KANNUR UNIVERSITY

BSc MATHEMATICS PROGRAMME

WORK AND CREDIT DISTRIBUTION STATEMENT

Semester	Course Title	Credits	Hours per week	Total Credits	Total Hours
I	English Common Course 1	4	5	20	25
	English Common Course 2	3	4		
	Additional Common Course 1	4	4		
	Core Course 1	4	4		
	First Complementary Elective Course 1	3	4		
	Second Complementary Elective Course 1	2	4		
II	English Common Course 3	4	5	20	25
	English Common Course 4	3	4		
	Additional Common Course 2	4	4		
	Core Course 2	4	4		
	First Complementary Elective Course 2	3	4		
	Second Complementary Elective Course 2	2	4		
III	English Common Course 5	4	5	17	25
	Additional Common Course 3	4	5		
	Core Course 3	4	5		
	First Complementary Elective Course 3	3	5		
	Second Complementary Elective Course 3	2	5		
IV	English Common Course 6	4	5	21	25
	Additional Common Course 4	4	5		
	Core Course 4	4	5		
	First Complementary Elective Course 4	3	5		
	Second Complementary Elective Course 4 (T+P)	6(2+4)	5		
V	Core Course 5	4	4	21	25
	Core Course 6	4	5		
	Core Course 7	4	5		
	Core Course 8	3	4		
	Core Course 9	4	5		
	Generic Elective Course	2	2		
VI	Core Course 10	4	5	21	25
	Core Course 11	4	5		
	Core Course 12	4	5		
	Core Course 13	4	5		
	Core Course 14 (Discipline Specific Elective Course)	3	5		
	Project	2	---		
Total				**120**	

PART A

MATHEMATICS CORE COURSES
WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEM.	HOURS PER WEEK	CREDIT	EXAM HOURS
1B01 MAT	Set Theory, Differential Calculus and Numerical Methods	I	4	4	3
2B02 MAT	Integral Calculus and Logic	II	4	4	3
3B03 MAT	Analytic Geometry and Applications of Derivatives	III	5	4	3
4B04 MAT	Number Theory and Applications of Integrals	IV	5	4	3
5B05 MAT	Set Theory, Theory of Equations and Complex Numbers	V	4	4	3
5B06 MAT	Real Analysis I	V	5	4	3
5B07 MAT	Abstract Algebra	V	5	4	3
5B08 MAT	Differential Equations and Laplace Transforms	V	4	3	3
5B09 MAT	Vector Calculus	V	5	4	3
5D-----	Generic Elective Course	V	2	2	2
6B10 MAT	Real Analysis II	VI	5	4	3
6B11 MAT	Complex Analysis	VI	5	4	3
6B12 MAT	Numerical Methods, Fourier Series and Partial Differential Equations	VI	5	4	3
6B13 MAT	Linear Algebra	V	5	4	3
DISCIPLINE SPECIFIC ELECTIVE		VI	5	3	3
6B14A MAT	Graph Theory				
6B14B MAT	Operations Research				
6B14 C MAT	Cryptography				
6B14D MAT	Fuzzy Mathematics				
6B14E MAT	Programming in Python				
6B15 MAT	Project	VI	---	2	---

CORE COURSE 1:
SET THEORY, DIFFERENTIAL CALCULUS AND NUMERICAL METHODS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
I	1B01 MAT	4	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand Relations and Functions
CO2	Understand limit of a function, limit laws, continuity, Inverse functions and their derivatives
CO3	Understand successive differentiation and Leibnitz theorem
CO4	Understand functions of several variables, limit and continuity, partial derivatives, chain rule, homogenous functions and Euler's theorem on homogenous functions
CO5	Understand bisection method, Regula-falsi method and Newton-Raphson method to solve algebraic and transcendental equations

Unit I - Relations and Functions (22 hours)

Relations, Types of relations, Partitions, Equivalence relation, Partial ordering relation, Functions, Composition of functions, One-to-one, onto and invertible functions, Mathematical functions, exponential function, logarithmic function (Sections 3.3, 3.6, 3.8, 3.9, 3.10 and sections 4.1 to 4.5 of Text 1).

Unit II – Limit, Continuity and Successive differentiation (18 hours)

Limit of a function and limit laws, continuity, Inverse functions and their derivatives (Sections 2.2, 2.5, 7.1 of Text 2. Proof of Theorem 10 in section 2.5 is omitted). Successive differentiation, standard results, n^{th} derivatives, Leibnitz theorem (Sections 4.1, 4.2 of Text 3).

Unit III – Functions of several variables (22 hours)

Functions of several variables, limit and continuity, partial derivatives, chain rule (theorems without proof) (Sections 14.1, 14.2, 14.3, 14.4 of Text 2). Homogenous functions, Euler's theorem on homogenous functions (Sections 11.8, 11.8.1 of Text 4).

Unit IV - Solution of Algebraic and Transcendental Equations (10 Hours)

Introduction to solution of algebraic and transcendental equation**,** Initial approximations, Bisection method, Regula-falsi method, Newton-Raphson method (Sections 3.2, 3.2.1, 3.3, 3.4, 3.5 of Text 5).

COMMON COURSE I Communicative English

Name of the Course	Communicative English
Course Code	1A01 ENG
Semester Assigned	1
Number of Credits	4
Contact Hours per Week	5
Total Contact Hours	90

Prescribed Textbook	*Equip*: English for Undergraduates by Cambridge University Press

Course Outcomes

1. Understand and apply the rubrics of English grammar
2. Recognize and apply the basic patterns in English vocabulary
3. Read and elicit data, information, inferences and interpretations based on a given material in English
4. Develop the ability to speak in English in real life situations
5. Elicit necessary information after listening to an audio material in English
6. Compose academic and non-academic writings including letters, paragraphs and essay on a given topic and CV's for specific purposes

Content Specifications

Module 1 (Grammar and Usage)- 2 Hours/Week

Grammar

Articles, Modals, Tenses, Voices, Subject- Verb Agreement, Direct & Reported Speech,

Usage

Question Tags, Types of Words, Phrasal Verbs and Idiomatic Expressions.

Module 2 (Listening and Speaking) -2 Hours/Week

Listening

What is Communication? Phonemes in English, Syllables and Word Stress, Listening to News Bulletins, Listening to Instructions and Directions, Listening to Lectures, Listening to Speeches

Speaking

Greetings and Introductions, Small Conversations, Talking on Telephone, Making Requests, Making Enquiries, Making Suggestions, Expressing Gratitude, Complaining.

Module 3 (Reading and Writing)- 1 Hour/Week

Reading

Reading Official Letters and Profiles, Reading Advertisements, Reading News Reports, Reading Charts, Reading Online Content.

Writing

Writing Paragraphs, Taking and Making Notes, Essay and Academic Writing, Writing Letters, Writing Resumes.

COMMON COURSE 2. Readings on Kerala

Name of the Course	Readings on Kerala
Course Code	1A02 ENG
Semester Assigned	1
Number of Credits	3
Contact Hours per Week	4
Total Contact Hours	72
Prescribed Textbook	*Multiple Modernity*: Readings on Kerala published by Hornbill Publications

Course Outcomes

1. Understand the basic facts and patterns regarding the cultural evolution of Kerala through articles, poems, stories, life writings and historical narratives.

2. Acquaint with the life and works of the illustrious leaders of Kerala Renaissance and the major events.
3. Assimilate the notion of Kerala as an emerging society and critically examine the salient features of its evolution.
4. Understand the evolution and contemporary state of the concept of "gender" with reference to Kerala
5. Understand the form and content of Kerala's struggle against "casteism" and for "secularism"
6. Develop an awareness about the ecological problems and issues in Kerala

Content Specifications

Module 1- (2 Hrs/Week)

1. "Conversation": SreeNarayana Guru
2. "Curing Caste": Sahodaran Ayyappan
3. Excerpts from "Eri": Pradeepan Pambirikkunnu
4. Excerpts from Kelu: N. Sasidharan, E.P. Rajagopalan
5. Excerpts from "Parting from the Path of Life": Cherukad Govinda Pisharodi

Module 2- (2 Hrs/Week)

1. "Not an Alphabet in Sight": Poykayil Appachan
2. "Kuttippuram Palam": Idasseri
3. "Courageous Act": Anasuya Menon
4. "Vaikom Satyagraha": K. N.Panikkar
5. "The Voice": Suresh Menon

COMPLEMENTARY ELECTIVE COURSE I: BASIC STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1C01 STA	4	3	3

COURSE OUTCOME

Student should be able to

CO1: understand the different types of data.
CO2: compute various measures of central tendency, measures of variation.
CO3: analyse the relationship between two variables.
CO4: acquire knowledge in time series data and compute various index numbers.

Unit I : Statistical Methods - Scales of measurement - Nominal, Ordinal, Ratio and Interval, Collection of data, Primary and Secondary data, Census method, Sample survey method, Comparison of census method and sample survey method, Principal steps in a sample survey, Types of sampling - probability, restricted and non-restricted sampling, judgement and mixed sampling, SRSWOR, SRSWR, stratified and systematic random sampling(concepts only).

(12 Hrs.)

Unit II : Measures of Central Tendency Definition and properties of various measures of central tendency - A.M,weighted A.M, Median, Mode, G.M., H.M. and weighted averages, Partition values - Quartiles, Deciles, Percentiles, Dispersion - Definition and properties of

various measures of dispersion - Range, Q.D, M.D, S.D, and relative measures of dispersion, Moments - raw moments, central moments and relation between them, Skewness and Kurtosis - Definition and various measures of skewness and kurtosis.

(30 Hrs)

Unit III: Correlation and Regression Analysis - Method of least squares - Fitting of linear, quadratic and exponential curves, Regression analysis - linear regression, fitting of regression lines, regression coefficients and their properties, Correlation analysis - Definition and properties of correlation coefficient, Rank correlation coefficient-formula and problems only, Definitions of partial and multiple correlation coefficients(trivariate case only).

(18 Hrs)

Unit IV: Time Series and Index Numbers- Time series - Meaning, need, components and models of time series, estimation of linear trend by moving average method and least square method, Index numbers - Meaning and uses of index numbers, weighted index numbers - Laspeyer's, Paasche's and Fisher's index numbers, time reversal and factor reversal tests.

(12 Hrs)

SECOND COMPLEMENTARY ELECTIVE COURSE I: INTRODUCTION TO COMPUTERS AND PROGRAMMING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
1	1C01CSC	2	2	3

COURSE OUTCOME

CO1: Familiarize with the hardware components of a digital computer **CO2:** Understand the basic idea of how data is represented in computers **CO3:** Familiarize with types of software
CO4: Ability to design algorithmic solutions to problems

Unit I: Introduction to Computers

Characteristics of Computers, Computer System Hardware, Basic Concepts of CPU, ALU, Registers, Control Unit and System Bus, Components Inside a Computer Cabinet (Motherboard, BIOS, CMOS Chip, Ports and Interfaces, Expansion Slots, Memory Chips, Storage Devices, Processor - Basic functions), Computer Memory Representation, Memory Hierarchy, Basic Concepts of Cache Memory, Primary Memory (RAM and ROM), Secondary Memory Types (Working principle is not required).

(10 Hrs)

Unit II: Number System and Codes

Decimal, Binary, Hexa-Decimal and Octal Number Systems, Conversion Between Number Systems, Binary Arithmetic, Complements of Binary Numbers (1's Complement and 2's Complement), Signed Numbers, Floating Point Numbers, Binary Coded Decimal (8421 BCD Code, Applications, BCD Addition), Gray Code, ASCII Code, Unicode

(8 Hrs)

Unit III: Types of Software and Networking

System Software, Operating System (Functions of Operating Systems), Application Software, Software Acquisition (Retail, OEM, Demo, Shareware, Freeware, Open-Source Software), Computer Networks (Importance, Types of Networks – LAN, MAN, WAN).

(8 Hrs)

Unit IV: Introduction to Programming

Types of Computer Languages (Machine Language, Assembly Language, High-level Language), Basic Concepts of Compiler, Assembler, Interpreter, Linker and Loader. Program Development Life Cycle, Algorithm, Flowcharts, Program Control Structures (Sequential, Selection, Loop), Programming Paradigms (Structured Programming, Basic Idea of Object-Oriented Programming), Characteristics of a Good Program

(10 Hrs)

COMMON COURSE I

കഥാമാത്യകകൾ

(പഠനമണിക്കൂർ 72)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1A07 MAL	4	4	3

COURSE OUTCOME

CO1. ചെറുകഥ, നോവൽ എന്നീ സാഹിത്യരൂപങ്ങളെ സാമാന്യമായി പരിചയപ്പെടുക, വായനാഭിരുചിയും ആസ്വാദനശേഷിയും വളർത്തിയെടുക്കുക.

CO2. ചെറുകഥയുടെയും നോവലിന്റെയും ഉദയവികാസങ്ങളെക്കുറിച്ചുള്ള അവബോധമുണ്ടാക്കുക.

CO3. ഘടന, പ്രമേയം, ആഖ്യാനം തുടങ്ങിയവ വിലയിരുത്തുകയും രചനകളുടെ രാഷ്ട്രീയം അപഗ്രഥിക്കുകയും ചെയ്യുക.

CO4. ജീവിതാവസ്ഥകളുടെ സങ്കീർണ്ണതകളും അനുഭൂതികളും ബോധ്യപ്പെടുത്തുകയും വിദ്യാർത്ഥികൾക്ക് മൗലികരചനകൾ നടത്തുന്നതിന് വഴിയൊരുക്കുകയും ചെയ്യുക.

യൂണിറ്റ് 1 (പഠനമണിക്കൂർ 15)

ചെറുകഥ

1. മദിരാശി പിത്തലാട്ടം- വേങ്ങയിൽ കുഞ്ഞിരാമൻ നായനാർ (വേങ്ങയിൽ കുഞ്ഞിരാമൻ നായനാരുടെ കഥകൾ- ഹരിതം ബുക്സ്)
2. ഉത്തരം കിട്ടാത്ത ചോദ്യം- വി.ടി. ഭട്ടതിരിപ്പാട് (വി.ടിയുടെ സമ്പൂർണ്ണകൃതികൾ, ഡി.സി. ബുക്സ്)
3. മരപ്പാവകൾ- കാരൂർ (തെരഞ്ഞെടുത്ത കഥകൾ- കാരൂർ, എൻ.ബി.എസ്)

യൂണിറ്റ് 2 (പഠനമണിക്കൂർ 15)

4. തരിശുനിലം - മാധവിക്കുട്ടി ((മാധവിക്കുട്ടിയുടെ കഥകൾ സമ്പൂർണ്ണം- ഡി.സി ബുക്സ്)
5. വൻമരങ്ങൾ വീഴുമ്പോൾ- എൻ.എസ് മാധവൻ (എൻ.എസ് മാധവന്റെ കഥകൾ സമ്പൂർണ്ണം, ഡി.സി ബുക്സ്)
6. അശോക- സാറാജോസഫ്- (സാറാജോസഫിന്റെ സമ്പൂർണ്ണകഥകൾ, കറന്റ്ബുക്സ്)

7. മോദസ്ഥിതനായങ്ങ് വസിപ്പൂ മലപോലെ – എസ്. ഹരീഷ് (അപ്പൻ, ഡി.സി ബുക്സ്)

യൂണിറ്റ് 3 (പഠനമണിക്കൂർ 20)

നോവൽ

ആധുനിക നോവൽ രചനയിലും സങ്കേതത്തിലും പ്രമേയസ്വീകരണത്തിലും ഉള്ള മാറ്റങ്ങൾ- സ്വത്വസംഘർഷങ്ങൾ- ദലിത് പരിപ്രേക്ഷ്യം സാമാന്യധാരണ

വിശദപഠനം

1. നൂറു സിംഹാസനങ്ങൾ- ജയമോഹൻ (മാതൃഭൂമി ബുക്സ്)

യൂണിറ്റ് 4 (പഠനമണിക്കൂർ 22)

നോവൽ ഭാഗങ്ങൾ

നോവൽ പ്രമേയത്തിലും അവതരണത്തിലും ആഖ്യാനത്തിലും പ്രകടമാവുന്ന നവചലനങ്ങൾ- പ്രാതിനിധ്യസ്വഭാവത്തിലുള്ള നോവലുകളുടെ തിരഞ്ഞെടുപ്പിലൂടെ അവയുടെ മേൽസൂചിപ്പിച്ച ഒരോ അധ്യായം മാത്രം പഠനമാതൃകയായി വിശദപഠനത്തിന് ഉപയോഗപ്പെടുത്തിയാൽ മതി. ബാക്കി ഭാഗങ്ങൾ അവർക്ക് സൗകര്യം പോലെ വായിച്ചാസ്വദിക്കുകയും വിലയിരുത്തുകയും ആവാം

വിശദപഠനം

1. സരസ്വതിവിജയം- പോത്തേരി കുഞ്ഞമ്പു (അധ്യായം ഒന്ന്- പ്രാരംഭം, ചിന്ത പബ്ലിക്കേഷൻസ്)
2. ഒരു തെരുവിന്റെ കഥ- എസ്. കെ. പൊറ്റെക്കാട് (അധ്യായം ഏഴ്- ജ്യോതിഷക്കാരന്റെ കഥ, ഡിസി ബുക്സ്)
3. ഖസാക്കിന്റെ ഇതിഹാസം- ഒ.വി വിജയൻ (അധ്യായം ഒമ്പത്- ആദ്യപാഠങ്ങൾ, ഡി.സി ബുക്സ്)
4. ആരാച്ചാർ- കെ.ആർ. മീര (അധ്യായം ഇരുപത്തിനാല്-ഡി.സി ബുക്സ്)

ADDITIONAL COMMON COURSE : VII

हिन्दी कविता (HINDI KAVITHA)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1A07HIN	4	4	3

COURSE OUTCOME

CO1 : Understanding the role played by the poets of bhakthikal in literature and society.

CO2 : Understanding the philosophy of life as well as poems of chayavad.

CO3 : Understanding the poems of Modern poets in context with their experience of life.

CO4 : Understanding the contemporary spirit of the poets.

Unit I :

1. कबीरदास – पद- 1
   दोहा- प्रथम पॉच
2. सूरदास – पद- 1, 2, 3
3. तुलसीदास – विनय के पद- 1, 2
4. रहीम - दोहा- प्रथम पॉच

(15 Hrs)

Unit II :

1. मैथिलीशरण गुप्त- आर्य
2. सूर्यकांत त्रिपाठी निराला- जागो फिर एक बार
3. महादेवी वर्मा- पंथ होने दो अपरिचित
4. हरिवंशराय बच्चन – अग्निपथ

Unit III:

1. सर्वेश्वर दयाल सक्सेना- पोस्टर और आदमी
2. अज्ञेय- नाच

(15 Hrs)

Unit IV:

1. कुंवर नारायण –घर पहुँचना
2. लीलाधर जगूड़ी – जरूरत है
3. अरुण कमल – पुतली में संसार
4. अशोक बाजपेय – एक खिड़की
5. कात्यायनी – सिटकनी
6. ओमप्रकाश वाल्मीकी – ठाकुर का कुआँ
7. ज्ञानेन्द्रपति – रेत के द्वीप पसर आये हैं

(25 Hrs)

Semester II

CORE COURSE 2:
INTEGRAL CALCULUS AND LOGIC

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
II	2B02 MAT	4	4	3	48	12	60

COURSE OUTCOME

CO	CO Statement
CO1	Understand Hyperbolic functions
CO2	Understand Reduction formulae for trigonometric functions and evaluation of definite integrals $\int_0^{\frac{\pi}{2}} sin^n x\, dx$, $\int_0^{\frac{\pi}{2}} cos^n x\, dx$ and $\int_0^{\frac{\pi}{2}} cos^q x dx$ $\int_0^{\frac{\pi}{2}} sin^p x$.
CO3	Understand Polar coordinates
CO4	Understand Double integrals in Cartesian and polar form.
CO5	Understand triple integrals in rectangular, cylindrical and spherical co-ordinates
CO6	Understand Substitution in multiple integrals
CO7	Understand Numerical integration: Trapezoidal rule, Simpson's $1/3^{rd}$ rule
CO8	Understand Logic and methods of proofs
CO9	Understand Propositional functions, truth set and Negation of quantified statements

2B02 MAT: Integral Calculus and Logic

Unit I – Integration of hyperbolic functions, Reduction formulae

(20 hours)

Hyperbolic functions (Section 7.7 of Text 1).

Reduction formulae, Integration of $sin^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^n x\, dx$, Integration of $cos^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} cos^n x\, dx$, Integration of $sin^p x cos^q x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^p x\, cos^q x dx$, integration of $tan^n x$, integration of $cot^n x$, integration of $sec^n x$, integration of $cosec^n x$ (Sections 2.8, 4.1, 4.1.1, 4.2, 4.2.1, 4.3, 4.3.1, 4.4.1, 4.4.2, 4.5.1, 4.5.2 of Text 2)

Unit II – Multiple integrals **(20 hours)**

Polar coordinates (Sections 11.3 of Text 1).

Multiple integrals: Double and iterated integrals over rectangles, double integrals over general regions, area by double integration, double integrals in polar form, triple integrals in rectangular coordinates, triple integrals in cylindrical and spherical co-ordinates, substitution in multiple integrals (Sections 11.3, 15.1, 15.2, 15.3, 15.4, 15.5, 15.7, 15.8 of Text 1).

Unit III - Numerical integration **(12 hours)**

Numerical integration, Trapezoidal rule, Simpson's 1/3 rd rule (Sections 6.3, 6.3.1, 6.3.2 of Text 3).

Unit IV – Logic and proofs **(20 hours)**

Logic and proofs (Appendix A of Text 4).

Propositional functions and truth set, Negation of quantified statements (Section 10.11, 10.12 of Text 5).

Common Course III - 2A03 ENG Readings on Life and Nature

Name of the Course	Readings on Life and Nature
Course Code	2A03 ENG
Semester Assigned	2
Number of Credits	4
Contact Hours per Week	5
Total Contact Hours	90
Prescribed Textbook	*Nature Matters* by MainSpring Publishers

Course Outcomes

1. Understand the basic themes and issues related to ecology through articles, poems, stories, life writings and historical narratives.
2. Assume ecologically friendly attitudes in events related to everyday life.
3. Identify the specific ecological problems related to Kerala.
4. Identify the major ecological movements around the world and within the country.
5. Ability to express specific opinions when confronted with ecology/development binary.
6. Identify the major or minor ecological issues happening around the student's native place.

Contents

Module – I (2 hours/week)

1. Environmental Studies: Definition, Scope and Importance
2. Concept of an Ecosystem
3. The Fish – Elizabeth Bishop
4. Trophic Cascade – Camille T. Dungy
5. The Rightful Inheritors of the Earth – Vaikom Muhammad Basheer

Module – II (2 hours/week)

1. Biodiversity
2. Disaster Management: Floods, Earthquakes, Cyclones, Landslides
3. Real Estate - Sebastian
4. The Truth about the Floods – Nissim Ezekiel
5. Matsyagandhi – Sajitha Madathil

Module – III (1 hour/week)

1. Role of an Individual in Prevention of Pollution
2. Environmental Values
3. The End of Living - The Beginning of Survival – Chief of Seattle
4. Going Local – Helena Norberg-Hodge

Common Course IV 2A04 ENG Readings on Gender

Name of the Course	Readings on Gender
Course Code	2A04 ENG
Semester Assigned	2
Number of Credits	3
Contact Hours per Week	4
Total Contact Hours	72
Prescribed Textbook	*Plural Perspectives* by Macmillan Publishers

Course Outcomes

1. Understand the basic themes and issues related to gender through articles, poems, stories, life writings and historical narratives.
2 Understand the divergent approaches towards gender issues.
3. Understand gender as a social construct and also as a site of struggle.
4. Critically engage with certain seminal topics that have become a part of gender studies.
5. Understand the basic gender issues faced by Kerala.
6. Appreciate and use gender sensitive and politically right terms and usages in everyday life.

Contents

Module – I (2 hours/week)

1. "An Introduction"- Kamala Das (Poem)

2. “Kitchen Rags”- Vijila Chirappadu (Poem)
3. “Dakshayani Velayudhan: A Life Sketch”- Meera Velayudhan (Biography)
4. “Learning to be a Mother: - Shashi Deshpande (Essay)
5. “Is this Desirable”- Lalithambika Antharjanam (Story)

Module – II (2 hours/week)

1. “Still I rise”- Maya Angelou (Poem)
2. “I am not that Woman”- Kishwar Naheed (Poem)
3. “Structural Violence and the Trans Struggle for Dignity”- Gee Imaan Semmalar(Essay)
4. “Gender Justice and Media”- Ammu Joseph
5. “Clothing Matters: Visiting the Melmundusamaram in Keralam”- K M Sheeba

ADDITIONAL COMMON COURSE : VIII

रचना तथा प्रयोग (RACHANA THATHA PRAYOG)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2AO8HIN	4	4	3

COURSE OUTCOME

CO1: Understanding Fundamental principles of Hindi Grammer.

CO2 : Understanding the correct usage of hindi grammar.

CO3 : Developing significant increase in word knowledge.

CO4 : Develop communicative skill in Hindi.

Unit I :

संज्ञा – संज्ञा के भेद – सर्वनाम – सर्वनाम के भेद – विशेषण – विशेषण के भेद – क्रिया – क्रिया के भेद – प्रेरणार्थक क्रिया – संयुक्त क्रिया – सहायक क्रियाएँ (सक,चुक, लग, चाहिए, पड़) – लिंग – लिंग की पहचान और लिंग के नियम – वचन – भेद – नियम – कारक – भेद – सर्वनाम की कारकीय रूपरचना – क्रिया विशेषण – भेद – संबंध बोधक – समुच्चय बोधक – विस्मयादि बोधक।

(44 Hrs)

Unit II :

पत्र लेखन – पारिवारिक पत्र – आवेदन पत्र – शिकायती पत्र – अनुवाद – अंग्रेज़ी से हिन्दी में।

(10 Hrs)

Unit III:

संक्षेपण के अभ्यास – संकेत बिन्दुओं के आधार पर कहानी लेखन।

(10 Hrs)

Unit IV:

निबंध लेखन

1. यात्रा जिसे मैं भुला नहीं पाता।
2. समय का महत्व
3. इंटरनेट की दुनिया।
4. प्रदूषण की समस्या।
5. भ्रष्टाचार: एक समस्या।
6. सांप्रदायिकता: एक अभिशाप।
7. आरक्षण : कितना उचित या कितना अनुचित।
8. भारत में आतंकवाद।
9. विद्यार्थी और अनुशासन।
10. खेल और व्यायाम।

(8 Hrs)

Or

COMMON COURSE II
കവിതാമാത്യകകൾ
(പഠനമണിക്കൂർ 72)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2A08 MAL	4	4	3

COURSE OUTCOME

CO1. ജീവിതാവസ്ഥകൾ, സങ്കീർണ്ണതകൾ, അനുഭൂതികൾ എന്നിവ ആവിഷ്ക്കരിക്കുന്ന ഭാഷയുടെ സാന്ദ്രീകൃത രൂപമായ കവിത എന്ന സാഹിത്യരൂപത്തെ സാമാന്യമായി പരിചയപ്പെടുകയും കാവ്യാസ്വാദനശേഷി രൂപപ്പെടുത്തിയെടുക്കുകയും ചെയ്യുക.

CO2. മലയാളകവിതയുടെ വളർച്ചയിലും വികാസത്തിലും നിർണ്ണായക സ്വാധീനം ചെലുത്തിയ കവികളെയും കാവ്യമാത്യകകളെയും കുറിച്ച് അവബോധമുണ്ടാക്കുക.

CO3. പ്രാചീനം, മധ്യകാലം, നവോത്ഥാനം, ആധുനികം , ആധുനികാനന്തരം എന്നീ കാലഘട്ടങ്ങളിൽ മലയാളകവിതയിലുണ്ടായ രൂപ-ഭാവ പരിണതികളെ പരിചയപ്പെടുക.

CO4. ഭാഷയുടെ സവിശേഷപ്രയോഗത്തിലൂടെ കവിത സാധ്യമാക്കുന്ന സാമൂഹ്യ സാംസ്കാരിക പരിതോവസ്ഥകളുടെ ആവിഷ്ക്കരണവും അവയുടെ രാഷ്ട്രീയവും തിരിച്ചറിഞ്ഞ് നിരൂപണ ബുദ്ധ്യാ വിലയിരുത്താനുള്ള പരിശീലനം നൽകുക.

യൂണിറ്റ് –1 (പഠനമണിക്കൂർ 18)

1. ശൂർപ്പണാഖാഗമനം– എഴുത്തച്ഛൻ (ആരണ്യകാണ്ഡം) അദ്ധ്യാത്മരാമായണം കിളിപ്പാട്ട്

ഇത്തരം സൗമിത്രിയോടരുളിചെയ്തു--- *മുതൽ*
ദേവദേവനുമരുൾ ചെയ്തിരുന്നരുളിനാൻ *വരെ*

2. ശരത് വർണ്ണനം– ചെറുശ്ശേരി (കൃഷ്ണഗാഥ)

കാർമുകിൽ മാലകൾ പോയൊരു നേരത്തു-- *മുതൽ*
ആനായമാനിനിമാരെന്നപ്പോൾ *വരെ.*

യൂണിറ്റ് –2 (പഠനമണിക്കൂർ 18)

1. മാപ്പിളപ്പാട്ട്-ബദറുൽ മുനീർ ഹുസ്നുൽ ജമാൽ- മൊയിൻകുട്ടി വൈദ്യർ (ഇശൽ - ചൊന്നവനും)
കുനിത്ത് ബന്ത് ഉബൈസെന്നോളും --*മുതൽ*
അവൻ ഇവ പാത്തജബായുദെ *വരെ*.

2. വേദവിഹാരം - ആദ്യഭാഗം-മനുഷ്യസൃഷ്ടി) കെ. വി. സൈമൺ
തദനന്തരം സൃഷ്ടിജാലത്തിൻമകുടമായ്-- *മുതൽ*
ആദിയായോരിൻ പുരാവൃത്തത്തിൽ കിടക്കുന്നു *വരെ*

3. കരുണ- (ആദ്യഖണ്ഡം മാത്രം)- കുമാരനാശാൻ- കുമാരനാശാന്റെ സമ്പൂർണ്ണകൃതികൾ

യൂണിറ്റ് -3 (പഠനമണിക്കൂർ 18)

1. ഓണപ്പാട്ടുകാർ- വൈലോപ്പിള്ളി (വൈലോപ്പിള്ളി സമ്പൂർണ്ണ കൃതികൾ, കറന്റ് ബുക്സ്)
2. കാലവർഷമേ നന്ദി- പി. കുഞ്ഞിരാമൻ നായർ (പി.തെരഞ്ഞെടുത്ത കവിതകൾ, ഡി.സി ബുക്സ്)
3. അട്ടപ്പാടിയെ സ്വപ്നം കണ്ടു ഞാനിന്നും- സുഗതകുമാരി (സുഗതകുമാരിയുടെ സമ്പൂർണ്ണ കവിതകൾ, ഡി. സി ബുക്സ്)
4. ഒരു കാലമുണ്ടായിരുന്നു- അയ്യപ്പപ്പണിക്കർ അയ്യപ്പപ്പണിക്കരുടെ കവിതകൾ, ഡി. സി. ബുക്സ്)

യൂണിറ്റ്-4 (പഠനമണിക്കൂർ 18)

1. മാൻമാർക്കു കൂട- പി.പി. രാമചന്ദ്രൻ (കാണെക്കാണെ, കറന്റ് ബുക്സ്)
2. കൂട ചൂടി മറഞ്ഞവൾ- എസ്. ജോസഫ്, (ഐഡന്റിറ്റി കാർഡ്, ഡി. സി ബുക്സ്)
3. പുകയില്ലാത്ത അടുപ്പുകളുടെ ഉപമ- വീരാൻകുട്ടി (വീരാൻകുട്ടിയുടെ കവിതകൾ, ഡി.സി ബുക്സ്)
4. രാത്രി മരം- വി. എം. ഗിരിജ (ഇരുപക്ഷംപെടും ഇന്ദുവല്ല ഞാൻ, സൈകതം ബുക്സ്)
5. പട്ടിജന്മം- രമ്യ സഞ്ജീവ് (ചൂലറ്റങ്ങളിലേക്ക് തിരിച്ചുപറക്കുന്നത്, കറന്റ് ബുക്സ്, കോട്ടയം)

COMPLEMENTARY ELECTIVE COURSE II: PROBABILITY THEORY AND RANDOM VARIABLES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	**2C02STA**	**4**	**3**	**3**

COURSE OUTCOME

Student should be able to

CO 1: evaluate the probability of events.

CO 2: understand the concept of random variables with examples in real life

CO3: calculate the probability distribution of discrete and continuous random variables.

CO 4: understand the change of variable technique.

Unit I: Probability Theory-I

Random experiments, sample space, events, classical definition and frequency approach to probability, laws of events, sigma field, axiomatic definition of probability, probability space, addition theorem (2 and 3 events), Boole's inequalities.

(25 Hrs)

Unit II: Probability Theory-II

Conditional probability, multiplication theorem, independence of events, pair wise and mutual independence, Baye's theorem and its applications.

(18 Hrs)

Unit III: Random Variables - Discrete and continuous random variables, probability mass function and probability density function, distribution function - definition and properties, transformation of random variables-discrete and continuous.

(17 Hrs)

Unit IV: Bivariate Random Variables - Definitions, joint probability distributions, marginal and conditional distributions, independence of random variables, transformations of bivariate random variables.

(12 Hrs)

SECOND COMPLEMENTARY ELECTIVE COURSE II: PROGRAMMING IN C

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
2	2C02CSC	2	2	3

COURSE OUTCOME

CO1: Understand the building blocks of C programming language
CO2: Familiarize with program control structures in C
CO3: Learn procedural programming using functions
CO4: Understand user defined data types

Unit I: Introduction to C

C Character Set, Constants, Variables, Keywords, Instructions in C (Type Declaration, Arithmetic, Integer and Float Conversions), Operators in C (Arithmetic, Relational, Logical, Increment/Decrement, Assignment, Bitwise), Operator Precedence, Data Types (int, char, float, double, void), Compiling and Running C Programs in Linux.

(7 Hrs)

Unit II: Inputs and Control Statements

Formatted Console I/O Functions (printf, scanf), Escape Sequences, Unformatted Console I/O Functions (getch, putch, gets, puts), Decision control structures (Different forms of if statement), Conditional Operator, Case Control Structure (switch), Loop control structure (while, do-while, for), break and continue statements.

(10 Hrs)

Unit III: Functions and Pointers

User defined Functions (Advantages, Definition, Calling and Prototype), Library Functions, Pointers (Introduction to Pointers, Pointer Notation, Pointer Declaration and Initialization, Accessing Variable through Pointer), Call by Value and Call by Reference, Recursion

(10 Hrs)

Unit IV: Arrays, Strings and Structures

Arrays (Introduction, One Dimensional Arrays, Two Dimensional Arrays), Strings, Standard Library String Functions (strlen, strcpy, strcat, strcmp), Two-Dimensional Array of Characters. Storage Classes in C, Structures (Declaration, Initialization, Accessing Structure Elements), Array of Structures, Array Within Structure, Renaming Data Types with Typedef, C Preprocessors (#define, #include).

(9 Hrs)

Semester III
CORE COURSE 3:

3B03MAT:
Analytic Geometry and Applications of Derivatives

Unit I: Conic Sections (25 hours)

Conic Sections: Parabola, Ellipse, Hyperbola, Conics in Polar Co ordinates: Eccentricity, polar equations for a conic, lines, circles (Sections 11.6, 11.7 of Text 1)

Unit II: Tangnts, Normals and Asymptotes (25 hours)

Tangents and normals: Equation of tangent, equation of Normal, Angle of intersection of two curves, Lengths of tangents, normal.

Polar Curves: Angle between radius vector and tangent, Length of the perpendicular from pole on the tangent.

Asymptotes.

(Sections 4.6, 4.7, 4.16 of Text 2).

Unit III: Curvature and Evolutes (15 hours)

Curvature, Radius of curvature for Cartesian and polar curves, Centre of Curvature, Circle of curvature, Evolutes (Sections 4.10, 4.11, 4.12 of Text 2).

Unit IV: Mean Value Theorems, Extreme values of functions, Curve Sketching and Indeterminate forms (25 hours)

Fundamental Theorems: Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Taylors Theorem (without proof), Expansions of functions (Sections 4.3, 4.4 of Text 2)

Extreme values of functions, Monotonic functions and first derivative test, concavity and curve sketching, Indeterminate forms (Proof of L'Hospital's rule excluded) (Sections 4.1, 4.3, 4.4, 7.5 of Text 1).

3A05ENG Common Course V- Readings on Democracy and Secularism

Name of the Course	Readings on Democracy and Secularism
Course Code	3A05 ENG
Semester Assigned	3
Number of Credits	4
Contact Hours per Week	5
Total Contact Hours	90
Prescribed Textbook	Muraleedharan, K C, ed*Discoursing Diversities*: Readings on Democracy and Secularism. Trivandrum: Infogate Publishers Pvt. Ltd., 2020.

Content Specifications

Module I (2 hours)

Introduction: Preamble and the Statement of Fundamental Rights in the Constitution of India

1. "Ambedkar's Concluding Speech in theConstituent Assembly": Dr. B R Ambedkar
2. "The Humiliation of a Brown Child in a European School": Kamala Das
3. "The Story of a Dalit Woman's Education and Job": Kumud Pawde
4. "The Election": Sitakant Mahapatra
5. "Postcard from Kashmir": Agha Shahid Ali

Module II (2 hours)

6. "Indian Constitution for Millennials": Gopinath Ravindran
7. "The Rich Will Make Temples for Siva": Basavanna
8. "Centre State Relations: Union Government, Not Central Government": Nani A. Palkhivala
9. "Nehru and Science in the age of Corona Virus": Santosh Paul and Dr. Harsh Hegde
10. "Democracy": Langston Hughes

Module III (1 hour)

11. "Blackout": Roger Mais
12. "Africa": Maya Angelou
13. "A Hindu Princess and Her Islamic Dynasty": Kottarathil Sankunny

COMPLEMENTARY ELECTIVE COURSE III: PROBABILITY DISTRIBUTIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	SEMESTER	COURSE CODE
III	**3C03 STA**	**5**	**3**	**3**

COURSE OUTCOME

Student should be able to

CO1: compute mathematical expectation of a random variable.

CO2: familiarize with different discrete probability distribution associated with real life situations.

CO3: understand the characteristics of different continuous distributions.
CO4: identify the appropriate probability model that can be used.

Unit I: Mathematical Expectation: Definition and properties of mathematical expectation, Addition and multiplication theorem on expectation, Expectation of functions of random variables, Moments - Definition of raw and central moments, relation between raw and central moments, Expectation of bivariate random variables, conditional mean and variance, Coefficient of correlation between random variables. Moment generating function - Definition and properties, Characteristic function - Definition and properties.

(22 Hrs)

Unit II: Discrete Distributions - Definition, moments, m.g.f., characteristic function, properties and different characteristics of discrete uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution and Geometric distribution.

(25 Hrs)

Unit III: Continuous Distributions Definition, moments, m.g.f., characteristic function, properties and different characteristics of Uniform distribution, Normal distribution, Standard normal distribution, Exponential distribution, Gamma distribution with one and two parameters, Beta distributions of I and II kind.

(25 Hrs)

Unit IV: Sampling distributions - Definition, standard error, sampling distribution of sample mean and sample variance, Chi-square, Student's t and F distributions, Interrelations between chi-square, t and F distributions.

(18Hrs)

COMPLEMENTARY ELECTIVE COURSE III: WEB TECHNOLOGY WITH DATABASE MANAGEMENT SYSTEM

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
3	3C03CSC	3	2	3

COURSE OUTCOME

CO1: Develop skills to design a web page using HTML
CO2: Understand HTML Forms and CSS Styling
CO3: Develop skills to develop database and retrieve data using SQL
CO4: Learn basics of server-side programming with PHP

Unit I:HTML Basics

Introduction to WWW and HTML, Steps for hosting a website, Structure of HTML, HTML elements and attributes, Headings, Paragraphs, Formatting tags, line breaks, Comments, Links, Images, Lists, HTML5 Semantic Elements (header, footer, nav, section, article, nav, aside), HTML Tables.

(14 Hrs)

Unit II:HTML Forms and CSS

HTML Forms (input, select, textarea, button, datalist), Input types (text, password, submit, radio, checkbox, date, email), Input attributes (value, readonly, disabled, maxlength, autocomplete, list, min, max, placeholder), HTML5 form validation (required and pattern attribute of input type), Applying style to html using CSS (Inline, Internal and External CSS, Colors, Fonts, Borders, Padding, Applying style using class and id attribute)

(12 Hrs)

Unit III: Database Management System

Database Management System (Introduction, Simplified DBMS structure, advantages of DBMS, Database Administrators, Designers, End Users, System Analysts and Application Programmers), Relational Data Model (Domains, Attributes, Tuples, Relations), Relational Data Model Constraints (Domain Constraints, Key Constraints) SQL Data Definition and Basic Data Types, Schema, DDL Statements (Create, Alter, Drop), Specifying Key Constraints in SQL, DML (Select, Insert, Update, Delete), Ordering Tuples, Renaming Attributes, Substring Pattern Matching and Arithmetic Operators, Aggregate Functions in SQL, Group By and Having, Joins (Inner and Outer)

(18 Hrs)

Unit IV: Introduction to PHP

Introduction to PHP, PHP basics (Variable, data types, Constants, Operators), Flow control (if, switch, while, for), Functions, Strings, Arrays, Form Handling (GET and POST methods), Connecting php to a database.

(10 Hrs)

COMMON COURSE III :
ഗദ്യസാഹിത്യം
(പഠനമണിക്കൂർ 90)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A09 MAL	5	4	3

COURSE OUTCOME

CO1. ആത്മകഥ/ സ്മരണ, ജീവചരിത്രം/കേട്ടെഴുത്ത്, സഞ്ചാരസാഹിത്യം, നിരൂപണം തുടങ്ങിയ ഗദ്യരൂപങ്ങളുടെ ഉദ്ഭവം,വളർച്ച,പരിണാമവഴികൾ എന്നിവയെ പറ്റി സാമാന്യാവബോധമുണ്ടാക്കുക.

CO2.ഗദ്യസാഹിത്യകൃതികൾവായിക്കുന്നതിനും നിരൂപണ മനോഭാവത്തോടെ ആസ്വദിക്കുന്നതിനും പ്രേരിപ്പിക്കുക.

CO3. ഗൗരവപൂർണ്ണമായ ഒരു സിനിമാസ്വാദനസംസ്കാരം വളർത്തിയെടുക്കുക.

CO4. വിവിധങ്ങളായ ഗദ്യരചനാ ശൈലികൾ പരിചയപ്പെടുക.

CO5. ഗദ്യഭാഷയുടെ പ്രയോഗശേഷി വികസിപ്പിക്കുക.

യൂണിറ്റ് 1 (പഠനമണിക്കൂർ 23)

ആത്മകഥ/സ്മരണ

1. കൊഴിഞ്ഞ ഇലകൾ (ആദ്യത്തെ 5 അധ്യായങ്ങൾ) – ജോസഫ് മുണ്ടശ്ശേരി, കറന്റ് ബുക്സ്.
2. നിർമാതളം പൂത്തകാലം (ആദ്യത്തെ7 അധ്യായങ്ങൾ) –മാധവിക്കുട്ടി, ഡി. സി ബുക്സ്.
3. ചിദംബരസ്മരണ('ഭ്രൂണഹത്യ'മുതൽ'രാജകുമാരിയും യാചകബാല'നും വരെയുള്ള 5 അധ്യായങ്ങൾ)ബാലചന്ദ്രൻ ചുള്ളിക്കാട്, ഡി.സി ബുക്സ്

യൂണിറ്റ് 2 (പഠനമണിക്കൂർ 23)

ജീവചരിത്രം /കേട്ടെഴുത്ത്

1. മൃത്യുഞ്ജയം കാവ്യജീവിതം ('നിത്യതയിൽ ഒരു നിർപ്പോള' (അധ്യായം 6) മുതൽ 'വേരുകൾ മണ്ണിനടിയിൽ പൂക്കൾ ചില്ലകളിൽ'(അധ്യായം 9) വരെയുള്ള 4 അധ്യായങ്ങൾ)– എം.കെ.സാനു, നാഷണൽ ബുക്സ്റ്റാൾ
2. അടിയാറ് ടീച്ചറും മറ്റ് അസാധാരണ ജീവിതങ്ങളും('അടിയാറ് ടീച്ചർ'എന്ന അധ്യായം മാത്രം)– താഹമാടായി, ഡി.സി ബുക്സ്.

യൂണിറ്റ് 3 (പഠനമണിക്കൂർ 22)

സഞ്ചാരസാഹിത്യം

1. ക്ലിയോപാട്രയുടെ നാട്ടിൽ ('പെരിയ പിരമിഡിന്റെ മുകളിൽ' മുതൽ 'ക്ലിയോപാട്രയുടെ നഗരത്തിൽ' വരെയുള്ള 3 അധ്യായങ്ങൾ) എസ്.കെ.പൊറ്റക്കാട്, മാതൃഭൂമി
2. ഏതേതോസരണികളിൽ (അധ്യായം 22മാത്രം) സി.വി.ബാലകൃഷ്ണൻ, മാതൃഭൂമി

യൂണിറ്റ് 4 (പഠനമണിക്കൂർ 22)

നിരൂപണം (സാഹിത്യം / സിനിമ)

1. 'ആഘോഷിക്കപ്പെടാതെ പോയ ഒരു സപ്തതിയുടെ ഓർമ്മയ്ക്ക് എന്ന അധ്യായം– പേറ്റുനോവും ഈറ്റുപുണ്യവും– പി. ഗീത, മാതൃഭൂമി ബുക്സ്.
2. 'മേഘാച്ഛാദിതമായ നക്ഷത്രം' എന്ന അധ്യായം –മത്സ്യമഴ പെയ്യുന്ന സന്ധ്യകൾ – എൻ.ശശിധരൻ, മാതൃഭൂമി ബുക്സ്

ADDITIONAL COMMON COURSE : IX

कथा साहित्य (KATHA SAHITHYA)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3AO9HIN	5	4	3

COURSE OUTCOME

CO1 : Analyze variety of short stories in the cultural and historical context.

CO2 : Analyze novel in the modern context.

CO3 : Understand the story content and structure in depth.

CO4 : Collaborate with peers of roll playing story analysis and presentations planning.

Unit I :

1. उपन्यास - सपनों की होम डेलिवरी (अविस्तृत अध्ययन) - ममता कालिया

(45- Hrs)

Unit II :

1.पूस की रात - प्रेमचन्द

2.बिसाती - जयशंकर प्रसाद

(15Hrs)

Unit III:

3.मक्रील - यशपाल

4. स्विमिंग पूल - असगर वजाहत

(15 Hrs)

Unit IV:

5.नो बार - जयप्रकाश करदम

6.हरी बिंदी - मृदुला गर्ग

(15 Hrs)

SEMESTER IV
CORE COURSE 4:
NUMBER THEORY AND APPLICATIONS OF INTEGRALS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
IV	4B04 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand Division algorithm, Greatest common Divisor, Euclidean Algorithm, Diophantine equation $ax+by=c$.
CO2	Understand Primes and their distribution, fundamental theorem of arithmetic, the sieve of Eratosthenes
CO3	Understand Basic properties of congruence
CO4	Understand Picard's little theorem, Wilson's theorem and Euler's theorem
CO5	Understand Substitution and the area between curves, Arc length, Areas and length in polar co-ordinates
CO6	Understand Volumes using cross sections, volumes using cylindrical shells and areas of surfaces of revolution

4B04 MAT:
Number Theory and Applications of Integrals

Unit I - Number Theory I (22 hours)

Number theory: Division algorithm (proof omitted), Greatest common Divisor, Euclidean Algorithm, Diophantine equation $ax+by=c$, primes and their distribution, fundamental theorem of arithmetic, the sieve of Eratosthenes (Sections 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2 of Text 1).

Unit II – Number Theory II (23 hours)

Basic properties of congruence, the little theorem and pseudo primes, Wilson's theorem, Euler's theorem (Proofs of Fermat's, Wilson's and Euler's theorems excluded) (Sections 4.2, 5.2, 5.3, 7.3 of Text 1).

Unit III – Area between curves and Arc length (23hours)

Substitution and the area between curves, Arc length, Areas and length in polar co-ordinates (Sections 5.6, 6.3, 11.5 of Text 2).

Unit IV – Volumes of solids and Areas of surfaces of revolution (22 hours)

Volumes using cross sections, areas of surfaces of revolution (Sections 6.1, 6.4 of Text 2).

ADDITIONAL COMMON COURSE : X

नाटक और एकांकी (NATAK AUR EKANKI)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A10HIN	5	4	3

COURSE OUTCOME

CO 1 : Understand the social and artistic movements that have shaped theatre.

CO2 : Analise and interpret texts and performances both in writing and orally.

CO3 : Develop and apply process skills in rehearsal production and class room settings.

CO4 : Demonstrate problem solving skills in various theatrical context.

Unit I :

1. चरवाहे - उपेन्द्रनाथ अश्क - कथावस्तु - प्रमुख समस्याएँ - विभिन्न पात्रों का विश्लेषण - विशेषताएँ - आधुनिक युग में इसकी प्रासंगिकता।

(15 Hrs)

Unit II :

2. ममता का विष - विष्णु प्रभाकर - कथावस्तु - प्रमुख समस्याएँ - विभिन्न पात्रों का विश्लेषण - विशेषताएँ - आधुनिक युग में इसकी प्रासंगिकता।

(15 Hrs)

Unit III:

3. कलिंग विजय - जगदीश चन्द्र माथुर - कथावस्तु - प्रमुख समस्याएँ - ऐतिहासिकता - विभिन्न पात्रों का विश्लेषण - विशेषताएँ - आधुनिक युग में इसकी प्रासंगिकता।

(15 Hrs)

Unit IV:

1. माधवी (नाटक) - भीष्म साहनी (विस्तृत अध्ययन) - माधवी की कथावस्तु - प्रमुख समस्याएँ - नारी विमर्श - विभिन्न पात्रों का विश्लेषण - विशेषताएँ - आधुनिक युग में इसकी प्रासंगिकता।

(45 Hrs)

COMMON COURSE IV
ദൃശ്യകലാസാഹിത്യം
(പഠനമണിക്കൂർ 90)

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A 10 MAL	5	4	3

COURSE OUTCOME

CO1. കേരളത്തിന്റെ തനതായ ദൃശ്യകലാപാരമ്പര്യങ്ങളെക്കുറിച്ചും സമ്പന്നതയെക്കുറിച്ചും വിദ്യാർത്ഥികൾക്ക് അറിവ് പകരുക

CO2. കഥകളി, തുള്ളൽ, നാടകം, സിനിമ പോലുള്ള ദൃശ്യകലകളെയും അവയ്ക്കാധാരമായ സാഹിത്യപാഠങ്ങളെയും പരിചയപ്പെടുത്തുക.

CO3. കലാപരവും സാഹിത്യപരവുമായ പുതിയ അനുഭവങ്ങളെ ഉൾക്കൊള്ളൽ, കാവ്യാനുഭൂതികൾക്കൊപ്പം ജീവിതാവബോധത്തിന്റെ സ്വാംശീകരണം എന്നിവ ലക്ഷ്യം.

CO4. സാമൂഹിക പരിഷ്ക്കരണത്തിന്റെയും മനഃസംസ്കരണത്തിന്റെയും ചാലകശക്തികളായി നാടകം പോലെയുള്ള കലാസൃഷ്ടികൾ വർത്തിക്കുന്നതിനെ വിശകലനം ചെയ്യുക.

CO5. സിനിമ എന്ന ജനകീയകലയുടെ കേവലാസ്വാദനത്തിനപ്പുറമുള്ള സൈദ്ധാന്തിക തലങ്ങളിലേക്കും സാമൂഹിക-സാംസ്കാരിക വായനകളിലേക്കും വിദ്യാർത്ഥികളെ സജ്ജരാക്കുക.

(പഠനമണിക്കൂർ 22)

യൂണിറ്റ് 1

ആട്ടക്കഥ

കഥകളി- ആട്ടക്കഥാസാഹിത്യം- ഉദ്ഭവം- ശ്രദ്ധേയ രചനകൾ- ഉണ്ണായിവാര്യർ- നളചരിതം- നാടകീയത- സാമാന്യധാരണ

വിശദപഠനം

1. നളചരിതം രണ്ടാം ദിവസം (ശ്ലോകം 1 മുതൽ ശ്ലോകം 11 വരെ- പതിനൊന്നിൽ ചരണം 3 വരെ)

സുരേന്ദ്രൻ സംപ്രീതൈരിഹ *മുതൽ--*
മരവുരി ധരിച്ചു നീ മരുവുക വിപിനേ *വരെ*

(പഠനമണിക്കൂർ 22)

യൂണിറ്റ് 2

തുള്ളൽ

തുള്ളൽ എന്ന ജനകീയകല-ചിരി-ചിന്ത-ലാളിത്യം- ഭാഷ-ശൈലികൾ-ലോകോക്തികൾ-പരിഹാസത്തിന്റെ ജനാധിപത്യമുഖം-സാമാന്യധാരണ

വിശദപഠനം

1. സടാപ്രവേശം പറയൻ തുള്ളൽ (കുഞ്ചൻ നമ്പ്യാരുടെ തുള്ളൽക്കഥകൾ, കേരളസാഹിത്യ അക്കാദമി, തൃശ്ശൂർ. സംശോധിത സംസ്കരണം-പി.കെ ശിവകരപ്പിള്ള)

ഇത്രമോരോ വിശേഷങ്ങൾ പറഞ്ഞു പാനവിപ്രൻ-- *മുതൽ*
നമസ്തേ മൽക്കലാധരേ! നമസ്തേ മംഗളാകൃതേ! *വരെ*

യൂണിറ്റ് 3 (പഠനമണിക്കൂർ 23)

നാടകം

നാടകം-അരങ്ങ്- രംഗപാഠം-യവനനാടകസങ്കല്പം-അരങ്ങിലെ പരീക്ഷണങ്ങൾ-ഇന്ത്യൻ നാടകവേദി-സംസ്കൃതനാടകങ്ങൾ-നാടകവിവർത്തനങ്ങൾ-മലയാളനാടകം- സാമാന്യധാരണ.

വിശദപഠനം

1. ആ മനുഷ്യൻ നീ തന്നെ – സി. ജെ തോമസ് (ഡി.സി ബുക്സ്)
2. കർണ്ണഭാരം – വിവർത്തനം- പെരുളിയിൽ കുഞ്ഞുണ്ണി നമ്പീശൻ

യൂണിറ്റ് 4 (പഠനമണിക്കൂർ 23)

സിനിമ/ചിത്രകല

(എ) സിനിമ-പുതിയകാലത്തിന്റെ ജനകീയകല-സാങ്കേതികതയുടെ പിൻബലം-തിരക്കഥയുടെ സാഹിത്യമൂല്യം- തിരക്കഥ- സംഗീതം- ശബ്ദലേഖനം- സംവിധാനം- ഛായാഗ്രഹണം- എഡിറ്റിംഗ്- കേവലാസ്വാദനത്തിന് അപ്പുറമുള്ള വാനകൾ

വിശദപഠനം

1. കൊടിയേറ്റം- അടൂർ ഗോപാലകൃഷ്ണൻ
(കൊടിയേറ്റം എന്ന സിനിമയുടെ ദൃശ്യപാഠമാണ് പഠനമാതൃക-തിരക്കഥയല്ല)

(ബി) കേരളത്തിലെ സമ്പന്നമായ ചിത്രകലാപാരമ്പര്യം - വരകളുടെയും വർണ്ണങ്ങളുടെയും ആന്തരികതാളം- ചിത്രകലയും സംസ്കാരവും- കേരളീയ ദൃശ്യബോധവും തെയ്യവും- സൗന്ദര്യസങ്കല്പങ്ങളും ആരാധനാരീതികളും - മുഖത്തെഴുത്തിലെയും ചിത്രകലാപ്രയോഗങ്ങൾ- പ്രതിരോധത്തിന്റെയും ചെറുത്തുനിൽപ്പിന്റെയും ആത്മാവിഷ്ക്കാരത്തിന്റെയും കല- സാമാന്യധാരണ.

വിശദപഠനം

1. തെയ്യം- ക്ഷണികകലയുടെ സൗന്ദര്യം- എ.ടി. മോഹൻരാജ്
(ചിത്രകല സർഗ്ഗാത്മകതയുടെ രൂപാന്തരങ്ങൾ- കേരളഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്-ഭാഗം ഒന്നിലെ ആറാമത്തെ ലേഖനം മാത്രം)

COMPLEMENTARY ELECTIVE COURSE IV: STATISTICAL INFERENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04 STA	5	3	3

COURSE OUTCOME

Student should be able to

CO 1: understand the uses of Chebychev's Inequality and Central Limit Theorem.

CO 2: apply various method of estimation

CO 3: understand the concept of testing statistical hypotheses and its importance in real life situation

CO 4: apply ANOVA

Unit I: Chebychev's Inequality and Law of Large Numbers Chebychev's Inequality and its applications, convergence in probability, Weak law of large numbers, Bernoulli's law of large numbers, Convergence in distribution and central limit theorem for IID random variables (Statement only).

(15 Hrs)

Unit II: Theory of Estimation Point estimation, Desirable properties of a good estimator, Cramer-Rao inequality (statement only), Methods of estimation - method of MLE and method of moments. Interval estimation - Confidence interval for mean, proportion, variance, difference of means, difference of proportions.

(25 Hrs)

Unit III : Testing of Hypotheses - Statistical hypotheses, Simple and composite hypotheses, Null and alternative hypotheses, Types of errors, Critical region, Size and power of test – Definition and problems, most powerful test, Neyman - Pearson lemma (without proof).

(20 Hrs)

Unit IV: Large and small sample tests - Test for mean, proportion, equality of means, equality of proportions, paired t-test, test for variance and equality of variance, Chi-square test for goodness of fit, test for independence of attributes, One-way ANOVA (assumptions and problem only).

(30 Hrs)

SECOND COMPLEMENTARY ELECTIVE COURSE IV: COMPUTATION USING PYTHON

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
4	4C04CSC	3	2	3

COURSE OUTCOME

CO1: Learn Python for expressing computation
CO2: Familiarize with functions and modules in python
CO3: Understand object-oriented programming concepts
CO4: Learn the techniques for data visualization in python

Unit I: Basic Elements and Control Statements

Features of Python, Different Methods to Run Python, Basic Elements (Objects, Expressions, Numerical Types, Strings, Variables), Comments, Indentation in Python, Input and Output in Python, import function, Operators in Python, Branching (if, else, elif), Iteration (while, for), range and enumerate functions, Tuples, Lists, Sets, Dictionaries, Built-in methods of lists, sets and dictionaries, Mutable and Immutable Objects.

(16 Hrs)

Unit II: Functions, Modules and Exception Handling

Functions Definition, Function Calling, Function Arguments (Required, Keyword, Default), Recursion, Modules, Built-in Modules (math, statistics), Creating Modules, File Handling (Opening, Closing, Writing, Reading), Exceptions, Built-in Exceptions (IndexError, OverflowError, ZeroDivisionError, RuntimeError), Exception Handling.

(16 Hrs)

Unit III: Object Oriented Programming

Class Definition, Object Creation, Built-in Attribute Methods, Encapsulation, Data Hiding, Inheritance, Multi-Level Inheritance, Polymorphism (Method Overriding, Operator Overloading)

(10 Hrs)

Unit IV: Arrays and Data Visualization

Arrays in Python, Numpy Module, ndarray, Creating Arrays (array, zeros, ones, empty, linspace, arrange, random), Two-Dimensional Array, Indexing, Slicing, Iterating, Copying, Splitting, Shape Manipulation (reshape, transpose, resize), Arithmetic Operations on Arrays.
Data Visualization in Python (matplotlib Module, pyplot, plot(), hist, scatter, bar charts, Formatting, figure(), subplot(), text(), xlabel(), ylabel(), title(), Plotting Simple Mathematical Functions (sin x, x^2)

(12 Hrs)

Semester V
CORE COURSE 5:
SET THEORY, THEORY OF EQUATIONS AND COMPLEX NUMBERS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
V	5B05 MAT	4	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand finite and infinite sets, Countable and Uncountable sets, Cantor's theorem.
CO2	Understand Roots of equations, Relations connecting the roots and coefficients of an equation, Transformation of equations, The cubic equation, Character and position of roots of an equation.

CO3	Understand Descarte's rule of signs, De Gua's Rule, Limits to the roots of an equation, Rational roots of equations, Newton's method of divisors, Symmetric functions of roots of an equation, Symmetric functions involving only the difference of the roots of f(x)=0, Equations whose roots are symmetric functions of α,β, γ.
CO4	Understand Reciprocal equations.
CO5	Understand Cubic equation, Equation whose roots are the squares of the difference of the roots, Character of the Roots, Cardan's Solution
CO6	Understand Roots of complex numbers, General form of De Moivre's theorem, the n^{th} roots of unity, the n^{th} roots of -1, Factors of x^n-1 and x^n+1, the imaginary cube roots of unity.
CO7	Understand polar form of complex numbers, powers and roots.

5B05 MAT:
Set Theory, Theory of Equations and Complex Numbers

Unit I - Finite and Infinite Sets (14 hours)

Finite and infinite sets, Countable sets, Uncountable sets, Cantor's theorem (Section 1.3 of Text 1).

Unit II - Theory of equations I (20 hours)

Roots of equations, Relations connecting the roots and coefficients of an equation, Transformation of equations, Special cases, The cubic equation, Character and position of roots of an equation, Some general theorems, Descarte's rule of signs, Corollaries, De Gua's Rule, Limits to the roots of an equation, To find the rational roots of an equation, Newton's method of divisors, Symmetric functions of roots of an equation, Symmetric functions involving only the difference of the roots of f(x) =0, Equations whose roots are symmetric functions of α, β, γ (Sections 1 to 17 in chapter VI of Text 2).

Unit III - Theory of equations II (20 hours)

Reciprocal equation (Proof of theorems excluded) (Section 1 in chapter XI of Text 2) The Cubic equation, Equation whose roots are the squares of the difference of the roots, Character of the Roots, Cardan's Solution (Section 5 of chapter VI and sections 1 to 4 of chapter XI I in Text 2).

Unit IV – Complex numbers (18 hours)

Quick review of a complex number, equality of complex numbers, fundamental operations, zero product, geometrical representation of complex numbers, addition and subtraction, product and quotients, conjugate numbers (Sections 1 to14 in chapter V of Text 2) [*Questions should not be included in the End Semester Examination from these topics for Quick review*]. Roots of complex numbers, General form of De Moivre's theorem, the n^{th} roots of unity, the n^{th} roots of -1, Factors of x^n -1 and x^n +1, the imaginary cube roots of unity (Sections 15 to 20 of chapter V of Text 2). Polar form of complex numbers, powers and roots (Section 13.2 of Text 3).

CORE COURSE 6: REAL ANALYSIS I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
V	5B06 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand Algebraic Properties, Order Properties and Absolute values of $\mathbb{R}$. Understand the Completeness Property of $\mathbb{R}$ and its applications to derive Archimedean Property and Density theorem.
CO2	Understand intervals in the real line.
CO3	Understand Sequences and their Limits, Limit Theorems, Monotone Sequences.
CO4	Understand Subsequences and the Bolzano-Weierstrass Theorem, The Cauchy Criterion.
CO5	Understand Infinite Series, Absolute Convergence.
CO6	Understand Comparison test, Root test, Ratio test, Integral test and Raabe's test for Absolute convergence.
CO7	Understand Alternating series test, Dirichlet's test and Abel's test for Non Absolute convergence.
CO8	Understand Continuous Functions, composition of continuous functions and continuous functions on intervals.

5B06 MAT: Real Analysis I

Unit I - The Real Numbers **(20 hours)**

Algebraic and Order Properties of $\mathbb{R}$, Absolute Value and Real Line, The Completeness Property of $\mathbb{R}$, Applications of the Supremum Property, Intervals (Sections 2.1, 2.2, 2.3, 2.4, 2.5 of the Text).

Unit II – Sequences **(30 hours)**

Sequences and their Limits, Limit Theorems, Monotone Sequences, Subsequences and the Bolzano-Weierstrass Theorem, The Cauchy Criterion (Sections 3.1, 3.2, 3.3, 3.4, 3.5 of the Text).

Unit III - Series **(20 hours)**

Introduction to Infinite Series, Absolute Convergence, Tests for Absolute Convergence, Tests for Non Absolute Convergence (Sections 3.7, 9.1, 9.2, 9.3 of the Text).

Unit IV - Continuous Functions **(20 hours)**

Continuous Functions, Combination of Continuous Functions, Continuous Functions on Intervals (Sections 5.1, 5.2, 5.3 of the Text).

CORE COURSE 7:
ABSTRACT ALGEBRA

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
V	5B07 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand definition and elementary properties of Groups, Subgroups and Cyclic groups
CO2	Understand Groups of Permutations, orbits, Alternating groups and theorem of Lagrange
CO3	Understand group homomorphisms , factor Groups
CO4	Understand Fundamental Homomorphism Theorems
CO5	Understand definition and properties of rings and fields
CO6	Understand Ring homomorphisms and isomorphisms
CO7	Understand zero divisors , integral domains , characteristic of a ring and their properties

5B07 MAT: Abstract Algebra

Unit I **(27 hours)**

Groups and Subgroups - Binary Operations, Groups, Subgroups, Cyclic Groups (Sections 2, 4, 5, 6 of the Text).

Unit II **(28 hours)**

Groups of Permutations, Orbits, Cycles and the Alternating Groups, Cosets and Theorem of Lagrange (Sections 8, 9, 10 of the Text).(Proof of Theorem 9.15 omitted).

Unit III **(20 hours)**

Homomorphisms, Factor Groups (Sections 13, 14 of the Text).

Unit IV **(15 hours)**

Rings and Fields, Integral Domains (Sections 18, 19 of the Text).
(*Problems involving direct products are omitted from all sections*)

CORE COURSE 8:
DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
V	5B08 MAT	4	3	3	48	12	60

COURSE OUTCOMES

CO1	Understand Separable ODEs, Exact ODEs, Linear ODEs, Bernoulli equation and methods to solve these ODEs
CO2	Understand the theorem of Existence and Uniqueness of solutions of first and second order ODEs
CO3	Understand Homogeneous Linear ODEs of Second Order and solve homogeneous linear ODEs of second order with constant coefficients and Euler-Cauchy equation
CO4	Understand Nonhomogeneous ODEs and solve by variation of parameters
CO5	Understand Laplace Transform and inverse Laplace Transformation
CO6	Understand The first and The second shifting theorems and their applications
CO7	Understand the methods to find Laplace transforms of derivatives and integrals of functions
CO8	Understand the method of differentiating and integrating Laplace transform
CO9	Solve ordinary differential equations and integral equations using Laplace transform

5B08 MAT:
Differential Equations and Laplace Transforms

Unit I - First Order ODEs (25Hours)

First Order ODEs: Basic concepts (Modelling excluded), Separable ODEs(Modelling excluded), Exact ODEs. Integrating factors, Linear ODEs, Bernoulli equation (except Population Dynamics), Orthogonal Trajectories, Existence and uniqueness of solutions (Sections 1.1, 1.3, 1.4, 1.5, 1.6, 1.7 in Chapter 1of the Text).

Unit II – Second-Order Linear ODEs (22 Hours)

Second-Order Linear ODEs: Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Differential Operators, Euler-Cauchy Equations, Statement of Existence and Uniqueness theorem for initial value problems, linear independence of solutions, Wronskian, general solution, Nonhomogeneous ODEs, Method of undetermined coefficients, Solution by Variation of Parameters (Sections 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.10 in Chapter 2 of the Text).

Unit III - Laplace Transforms (25 hours)

Laplace Transform, Inverse Transform, Linearity. s-Shifting, Transforms of Derivatives and Integrals. ODEs, Unit Step Function. t-Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms (Sections 6.1 to 6.6 in Chapter 6 of the Text).

CORE COURSE 9: VECTOR CALCULUS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
V	5B09 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand lines and planes in space
CO2	Understand curves in space, their tangents, normal, curvature, tangential and normal curvature of acceleration
CO3	Understand Directional derivatives and gradient vectors, tangent planes and differentials. Solve extreme value problems using Lagrange multipliers
CO4	Understand Partial derivatives with constrained variables and Taylor's formula for two variables
CO5	Understand Line integrals. Solve for work, circulation and flux using line integrals
CO6	Understand path independence conservative fields and potential functions
CO7	Understand Green's theorem and solve problems using Green's theorem
CO8	Understand Surface area and surface integrals
CO9	Understand Stoke's theorem and solve problems using Stoke's theorem
CO10	Understand Divergence theorem and solve problems using Divergence theorem

5B09 MAT: Vector Calculus

Unit I – Geometry of space and motion in space (25 Hours)

Lines and planes in space, curves in space and their tangents, arc length in space, curvature and normal vector of a curve, tangential and normal components of acceleration (Sections 12.5, 13.1, 13.3, 13.4, 13.5 of the Text).

Unit II - Partial derivatives (25 Hours)

Directional derivatives and gradient vectors, Tangent planes and differentials, Extreme values and saddle points, Lagrange multipliers, Partial derivatives with constrained variables, Taylor's formula for two variables (Sections 14.5, 14.6, 14.7, 14.8, 14.10 of the Text).

Unit III – Integration in vector fields I (20 Hours)

Line integrals, Vector fields and line integrals: work, circulation, flux, Path independence, conservative fields and potential functions, Green's theorem in the plane (Sections 16.1, 16.2, 16.3, 16.4 of the Text).

Unit IV - Integration in vector fields II (20 Hours)

Surfaces and area, surface integrals, Stokes' theorem (theorem without proof) (paddle wheel interpretation of $\nabla \times \mathbf{F}$ is excluded), the Divergence Theorem (theorem without proof) (Gauss' law: one of the four great laws of Electromagnetic Theory, continuity equation of hydrodynamics, unifying the integral theorems are excluded) (Sections 16.5, 16.6, 16.7, 16.8 of the Text).

Semester VI
CORE COURSE 10: REAL ANALYSIS II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
VI	6B10 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand Uniform Continuity, Monotone and Inverse Functions
CO2	Understand Riemann Integral and Riemann-integrable Functions
CO3	Understand Fundamental Theorem of Calculus
CO4	Understand Improper Integrals
CO5	Understand Beta and Gamma Functions and their properties.
CO6	Understand Transformations of Gamma Function and Duplication formula
CO7	Understand Pointwise and Uniform Convergence of sequence of functions and Interchange of Limits
CO8	Understand Series of Functions
CO9	Understand the concept of Metric Spaces

6B10 MAT: Real Analysis II

Unit I – Uniform continuity and Monotone functions (20 hours)

Uniform Continuity, Monotone and Inverse Functions (Sections 5.4, 5.6 of Text 1).

Unit II – Riemann Integral (25 hours)

Riemann Integral, Riemann Integrable functions (proof of Additivity theorem is excluded), The Fundamental Theorem of Calculus (Lebesgue's Integrability Criterion and proof of Composition Theorem are excluded) (Sections 7.1,7.2, of Text 1).

Unit III - Improper Integrals and Beta and Gamma Functions (25 hours)

Improper Integrals (Section 8.7 of Text 2).

Beta and Gamma Functions – Definitions, Properties of Beta and Gamma Functions, Transformations of Gamma Function, Some Important Deductions, Duplication formula (Sections 7.1, 7.2, 7.3, 7.4, 7.5 of Text 3).

Unit IV – Sequence and Series of Functions and Metric spaces (20 hours) Pointwise and Uniform Convergence, Interchange of Limits, Series of Functions (Sections 8.1, 8.2, 9.4 of Text 1).

Metric Spaces – Definition, examples, neighbourhood of a point (Relevant topics from section 11.4 of the Text).

CORE COURSE 11: 6B11 MAT: COMPLEX ANALYSIS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
VI	**6B11 MAT**	**5**	**4**	**3**	**48**	**12**	**60**

COURSE OUTCOMES

CO1	Understand Analytic Function, Cauchy–Riemann Equations. Laplace's Equation.
CO2	Understand Exponential Function, Trigonometric Functions, Hyperbolic Functions, Logarithmic functions and General Power of complex numbers
CO3	Understand line integral in the complex plane ,Cauchy's integral theorem , Cauchy's integral formula and derivatives of analytic functions
CO4	Understand convergence of Sequences and Series of complex functions
CO5	Understand power series, functions given by power series, Taylor series, Maclaurin's Series and Laurent Series
CO6	Understand singularities and zeros of complex functions
CO7	Understand residue integration method and integrate real integrals

6B11 MAT: Complex Analysis

Unit I – Complex Functions and Analyticity (24 hours)

Complex Functions, Limit, Continuity, Derivative, Analytic Function, Cauchy–Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions, Euler's Formula, Logarithm, General Power, Principal Value (Sections 13.3, 13.4, 13.5, 13.6, 13.7 of the Text).

Unit II – Complex Integration (24 hours)

Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions (Sections 14.1, 14.2, 14.3, 14.4 of the Text).

Unit III – Power Series, Taylor Series (20 hours)

Sequences, Series, Convergence, Power Series, Functions given by Power Series, Taylor and Maclaurin's Series (Proof of Taylor's theorem excluded) (Sections 15.1, 15.2, 15.3, 15.4 of the Text).

Unit IV - Laurent Series, Residue Integration (22 hours)

Laurent Series (Proof of Laurent's Theorem excluded), Singularities and Zeros, Infinity, Residue Integration Method (Sections 16.1, 16.2, 16.3 of the Text).

CORE COURSE 12:
NUMERICAL METHODS, FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
VI	6B12 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand Interpolation techniques: Interpolation with unevenly spaced points, Langrange interpolation, Newton's divided differences interpolation, Finite difference operators and finite differences, Newton's interpolation formulae and Central difference interpolation.
CO2	Understand Numerical differentiation using difference formulae
CO3	Understand Picard's method, Solution by Taylor series method, Euler method and Runge- Kutta methods.
CO4	Understand Fourier Series: Arbitrary period, Even and Odd Functions, Half-Range Expansions and Fourier Integrals.
CO5	Understand Partial Differential eqations, Solution by Separating Variables.
CO6	Understand the use of Fourier Series in solving PDE: D'Alembert's Solution of the Wave Equation. Characteristics and solving Heat Equation by Fourier Series.
CO7	Understand Laplacian in Polar Coordinates

6B12 MAT:
Numerical Methods, Fourier series and Partial Differential Equations

Unit I- Interpolation **(25 Hours)**

Interpolation with unevenly spaced points, Langrange interpolation, Newton's divided differences interpolation, Finite difference operators and finite differences, Newton's interpolation formulae, Central difference interpolation. (Sections 4.2, 4.2.1, 4.2.3, 4.3.1, 4.3.2, 4.3.3 of Text 1).

Unit II - Numerical Solution of Differential Equations **(25 Hours)**

Introduction, Picard's method, Solution by Taylor series method, Euler method, Runge-Kutta methods (Sections 7.1, 7.2, 7.3, 7.4, 7.5 of Text 1).

Unit III - Fourier Series **(20 Hours)**

Fourier Series, Arbitrary period, Even and Odd Functions, Half-Range Expansions, Fourier Integrals (Sections 11.1, 11.2, 11.7 of Text 2).

Unit IV – Partial Differential Equations **(20 Hours)**

Basic Concepts, Solution by Separating Variables. Use of Fourier Series, D'Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series (Steady two-dimensional Heat problems, Laplace's equation, unifying power of methods, Electro statistics and Elasticity are excluded), Laplacian in Polar Coordinates (circular membrane, Bessel's equation are excluded). (Sections 12.1, 12.3, 12.4, 12.6, 12.10 of Text 2).

CORE COURSE 13: LINEAR ALGEBRA

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
					END SEM EXAM	INTERNAL	TOTAL
VI	6B13 MAT	5	4	3	48	12	60

COURSE OUTCOMES

CO1	Understand the concept of Vector spaces, subspaces, linear combinations ad system of equations.
CO2	Understand the concept of Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets and solves problems.
CO3	Understand the concept of Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation.

CO4	Understand Rank of a matrix, Elementary transformations of a matrix, Invariance of rank through elementary transformations, Normal form, Elementary matrices.
CO5	Understand the concept System of linear homogeneous equations Null space and nullity of matrix, Range of a matrix, Systems of linear non homogeneous equations.
CO6	Understand Eigen values, Eigen vectors, Properties of Eigen values, Cayley-Hamilton theorem.

6B13 MAT: Linear Algebra

Unit I – Vector Spaces **(20 Hours)**

Introduction, Vector spaces, Subspaces, Linear Combinations and Systems of Linear Equations (Sections 1.1, 1.2, 1.3 of Text 1).

Unit II – Bases and Dimension **(20 Hours)**

Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets (Sections 1.5, 1.6, 1.7 of Text 1).

Unit III - Linear Transformations, Matrices **(25 Hours)**

Linear Transformations, Null Spaces, and Ranges (Proof of Theorem 2.3 excluded), The Matrix Representation of a Linear Transformation (Sections 2.1, 2.2 of Text 1) (Operations of Linear Transformations and related theorems are excluded).

Introduction, Rank of a matrix, Elementary transformations of a matrix, Invariance of rank through elementary transformations, Elementary transformations of a matrix do not alter its rank, Multiplication of the elements of a row by a non zero number does not alter the rank, Addition to the elements of a row the products by a number of the corresponding elements of a row does not alter the rank, Reduction to normal form (Proof of theorem excluded), Elementary Matrices, Elementary Transformations and elementary matrices, Employment of only row (column) transformations, The rank of a product, A Convenient method for computing the inverse of a non singular matrix by elementary row transformations (Sections 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13 of Text 2).

Unit IV - System of linear equations, Eigen values and Eigen vectors **(25 Hours)**

Introduction, System of linear homogeneous equations, Null space and nullity of matrix, Sylvester's law of nullity, Range of a matrix, Systems of linear non

homogeneous equations (Sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 of Text 2)

Eigen values, eigen vectors, Properties of eigen values, Cayley-Hamilton theorem(without proof). (Sections 2.13, 2.14, 2.15 of Text 3)

DISCIPLINE SPECIFIC ELECTIVE COURSES

Discipline specific elective courses are:

1. **6B14A MAT: GRAPH THEORY**
2. **6B14B MAT: OPERATIONS RESEARCH**
3. **6B14C MAT: CRYPTOGRAPGY**
4. **6B14D MAT: FUZZY MATHEMATICS**
5. **6B14E MAT: PROGRAMMING IN PYTHON.**

One of the above courses is to be chosen as Discipline Specific Elective Course.

6B15 MAT: PROJECT

A student of B.Sc. Mathematics should compulsorily do a project work on a topic of his/her choice and prepare a project dissertation for completing the B.Sc. Mathematics Pogramme. The project work should satisfy the following criteria.

1. The topic of study should not be a part of the existing syllabus. But it can be an extension of a topic of the syllabus.
2. After the completion of the study, the student shall submit a project dissertation to the university in typed form.
3. The dissertation should have at least 15 pages excluding the page of table of contents.
4. The dissertation can be prepared using any typesetting software like LaTeX, MS Word or Libre Office Writer.
5. The project work can be done individually if the student so wishes. It can be done as a group having maximum 3 students.
6. The dissertation should contain a Title Page, Certificate from the Project Guide/Supervisor countersigned by the Head of the Department, Table of Contents, Preface/Introduction and References.

Evaluation of the project work and dissertation

1. **Internal Evaluation**
   Internal evaluation of the project has the following components.

Sl. No.	Components	Percentage of marks allotted	Marks allotted
1	Relevance of the topic and references	20	1.4
2	Layout	10	0.7
3	Content	20	1.4
4	Presentation and Viva-voce*	50	3.5
	Total	**100**	**7**

*Presentation and Viva-voce are to be conducted individually even if the project is done as a group.

1. **External Evaluation**

External evaluation of the project has the following components.

Sl. No.	Components	Percentage of marks	Marks allotted
1	Relevance and depth of the topic and layout	25	7
2	Seminar presentation*	25	7
3	Viva-voce*	50	14
Total		**100**	**28**