer. (2 Questions )

**UNIT II**

Implementing oops concepts in C++ Objects, Classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Default Parameter Value, Using Reference variables with Functions. (2 Questions )

**UNIT- III**

Introduction to MAT LAB, Elementary MATH Built – in Functions, Creating Arrays, one dimensional and

Two Dimensional arrays, Variables, Strings, Mathematical operations with arrays, Sriptfiles, Two dimensional plots, Functions and Function files. (2 Questions )

**UNIT – IV**

Programming in MAT LAB, Relational and Logical operators, Conditional statements, the switch-case statement, Loops, Nested Loops and Nested conditional statements, The break and continue commands, Polynomials, Curve Fitting and Interpolation, Applications to Numerical Analysis. (2 Questions )

**REFERENCES :**

- |   |   |                           |
|---|---|---------------------------|
| MAT LAB An Introduction with Applications | : | Amos Gilat (Wiley India ) |
| Programmin in C++                         | : | J. B. Dixit               |
| Let us C++                                | : | Yashavant P. Kanetkar     |

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

COURSE CODE – CCMATH 06

TITLE – ODE, PDE AND INTEGRAL EQUATION

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Existence and Uniqueness of solutions of Initial value problems for first order Ordinary differential equations,

Singular solutions of first order ODEs, system of ODEs. ( 2 Questions )

**UNIT – II**

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs.

(2 Questions )

**UNIT – III**

Classification of second order PDEs, General Solution of higher order PDEs with constant Coefficients, Method of Separation of Variables for the solution of Laplace, Heat and Wave equations.

( 2 Questions )

**UNIT – IV. INTEGRAL EQUATION :**

Linear Integral equation of first and second kind of Fredholm and Volterra type, solutions with Separable kernels. Characteristic number and eigen functions, resolvent kernel.

( 2 Questions )

**REFERENCES :**

Partial Differential Equation	:	R. K. Gupta ( Fourth Edition – 2012 )
Ordinary and Partial Differential Equation	:	M. D. Rajsinghania
Method of Mathematical Physics	:	Hilbert & Courant
Integral Equations	:	Shanti Swarup and Shiv Raj Singh

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - II**

COURSE CODE – CCMATH 07

TITLE – ANALYTICAL DYNAMICS & CALCULUS OF VARIATION

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, Rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I. LAGRANGIAN DYNAMICS :**

Generalized Co-ordinates, Holonomic and Non – Holonomic Systems, Scleronomic and Rhenomic systems,

Generalized Components of effective force, impulse. Lagranges equation of first and second kind, Energy equation for conservative fields. ( 2 Questions )

**UNIT – II. EQUATIONS OF HAMILTON AND ROUTH :**

Hamilton's canonical equation, Equation of energy from Hamilton's equation.

Cyclic Co-ordinates, Routh's equations, Jacobi – Poisson Theorem, Theory of small Oscillations. ( 2 Questions )

**UNIT – III. VARIATIONAL PRINCIPLE IN DYNAMICS AND BRACKETS :**

Hamilton's principle, Principle of least action, Two dimensional motion of rigid body, Euler's dynamical Equations for the motion of a rigid body about an axis.

Lagrange brackets and Poisson brackets, Invariance of Lagrange brackets and Poisson brackets under Canonical Transformation, Jacobi's equation, Hamilton - Jacobi's equations, Jacobi's Theorem. ( 2 Questions )

**UNIT – IV. CALCULUS OF VARIATIONS :**

Fundamental lemma of Calculus of Variation, Euler – Lagrange equation, Conditional extremum, Application to minimum surface of revolution, Brachistochrone problems, Isoperimetric problems and geodesics, Variational methods for boundary value problem in ordinary and partial differential equation. ( 2 Questions )

**REFERENCES :**

Classical Mechanics : H. Goldstein  
Calculus of Variation : C. Fox  
Higher Dynamics : R. K. Choudhary  
Rigid Dynamics- II : Dr. P. P. Gupta  
Classical Mechanics : Gupta and Sharma (Pragati Prakashan Meerut )  
Classical Mechanics of particles and Rigid bodies : R. C. Gupta



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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - II**

COURSE CODE – CCMATH 08

TITLE – NUMERICAL ANALYSIS& THEORY OF NUMBERS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Numerical Solution of algebraic equations, Method of Iteration and Newton – Raphson method, Rate of Convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss – Seidel Methods. Finite differences, Lagrange, Hermite and Spline Interpolation.

(2 Questions )

**UNIT – II**

Numerical differentiation and Integration, Numerical Solution of ODEs using Picard, Euler, modified Euler and Runge – Kutta methods.

(2 Questions )

**UNIT – III**

Divisibility, The division algorithm, Gcd, Euclidean algorithm for gcd, L.C.M, representation of Integers, prime Number, Composite number, The Fundamental Theorem of arithmetic, Unique factorization Theorem, Fermat number, Congruence, Complete system of residues modulo, Linear Diophantine equation, Linear Congruences, The Chinese remainder Theorem, System of Linear Congruences in two unknowns, Wilson’s Theorem, Fermat’s Little Theorem.

( 2 Questions )

**UNIT – IV**

Arithmetic function, Multiplicative arithmetic function, Euler  $\phi$ - function, Reduced residue system modulo  $m$ , Euler’s Theorem. Order of  $a$  modulo  $m$ , Primitive roots, solution of Congruences, Degree of Congruences, Lagrange’s Theorem, The function  $\tau$  and  $\sigma$ , Möbius  $\mu$  function, Möbius inversion formula.

(2 Questions )

**REFERENCES :**

1. Numerical Analysis : Goyal and Mittal
2. Numerical Analysis :James B. Scarborough
3. Calculus of Finite differences and Numerical Analysis : Gupta and Mallik
4. The Theory of Numbers : Irvan Niven, Herbert S. Zuckerman & Hugh L. Montgomery
5. Lectures on Elementary Number Theory : T. M. Karade, J. N. Salunke, K. D. Thengane & Maya S Bendre



**M. Sc / M. A. MATHEMATICS**

**SYLLABUS BASED ON CBCS SEMESTER**

**SYSTEM**

**POST GRADUATE COURSE**

**W.E.F. THE SESSION: 2020-2022**

**SEMESTER – III**

**(DETAILS DESCRIPTION )**

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**SEM - III**

COURSE CODE – OPEN ELECTIVE 09 (For Physics/Chem/Bot/Zool Students)

TITLE – TENSOR CALCULUS & INTEGRAL TRANSFORM

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**TENSOR CALCULUS :**

**UNIT – I**

Summation convention, Dummy Suffix, Real Suffix, Kronecker delta, Transformation of Co-ordinates, covariant and contravariant Vectors and Tensors, Symmetric and Antisymmetric Tensors, Addition of Tensors, Outer Product and Inner product of Tensors, contraction, Quotient law of Tensor, Reciprocal symmetric Tensor.

(2 Questions)

**UNIT – II**

Riemannian metric, Fundamental Tensor, Associate Tensor, Christoffel symbols, Geodesic, differential equation of geodesic.

(2 Questions)

**INTEGRAL TRANSFORM :**

**UNIT – III**

Laplace transform of elementary functions, simple properties of Laplace transform, Shifting Theorem, Laplace Transform of derivatives, integrals, Inverse Laplace Transform, application of Laplace Transform in finding Solution of Ordinary differential equation.

(2 Questions)

**UNIT – IV**

Fourier sine and cosine transform, General Fourier transforms, Properties of Fourier transforms, Inversion Theorem, Convolution Theorem, application of Fourier transform in the solution of physical problems and Evaluation of Integrals.

( 2 Questions )

**REFERENCES :**

- |  |   |                          |
|--|---|--------------------------|
| 1. Integral transform                      | : | A.R.Vashitha & R.K.Gupta |
| 2. The Theory of Relativity                | : | Goyal and Gupta          |
| 3. Tensor Calculus                         | : | Barrystain               |
| 4. Tensor Calculus and Riemannian Geometry | : | D. C. Agarwal            |

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - III**

COURSE CODE – CCMATH 10

TITLE – MEASURE THEORY & FUNCTIONAL ANALYSIS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Lebesgue Outer and Inner measure and their properties, properties of a measurable set, Measurable functions and their properties, limit sup. , limit inf. And limit of sequence of Measurable functions.  
( 2 Questions )

**UNIT – II**

Characteristic function, Simple function, Canonical representation of Simple function, Integral of Simple function,

Some Important Theorems :-Fatou's Lemma, monotone Convergence Theorem, Bounded and dominated Convergence Theorem, Monotone Convergence Theorem.

The general Lebesgue Integral, Convergence in measure, Cauchy sequence in measure, Function of Bounded Variation.  
(2 Questions )

**UNIT – III**

Definition and Examples of Normed linear space, Basic properties of Norm function, Convergent and Cauchy Sequences, Definition and Examples of Banach space, Example of a normed linear space which is not a Banach Space, subspace and quotient space of a normed linear space, Completeness, equivalent norms.

(2 Questions )

**UNIT – IV**

Transformation on Normed linear space, Bounded linear transformations on Normed linear space, Dual space with Examples.

Inner product spaces, Hilbert spaces, Orthonormal sets, Bessel's inequality, Complete Orthonormal sets.

(2 Questions)

**REFERENCES :**

Measure Theory	:	K. P. Gupta
Measure Theory	:	P. R. Halmos
Measure Theory and Integration	:	S. K. Berberian
Introduction of Functional Analysis with Application	:	E. Kreyszig
Functional Analysis	:	A. R. Vasishtha & J. N. Sharma
Introduction of Modern Analysis and Topology	:	G. F. Simmons

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UNIVERSITY DUMKA CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION:  
2020-2022**

**SEM - III**

COURSE CODE – ECMATH 11 (A)

TITLE – ADVANCED DISCRETE MATHEMATICS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I. MATHEMATICAL LOGIC :**

Statement, negation of a statement, Conjunction, disjunction, conditional and biconditional Statement, Truth Tables, Tautology and Contradiction, Equivalent Statement, Law of dualities, functionally complete set of Operations, Quantifier, Argument.

( 2 Questions )

**UNIT – II. LATTICES AND BOOLEAN ALGEBRA :**

POSET, Hasse diagrams, Minimal and Maximal elements, Least and greatest elements, Lattice as partially ordered set, Some properties of Lattices, Lattice as Algebraic System, Sublattice, Complete and Complemented lattice, Cover of an element, Atoms and Irreducible elements, Distributed and modular Lattice.

Introduction to Boolean Algebra, Subalgebra, Boolean Algebra as Lattice, Representation Theorem for finite Boolean Algebra, Boolean function, Conjugate normal form, Minimization of Boolean function/Karnaugh Maps, switching circuits And logic circuits.

( 2 Questions )

**GRAPH THEORY :**

**UNIT – III**

Graph, Isomorphic Graph, Subgraphs and Complements, Walk, Path and circuits, Connected graph and Components, Operations on graphs, Special graphs, Eulerian graphs, Hamiltonian graphs, Weighted graphs, Planer Graphs, Map and Region, Euler's formula, detection of planarity, Non planer graphs.

(2 Questions)

**UNIT – IV**

Trees, Distance and centre in a tree, Rooted trees and Binary trees, Spanning trees, fundamental circuits, minimal( Shortest ) Spanning trees, edge connectivities, Vertex connectivity and seperability, incident matrix, adjacency matrix, Path matrix, circuit matrix, Directed Graph- basic definition and concepts, Euler digraphs, A cyclic digraphs, matrices in Digraphs. colouring of graphs, five colour problem.

( 2 Questions )

**REFERENCES :**

Discrete Mathematics : M. K. Gupta  
Element of Discrete Mathematics : C. L. Lin ( T. M. H. )  
Lattice Theory : G. Birkoff  
Graph Theory with Applications to Engineering and Computer Science :N. Deo

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - III**

COURSE CODE – ECMATH 11 (B)

TITLE – OPTIMIZATION TECHNIQUE

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No- 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Dual simplex method- Infeasible optimal initial solution, Dual simplex method, its advantage over simplex method, Difference between simplex and Dual simplex method.

(2 Questions)

**UNIT – II**

Sensitivity Analysis – Changes in coefficients in the objective function, Change in the structure of the LPP due to addition of new variable/deleting of existing variable/Addition of new constraints/Deleting of existing constraints.

(2 Questions)

**UNIT – III**

Theory of Games – Characteristics of game theory, maximin criteria and optimal strategy, solution of game with saddle points, Rectangular games without saddle points and its solutions by linear programming.

(2 Questions)

**UNIT – IV**

Queueing Theory – Basic Characteristics of queueing system, different performance measures, Steady state Solution of Markovian queueing models : M/M/I, M/M/I with limited waiting space, M/M/C, M/M/C with limited waiting space.

(2 Questions)

**REFERENCES :**

- Operation Research : S. D. Sharma ( KedarNath, Ram Nath and Company 1972 )  
Operation Research : H. A. Taha ( Prentice – Hall of India )  
Operation Research : R. K. Gupta ( Krishna Prakashan )

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - III**

COURSE CODE – ECMATH 12 (A)

TITLE – FLUID DYNAMICS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No - 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I. KINEMATICS :**

Definition and basic concepts fluid, shearing stress, perfect( ideal ) fluid, real ( actual ) fluid, pressure, density, viscosity, velocity, steady and unsteady flows, uniform and non-uniform flows, line of flow, stream line, path line, Stream surface, stream tube, rotational and irrotational motion, velocity potential Eulerian and Lagrangian methods, Boundary surface and related problems.

( 2 Questions )

**UNIT – II. EQUATION OF CONTINUITY :**

Equation of continuity by Euler's and Lagrange's methods and equivalence between them, equation of continuity in Stream tube concept, Cartesian Co-ordinates, Spherical polar co-ordinates and related problems.

( 2 Questions )

**UNIT-III. EQUATION OF MOTION :**

Euler's equation of motion, Integration of the equation of motion, Bernoulli's equation, Lagrange's hydrodynamical equation of motion, Circulation theorem, permanence of irrotational motion, equation of energy and related problems.

( 2 Questions )

**UNIT – IV. MOTION IN TWO DIMENSIONS :**

Stream function, complex potential, stream line, source, sink and doublet, circle theorem and image in two dimension case, image of a source and doublet with respect to a circle, Blasius Theorem and related problem.

**VORTEX MOTION :**

Vorticity, properties of vortex filament, strength of vortex, rectilinear vortices, motion due to m vortices, center of vortices two vortex filaments, vortex pair, image of vortex with respect to a plane, image of a vortex outside a circular cylinder, vortex doublet, infinite single row of vortices of equal strength, two infinite rows of vortices and relevant problems.

( 2 Questions )

**REFERENCES :**

A Text Book of fluid Dynamics	:	F. Chorlton
Theoretical Hydrodynamics	:	L. M. Milnie Thomson
A Treatise on Hydromechanics Part-II	:	A. R. Ramsay
Fluid Dynamics	:	Dr. Shanti Swarup(K.P.M.)
Fluid Mechanics	:	L. D. Landau and F. M. Lipschitz

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**SEM - III**

COURSE CODE – ECMATH 12 (B)

TITLE – PROBABILITY & STATISTICS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Question will be set, out of which candidates are required to answer 5 Questions. Question No- 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Introduction to descriptive statistics and exploratory data analysis, sample space, discrete probability, independent events, Bayes Theorem, random variables distribution functions, expectation and moments, marginal probability distribution, central limit theorem. ( 2 Questions )

**UNIT – II**

Theoretical distributions, Standard discrete and continuous univariate distributions, Sampling distributions, Standard errors such as statistical, biased or unbiased etc, Methods of estimation, Properties of estimators, Confidence intervals, Tests of hypothesis. ( 2 Questions )

**UNIT – III**

Large sample tests, tests of single proportions, difference of proportions, tests of significance for single mean, Difference of mean and difference of standard deviation, Chi – square distribution, goodness of fit, Chi – square Tests for independence of attributes, degree of freedom, population variance. ( 2 Questions )

**UNIT – IV**

Tests of significance based on t, F and Z distributions. ( 2 Questions )

**REFERENCES :-**

Fundamentals of Statistics :- S. C. Gupta ( Himalaya Publishing House, 1981 )

Probability and Statistics :- Richard A. Johson, Miller and Freunots



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**M. Sc / M. A. MATHEMATICS**

**SEMESTER – IV**

**(DETAILS DESCRIPTION )**

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM -IV**

COURSE CODE – CCMATH 13

TITLE – SPECIAL FUNCTION & INTEGRAL TRANSFORMATION

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is Compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

UNIT – I. LEGENDRE'S POLYNOMIALS AND BESSEL'S FUNCTION :

Definition of  $P_n(X)$  and  $Q_n(X)$ , Generating function and definite Integral form of  $P_n(X)$ , Orthogonal properties of  $P_n(X)$ , Recurrence formula and Rodrigue's formula related to  $P_n(X)$ .

Solutions of Bessel's differential Equation, Recurrence formula for  $J_n(X)$ , Generating function for  $J_n(X)$ , Properties of  $J_n(X)$  for various values of  $n$ , Integral representation of  $J_n(X)$  ( when 'n' is an integer ), Orthogonality of Bessel's function. ( 2 Questions )

UNIT – II. HERMITE POLYNOMIALS, LAGUERRE POLYNOMIALS AND CHEBYSHEV POLYNOMIALS :

Definition of Hermite Polynomials  $H_n(X)$ , Generating function other forms for Hermite Polynomials including Rodrigue's formula, Orthogonal properties of Hermite Polynomials, recurrence formula for Hermite Polynomials.

Definition of Laguerre  $L_n(X)$ , Generating function, Rodrigue's formula, Orthogonal properties of Laguerre Polynomials, Recurrence formula for Laguerre Polynomials.

Two kinds of Chebyshev Polynomials  $T_n(X)$  &  $U_n(X)$ , Generating function for  $T_n(X)$  &  $U_n(X)$ , Orthogonal properties of Chebyshev Polynomials. ( 2 Questions )

INTEGRAL TRANSFORM :

UNIT – III. Laplace transform of elementary functions, simple properties of Laplace transform, Shifting Theorem, Laplace Transform of derivatives, integrals, Inverse Laplace Transform, application of Laplace Transform in finding Solution of Ordinary differential equation.

(2 Questions)

UNIT – IV.

Fourier sine and cosine transform, General Fourier transforms, Properties of Fourier transforms, Inversion

Theorem, Convolution Theorem, application of Fourier transform in the solution of physical problems and Evaluation of Integrals. ( 2 Questions )

**REFERENCES :**

- Special Function : E. D. Rainville ( Mac Millen, New York )  
Special Function : Sharma and Gupta  
Integral Transform : A.R.Vashitha & R.K.Gupta

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH 14 (A)

TITLE – SPACE DYNAMICS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I.TWO BODY PROBLEM :**

Equation of motion and Kepler's second law, Orbital position, Kepler's first and third law, Eccentric anomalies, Barycentric orbits, The Orbital elements.

( 2 Questions )

**UNIT – II.RESTRICTED THREE BODY PROBLEM :**

Equation of motion, The Jacobi Integral, Hill's Surface, determination of five equilibrium points and their stability.

( 2 Questions )

**UNIT – III .LAGRANGES PLANETARY EQUATION :**

Lagranges planetary equations by the application of Whittaker method, N-body problem.

( 2 Questions )

**UNIT – IV .ELLIPTIC RESTRICTED THREE BODY PROBLEM AND HANSEN'S CO-ORDINATES :**

Equation of motion of elliptic restricted problem of three bodies the position of five libration points and their Stability.

Hansen's ideal Co-ordinates, Equation of motion in Cartesian and polar Co-ordinates.

( 2 Questions )

**REFERENCES :-**

- |   |   |  |
|---|---|--|
| Introduction to Celestial Mechanics               | : | Jean Kovalevsky ( D' Reidel Publishing company Dordrecht Holland ) |
| Method of Celestial Mechanics                     | : | L. D. Brown and G. M. Clemence, ( Academic Press, New York )       |
| Solar System Dynamics                             | : | CariMurray( Cambridge University Press )                           |
| Higher Dynamics                                   | : | R. K. Chaudhary  |
| Analytical Dynamics of Particles and rigid bodies | : | E. T. Whittaker ( Cambridge University Press )                     |

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH 14 (B)

TITLE – ADVANCED FUNCTIONAL ANALYSIS

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Definition and example of topological Vector Spaces, Convex, balanced and absorbing set and their

Properties, Minkowski's functional, subspace, product space and quotient space of a topological Vector Spaces.

( 2 Questions )

**UNIT – II**

Locally convex topological Vector Spaces, Normable and metrizable topological Vector Spaces, Complete topological Vector Spaces and Frechet space.

( 2 Questions )

**UNIT – III**

Linear transformations and linear functional and their continuity, Finite- dimensional topological Vector Spaces, Linear Varieties and Hyperplanes, Geometric form of Hahn-Banach Theorem.

(2 Questions)

**UNIT – IV**

Uniform – boundedness principle, Open mapping Theorem and closed graph Theorem for Frechet spaces, Banach-Alaoglu Theorem.

( 2 Questions )

**REFERENCES :**

Topological Vector Spaces and Distribution : John Horvath

Linear Topological Spaces : J. L. Kelley and Isaac Namioka

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH14(C)

TITLE – FUZZY SET THEORY

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**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.

( 2 Questions)

**UNIT II**

The Extension Principle – The Zadeh's extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic.

(2 Questions)

**UNIT III**

Fuzzy Relations and Fuzzy Graphs – Fuzzy relations on fuzzy sets. Composition of fuzzy relations. Fuzzy relation equations. Fuzzy graph. Similarity relation.

( 2 Questions)

**UNIT IV**

Fuzzy Logic, An overview of Classical logic, Multivalued logics, Fuzzy propositions, Fuzzy quantifiers.

( 2 Questions)

**REFERENCES :**

Fuzzy Set Theory and its Applications : H.J. Zimmermann (Allied Publishers Ltd. New Delhi. 1991.)

Fuzzy Sets and Fuzzy logic : G.J. Klir and B. Yuan (Prentice-Hall of India. New Delhi, 1995.)

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH 15 (A)

TITLE – RELATIVITY AND COSMOLOGY

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT –I.SPECIAL THEORY OF RELATIVITY :**

Lorentz transformation, Lorentz and Fitzgerald Contraction, Time dialation, Relativistic formula for composition of Velocities and Accelaration, Lorentz transformation forms a group, Lorentz invariance.

Relativistic mass and momentum, Equivalence of mass and Energy, Minkowski space, Minkowski's equation of motion. ( 2 Questions )

**UNIT – II TENSOR CALCULUS :-**

Summation convention, Dummy Suffix, Real Suffix, Kronecker delta, Transformation of Co-ordinates, covariant And contravariant Vectors and Tensors, Symmetric and Antisymmetric Tensors, Addition of Tensors, Outer Product and Inner product of Tensors, contraction, Quotient law of Tensor, Reciprocal symmetric Tensor, Riemannian metric, Fundamental Tensor, Associate Tensor, Magnitude of a Vector, Angle between two Vectors. Christoffel symbols, Geodesic, differential equation of geodesic, covariant differentiation of tensor.

( 2 Questions )

**UNIT – III.THE GENERAL THEORY OF RELATIVITY :**

Principle of Covariance, Principle of equivalence, energy momentum tensors, Field equation, Poisson's equation as an approximation of field equation, Equality of Inertial and gravitational mass, Einstein law of gravitation in empty space, Schwarzschild exterior solution.

Birkhoff's Theorem, Relation between M and m, Isotropic Co-ordinates, planetary orbits, Advance of Perihelion, Gravitational Shift of Spectral lines, Schwarzschild's interior solution.

( 2 Questions )

**UNIT – IV.COSMOLOGY :**

Cosmological models, Einstein and de-sitter's universe, Comparison of Einstein model with actual universe, Comparison of de-sitter model with actual universe.

( 2 Questions )

**REFERENCES :**

The Theory of Relativity	:	Goyal and Gupta
Tensor Calculus	:	Barrystain
Tensor Calculus and Riemannian Geometry	:	D. C. Agarwal
Introduction of Riemannian Geometry and Tensor Calculus	:	C. E. Weatherburn
General Relativity and Cosmology	:	J. V. Narliker

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH 15 (B)

TITLE – ADVANCED TOPOLOGY

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No- 1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT - I**

**Product space & Local Connectedness** : Product of finite number of Topological Spaces, Projection mappings and their continuity, weak topology generated by a family of functions, definition of Tychonoff topology,  $R_n$ -space, and Tychonoff theorem, Evaluation map, condition under which an Evaluation mapping is an embedding, Relative Topology for a subspace of the product space, Tychonoff cubes, product invariant properties.

(2 Questions)

**UNIT- II**

Components (examples and properties), Totality, Disconnected Space( Definition and examples), Compact Hausdorff Space is totally disconnected if it has an open base whose sets are also closed, Locally connected space( Definition, examples and properties), Characterization of locally connected space in terms of open subbase, Product of finite numbers of locally connected spaces, Local connectedness is a Topology but not continuous invariant property, Compact locally connected space has finite number of components.

(2 Questions)

**UNIT – III**

**Compactness, Local Compactness and Compactification**: Compactness implies Local Compactness, but not converses, Characterization of compactness in terms of closed sets, Basic open sets and sub-basic open sets, Alexander's sub – base Lemma. Sequential compactness and Bolzano–Weierstrass property, Countable compactness, compactness in Metric Space, Total boundedness, Lebesgue covering Lemma, Equivalence of Compactness, SWP and sequential compactness is a Metric Space.

(2 Questions)

**UNIT – IV**

Definition of Compactification, motivation for one – point compactification, Alexandroff's one point compactification theorem, compactification of locally compact  $T_2$ -space. Stone-Cech compactification, Definition, existence and uniqueness of extension property, Uniqueness of Stone-Cech compactification.

( 2 Questions)



**Books suggested**

1. Advanced General Topology : K. K. Jha
2. Topology : J. N. Sharma
3. Elementary General Topology : R. Shukla
4. Linear Topological Space : Kelly

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

COURSE CODE – ECMATH 15 (C)

TITLE – MATHEMATICS OF FINANCE & INSURANCE

CREDITS – 5, FULL MARKS – 70, PASS MARKS – 32,

TIME – 3 HOURS

Nine Questions will be set, out of which candidates are required to answer 5 Questions. Question No-1 is compulsory consisting seven short answer type Questions each of 2 marks, rest four Questions each of 14 marks will be required to answer selecting one from each group.

**UNIT – I**

Financial Derivatives – An Introduction : Types of Financial Derivatives Forwards and Futures : Options and its kind and SWAPS. The Arbitrage Theorem and Introduction to and portfolio Selection and Capital Market Theory – Static and Continuous – Time Model.

( 2 Questions )

**UNIT – II**

Pricing by Arbitrage - A Single – period option pricing Model, Multi Pricing, Merton – Cox – Ross- Rubinstein Model: Bounds on Option prices. The Dynamics of Derivative Prices- Stochastic Differential Equations (SDEs ), Major Models of SDEs. Linear Constant coefficient SDEs, Geometric SDEs, Square Root process, Mean Reverting Process and Ornstein – 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 American 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 Models,

Poisson Arrival Processes :Ruin Probabilities and Bounds Asymptotic and Approximation.Time  
Dependent Risk Models – Ruin Problems and Computations of Ruin Functions, Dual Queuing  
Model : Risk Models in Continuous Time and Numerical Evaluation of Ruin Functions.

( 2 Questions )

**REFERENCES :**

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

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**CBCS PATTERN SYLLABUS ( P. G. LEVRL ) W.E.F. SESSION: 2020-2022**

**SEM - IV**

**COURSE CODE – MATH 16**

**TITLE – DISSERTATION PROJECT**

**ON ANY ONE OF THE SPECIAL PAPER**

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