B.Sc. Mathematics

PROFESSIONAL ETHICS

First Year	**CORE COURSE I DIFFERENTIAL CALCULUS AND TRIGONOMETRY**	**Semester I**
Code: 22SCCMM1	**(Theory)**	**Credit: 5**

COURSEOBJECTIVES:

- To inculcate what a derivative is in terms of the idea of a tangent line to the graph of a function, how a derivative can be used to describe the rate of change of one quantity with respect to another, and how to relate the geometric ideas to the analytic ideas.
- To understand intuitive explanation of the process of taking a limit, to compute basic limits of functions and understand the importance of limits tothe process of differentiation and be able to compute the derivative of a simple function.
- To know continuity as related to functions and able to relate an intuitivenotion of continuity to the mathematical definition of continuity, to compare and contrast the ideas of continuity and differentiability.
- To recognize and use the vocabulary of angles (including standard position, initial and terminal sides, quadrantal angles, acute, right, and obtuse angles)
- To know the usage of right triangles to evaluate the six trigonometric functions
- To compute the six trigonometric functions of any angle and use the unit circle to define the six trigonometric functions for all real numbers.

UNIT – I:

Functions and Limits: Constants and variables – Functions – Classification of functions - Limits.

UNIT – II:

Methods of Successive Differentiation – Leibnitz's Theorem and its applications- Increasing & Decreasing functions –Maxima and Minima of functions of two variables.

UNIT – III:

Curvature – Radius of curvature in Cartesian and Polar Coordinates – Centre of curvature– Radius of curvature – Evolutes & Involutes

UNIT – IV:

Expansions of $\sin(nx)$, $\cos(nx)$, $\tan(nx)$– Expansions of $\sin^n x$, $\cos^n x$ –Expansions of sin(x), cos(x), tan(x) in powers of x.

UNIT – V:

Hyperbolic functions – Relation between hyperbolic & Circular functions- Inverse

hyperbolic functions.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only):

The Double angle formulas and The Half-angles identities.

REFERENCES:

1. S.Narayanan and T.K.ManicavachagamPillai, **Calculus VolumeI**, S.Viswanathan (Printers&Publishers) PvtLimited , Chennai -2011.
2. S.Arumugam& others, **Trigonometry and Fourier series**, New Gamma Publications -1999

   UNIT – I : Chapter I Sections 1 to 10 of [1]
   UNIT – II : Chapter III Sections 1.1 to 2.2, Chapter IV Section 2.1, 2.2 & Chapter V 1.1 to 1.4 of [1]
   UNIT – III : Chapter X Sections 2.1 to 2.6 of [1]
   UNIT – IV : Chapter 1 Section 1.2 to 1.4 of [2]
   UNIT – V : Chapter 2 Section 2.1 & 2.2 of [2]
3. S. Arumugam and Isaac, Calculus, Volume1, New Gamma Publishing House, 1991.
4. S. Narayanan, T.K. ManichavasagamPillai, Trigonometry, S. ViswanathanPvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.

COURSE OUTCOMES:

After completing this course, the students will be able to;

- Explain the relationship between the derivative of a function as a functionand the notion of the derivative as the slope of the tangent line to a function at a point.
- Compare and contrast the ideas of continuity and differentiability.
- Find maxima, minima, critical points and inflection points of functions and to determine the concavity of curves.
- Convert angles from degrees to radians and vice versa.
- Compute the length of a circular arc given the radius and the interior angle.
- Understand the definitions of the inverse trigonometric functions compute the domain and range of the hyperbolic and inverse trigonometric functions and to find exact values of composite functions with inverse trigonometric functions.

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PROFESSIONAL ETHICS

First Year **CORE COURSE II** **Semester I**

INTEGRAL CALCULUS AND FOURIER SERIES

Code:22SCCMM2 **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To get exposed to the concepts of reduction formulae and Fourier series.
- To apply double and triple integral to find the area and volume.
- To understand the concepts of Beta and Gamma functions and theirapplications.

UNIT – I:

Definite integrals - Integration by parts and reduction formulae.

UNIT – II:

Geometric Application of Integration-Area under plane curves: Cartesian co-ordinates - Area of a closed curve - Examples - Areas in polar co-ordinates.

UNIT – III:

Double integrals – changing the order of Integration – Triple Integrals.

UNIT – IV:

Beta and Gamma functions and the relation between them –Integration usingBeta and Gamma functions.

UNIT – V:

Fourier series- definition - Fourier Series expansion of periodic functions with Period 2π – Use of odd & even functions in Fourier Series. Half-range Fourier Series – Development in Cosine series – Development in Sine series.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only):

Chemical, Physical and Biomedical Applications of Fourier series.

REFERENCES:

1. S.Narayanan and T.K.ManicavachagamPillai, Calculus Volume II,S.Viswanathan (Printers& Publishers) Pvt. Limited, Chennai -2011.
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt. Limited, and Vijay Nicole Imprints Pvt. Ltd, 2004.

UNIT – I : Chapter 1 section 11, 12 & 13 of [1]
UNIT – II : Chapter 2 section 1.1, 1.2,1.3& 1.4 of [1]
UNIT – III : Chapter 5 section 2.1, 2.2 & 4 of [1]

UNIT – IV : Chapter 7 section 2.1 to 2.5 of [1]
UNIT – V - Chapter 6 Section 1, 2, 3, 4, 5.1, 5.2 of [2]

REFERENCE(S):

1. Shanti Narayan, Differential & Integral Calculus.
2. Dr. S.Arumugam and Prof. A.ThangapandiIssac, Fourier series, New Gamma Publishing house.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Derive reduction formula and thereby evaluate some standard integrals.
- Explain the properties of Beta and Gamma functions and apply it to computethe integral.
- Identify odd and even functions and determine Fourier series expansion ofthese given functions.
- Apply change of variable method to evaluate double integral.
- Utilize double and triple integral to compute area and volume of a solid.

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PROFESSIONAL ETHICS

First Year | Semester : I

ALLIED COURSE I
PROGRAMMING IN C

Code: 22SCACCS1 **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To express algorithms and draw flowcharts in a language independentmanner.
- To teach how to write modular, efficient and readable C programs
- To impart knowledge in creating and using Arrays of the C data types.

UNIT - I:

Algorithms – Flow charts – Developing algorithms and flowcharts for solving simple problems using sequential, selection and iterative programming Structures.

UNIT - II:

History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Control structures – Looping structures.

UNIT - III:

Arrays – Character Arrays and Strings – User defined functions.

UNIT - IV:

Pointers: Introduction – Pointer Expressions – Chain of Pointers –Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Function pointer – Pointers and Structures

UNIT - V:

Structures: Introduction – Defining a structure – Declaration of structure – Accessing Structures members – Array of Structures – Structures within structures – Structures and functions – Structures and Pointers – Union. Files: Opening and closing files – Operations on files.

UNIT – VI CURRENT CONTOURS (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. S. Jaiswal, "Information Technology Today", Galgotia Publications, New Delhi, Fourth Edition, 2009.
2. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Seventh Edition, 2016.
3. E.Horowitz, S.Sahni and Susan Anderson Freed, "Fundamental Data Structures in C", 2ed, Orient BlackSwan Publisher, 2009.
4. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, Tata-McGraw Hill Edition, New Delhi, 1991.
5. E. Karthikeyan, "A Textbook on C Fundamentals, Data Structures and Problem Solving",Prentice-Hall of India Private Limited, New Delhi, 2008.
6. YashavantKanetkar, "Let us C", BPB Publications, Tenth Edition, New Delhi, 2010.
7. Szuhay, Jeff, and Szuhay, Jeff, "Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way", Packt Publishing, 2020.
8. Jena, Sisir Kumar, and Jena, Sisir Kumar, "C Programming: Learn to Code", CRC Press, 2021.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Recall algorithms and flowcharts for computing logic
- Summarize the basic knowledge to develop C programs
- Apply and implement programs for solving real world problems
- Examine and explore the use of memory allocation for application programs
- Design and develop alternate methods of solving variety of problems

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HUMAN VALUES

First Year	**PART-IV**	**Semester-I**
	VALUE EDUCATION	
Code:22UGVED	**(Theory)**	**Credit: 2**

OBJECTIVES:

- To understand the philosophy of life and values through Thirukural
- To analyse the components of values education to attain the sense of citizenship
- To understand different types of values towards National Integration and international understanding
- To learn yoga as value education to promote mental and emotional health
- To understand human rights, women rights and other rights to promote peace and harmony

UNIT I : PHILOSOPHY OF LIFE AND SOCIAL VALUES:

Human Life on Earth (Kural 629) -Purpose of Life (Kural 46) -Meaning and Philosophy of Life (Kural 131, 226) -Family (Kural 45), Peace in Family (Kural 1025) Society (Kural 446), The Law of Life (Kural 952), Brotherhood (Kural 807) Five responsibilities / duties of Man (a) to himself (b) to his family (c) to his environment (d) to his society, (e) to the Universe in his lives (Kural 43, 981).

UNIT-II – HUMAN VALUES AND CITIZENSHIP

Aim of education and value education: Evolution of value oriented education, Concept of Human values: types of Values- Character Formation – Components of Value education- A P J Kalam's ten points for enlightened citizenship- The role of media in value building

UNIT-III VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT:

Constitutional or national values: Democracy, socialism, secularism, equality, Justice, liberty, freedom and fraternity - Social Values: Pity and probity, self-control, universal brotherhood - Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith -Religious Values: Tolerance, wisdom, character - Aesthetic Values- Love and appreciation of literature and fine arts and respect for the same- National Integration and International Understanding.

UNIT IV : YOGA AND HEALTH:

Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga - Yoga Education with modern context - Different traditions and schools of Yoga - Yoga practices: Asanas, Pranayama and Meditation.

UNIT V : HUMAN RIGHTS:

Concept of Human Rights: Indian and international perspectives- Evolution of Human Rights- definitions under Indian and International documents -Broad classification of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty ad Dignity- Right to equality- Right against exploitation- Cultural and Educational Right- Economic Rights- Political Rights- Social Rights - Human Rights of Women and Children – Peace and harmony.

UNIT - VI: CURRENT CONTOURS: (for continuous internal assessment only):

BOOKS FOR REFERENCES:

1. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004
2. திருக்குறள் - ஜி.யு.போப் - ஆங்கில மொழியாக்கத்துடன் உமா நூல், வெளியீட்டகம், தஞ்சாவூர்,
3. Leah Levin, Human Rights, NBT, 1998
4. V.R. Krishna Iyer, Dialetics and Dynamics of Human Rights in India, Tagore Law Lectures.
5. Yogic Thearpy - Swami Kuvalayananda and Dr.S.L.Vinekar, Government of India, Ministry of Health, New Delhi.
6. SOUND HEALTH THROUGH YOGA - Dr.K.Chandrasekaran, Prem Kalyan Publications, Sedaptti, 1999.
7. Grose. D. N – "A text book of Value Education' New Delhi (2005)
8. Gawande . EN – "Value Oriented Education" – Vision for better living. New Delhi (2002) Saruptsons
9. Brain Trust Aliyar- "Value Education for Health, Happiness and Harmony" Erode (2004) Vethathiri publications

COURSE OUTCOMES: After completion of the course, the student will be able to:

- Apply the values in thirukural to be peaceful, dutiful and responsible in family and society
- Develop character formation and sense of citizenship
- Be secular, self-control, sincere, respectful and moral.
- Master yoga, asana and meditation to promote mental health
- Be attitudinal to follow the constitutional rights

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PROFESSIONAL ETHICS

First Year | **CORE COURSE III** | **Semester II**

DIFFERENTIAL EQUATIONS

Code: 22SCCMM3 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To know the order and degree of the ODE's.
- To study DEs and PDEs of first and second order.
- To identify some specific methods and solve them.
- To make difference between ODE and PDE.
- To know some standard methods.

UNIT – I:

Equations of the first order and first degree – Variable separable – Homogeneous, Non-homogeneous, Linear equations – Bernoulli's equation – Exact differential equations: Sufficient condition for exact differential equations – Practical rules for solving exact differential equations.

UNIT – II:

First order, higher degree differential equations– Equations solvable for dy/dx, solvable for y, solvable for x, Clairaut's form – Homogeneous equations in x and y– simple problems.

UNIT – III:

Particular integrals of second order differential equations with constant coefficients - Linear equations with variable coefficients – Method of Variation of Parameters (Omit third & higher order equations)..

UNIT – IV:

Formation of Partial Differential Equation – General, Particular & Complete integrals – Solution of PDE of the standard forms - Lagrange's method - Charpit's method and few standard forms.

UNIT – V:

PDE of second order homogeneous equation with Constant coefficients – Particular integrals of the forms e^{ax+by}, Sin(ax+by), Cos(ax+by), $x^r y^s$ and $e^{ax+by}.f(x,y)$.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only):

Moving Boundary Value Problems

REFERENCES:

1. T.K.ManicavachagamPillay&S.Narayanan, Differential Equations, S.Viswanathan Publishers Pvt.Ltd., 1996.
2. Arumugam& Isaac, Differential Equations, New Gamma Publishing House, Palayamkottai, 2003.

   UNIT – I : Chapter II – Sections 1,2,3,4,5,6 of [1]
   UNIT – II : Chapter IV – Sections 1,2& 3 of [1]
   UNIT – III : Chapter V – Sections 1,2,3,4 & 5, Chapter VIII – Section 4 of [1]
   UNIT – IV : Chapter XII – Sections 1 – 6 of [1]
   UNIT – V : Chapter V of [2]
3. M.D.Raisinghania , Ordinary and Partial Differential Equations, S.Chand& Co.
4. M.K. Venkatraman, Engineering Mathematics, S.V. Publications, 1985 Revised Edition.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Solve first-order ordinary differential equations.
- Solve higher order differential equations.
- Solve the Higher order differential equations using methods of variation of parameter.
- Solve partial differential equations using Lagrange's Method.

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PROFESSIONAL ETHICS

First Year | **CORE COURSE IV** | **Semester II**

ANALYTICAL GEOMETRY 3D

Code: 22SCCMM4 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To study three dimensional Cartesian Co-ordinates system.
- To enable the students to develop their skill in three dimensions

UNIT – I:

Symmetrical form of equation of a straight line – Equation of a straight line passing through two given points – Condition for a line to be parallel to a plane – Angle between a plane and a line – Condition for two straight lines to be coplanar – Shortest Distance between two given lines.

UNIT – II:

Sphere – Equation of a sphere when the centre and radius are given – Plane section of a sphere – Equation of a circle – Intersection of two spheres – The equation of a tangent plane to a sphere.

UNIT – III:

Equation of a surface – Cone – Right Circular cone – Intersection of a straight line and quadric cone – Tangent plane and normal.

UNIT – IV:

Condition for a plane to touch a quadric cone - angle between lines in which a plane cuts a cone – Condition that a cone has three mutually perpendicular generators.

UNIT – V:

Central quadrics – intersection of a line and a quadric – tangents and tangent planes – condition for a plane to touch a conicoid.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only):

An Introduction to Geo Gebra software.

REFERENCES:

1. T ManickavasagamPillay, T.K. and Natarajan. T, A Text of Analytical Geometry– Part II – Three dimensions, S.Viswanathan (Printers & Publishers) Pvt. Ltd. 2005,

   UNIT – I : Chapter III – Sections 1 to 8
   UNIT – II : Chapter IV – Sections 1 to 8
   UNIT – III : Chapter V – Sections 1 to 4
   UNIT – IV : Chapter V – Sections 5 to 7
   UNIT – V : Chapter V – Sections 9 to 12
2. Shanthi Narayanan and Mittal P.K, Analytical Solid Geometry, 16th Edition S.Chand& Co., New Delhi.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Gain knowledge about the regular geometrical figures and their properties.
- Analyze condition of tangency and find the tangent plane to the sphere.
- Examine the condition for the general equation of the cone.
- Understand the concept of quadric cone and its properties.
- Acquire the basic knowledge of tangents and conicoid.

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ALLIED COURSE II
PRINCIPLES OF INFORMATION TECHNOLOGY

Code: 22SCACCS2 **(Theory)**

COURSE OBJECTIVES: **Credit:4**

- To Provide the Basic Concepts in Information Technology
- To adapt to emerging technologies used in the global marketplace.
- To implement personal and interpersonal skills

UNIT - I:

Introduction to Computer – Classification of Digital Computer System – Computer Architecture – Memory Units – Auxiliary Storage Devices –Input and Output Devices.

UNIT - II:

Introduction to Computer Software – Operating System – Programming Languages – General Software Features and trends.

UNIT - III:

Database Management Systems – Data Processing – Introduction to Database Management System – database design.

UNIT - IV:

Introduction to Telecommunication – Networking – Communication System – Distributed System – Internet – Intranet.

UNIT - V:

Multimedia tools – Virtual Reality – E-Commerce – Data warehousing – Data Mining – Applications; Geographical Information System – Computer in Business, Industry, Home, Education and Training.

UNIT - VI CURRENT CONTOURS (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. Fundamentals of Information Technology, Alexis Leon And Mathews Leon,Vikas Publishing House Pvt. Ltd, 2009
2. Henry C.Lucas, Jr., Information Technology for Management – McGraw Hill(Part – III).c,1999

3. Williams, Sawyer, Hutchinson, Using Information Technology – McGraw Hill.1999.
4. Stephen Doyle, "Understanding Information Technology", Stanley Thornes, 2000
5. Kathleen M. Austin, Lorraine N. Bergkvist, "Principles of InformationTechnology", Good heart-Willcox Company, 2015
6. V. Rajaraman, "Introduction To Information Technology", PHI Learning Pvt.Ltd, 2018

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Explore careers in information technology
- Work with the Internet and other technologies for information exchange
- Handle online security and privacy issues
- Analyze the different types of application software, such as wordprocessing, desktop publishing, spreadsheet, and presentation software
- construct the basics of database technology

PROFESSIONAL ETHICS

ALLIED PRACTICAL I
PROGRAMMING IN C LAB

Code: 22SCACCS1P **(Theory)**

COURSE OBJECTIVES:

- To introduce students to the basic knowledge of programming fundamentals of C language.
- To impart writing skill of C programming to the students and solving problems.
- To impart the concepts like looping, array, functions, pointers, file, structure.

1. Write a Program to convert temperature from degree Centigrade toFahrenh
2. Write a Program to find whether the given number is Even or Odd.
3. Write a Program to find the greatest of Three numbers.
4. Write a Program to use the switch statement to display Monday to Sunday.
5. Write a Program to display first Ten Natural Numbers and their sum.
6. Write a Program to find Multiplication of Two Matrices.
7. Write a Program to find the maximum number in Array using pointer.
8. Write a Program to reverse a number using pointer.
9. Write a Program to solve Quadratic Equation using functions.
10. Write a Program to find factorial of a number using Recursion.
11. Write a Program to show Call by Value and Call by Reference.
12. Write a Program to add two numbers using pointer.
13. Write a Program to create a file containing Student Details.
14. Write a Program to update the details of student's information using various file modes.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Relate the ways to solve simple programs
- Understand and trace the execution of programs using arrays
- Develop programs with functions and pointers
- Compare and contrast structures and unions
- Solve data handling problems using files

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PROFESSIONAL ETHICS

First Year **PART-III : PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES-I** **Semester II**

Code: 22PELPS1

COURSE OBJECTIVES:

- To develop the language skills of students by offering adequate practice in professional contexts.
- To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
- To focus on developing students' knowledge of domain specific registers and the required language skills.
- To develop strategic competence that will help in efficient communication
- To sharpen students' critical thinking skills and make students culturally aware of the target situation.

LEARNING OUTCOMES:

- Recognise their own ability to improve their own competence in using the language
- Use language for speaking with confidence in an intelligible and acceptable manner
- Understand the importance of reading for life
- Read independently unfamiliar texts with comprehension
- Understand the importance of writing in academic life
- Write simple sentences without committing error of spelling or grammar

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

UNIT 1: COMMUNICATION

1. **Listening**: Listening to instructions

2. **Speaking**: Telephone etiquette and Official phone conversations

3. **Reading** short passages (3 passages, one from each – Physics, Chemistry, Mathematics/Computer Science)

5. **Writing:** Letters and Emails in professional context

6. Grammar in Context:

- Wh and yes or no,
- Q tags
- Imperatives

7, **Vocabulary in Context:** Word formation - .

i) Creating antonyms using Prefixes
ii) Intensifying prefixes (E. g inflammable)

Changing words using suffixes

A) Noun Endings
B) Adjective Endings
C) Verb Endings

UNIT 2: DESCRIPTION

Listening – Listening to process description

Speaking - Role play

Formal: With faculty and mentors in academic environment, workplace communication

Informal: With peers in academic environment, workplace communication

Reading –Reading passages on products, equipment and gadgets

Writing – Writing sentence definitions (e.g. computer) and extended definitions (e.g. artificial intelligence)

Picture Description – Description of Natural Phenomena

Grammar **in Context**: Connectives and linkers.

Vocabulary – Synonyms (register) - Compare & contrast expressions.

UNIT 3: NEGOTIATION STRATEGIES

Listening - Listening to interviews of specialists / inventors in fields (Subject specific)

Speaking – Brainstorming. (mind mapping). Small group discussions (subject-specific)

Reading – longer Reading text. (Comprehensive passages)

Writing – Essay Writing (250 word essay on topics related to subject area, like pollution, use of pesticides in cultivation, merits and demerits of devices like mobile phones, merits and demerits of technology in development)

Grammar in Context: Active voice & Passive voice – If conditional - Collocations –Phrasal verbs

UNIT 4: PRESENTATION SKILLS

Listening - Listening to presentation. Listening to lectures. Watching – documentaries (discovery / history channel)

Speaking –Short speech

- Making formal presentations (PPT)

Reading – Reading a written speech by eminent personalities in the relevant field /Short poems / Short biography.

Writing - Writing Recommendations

Interpreting visuals - charts / tables/flow diagrams/charts

Grammar in Context – Modals

Vocabulary (register) - Single word substitution

UNIT 5: CRITICAL THINKING SKILLS

Listening - Listening to advertisements/news and brief documentary films (with subtitles)

Speaking – Simple problems and suggesting solutions.

Reading: Motivational stories on Professional Competence, Professional Ethics and Life Skills (subject-specific)

Writing Studying problem and finding solutions- (Essay in 200 words)

Grammar-Make simple sentences

Vocabulary -Fixed expressions

SUGGESTED ACTIVITIES

UNIT 1

Listening: Links for formal conversation can be given - Gap filling exercises – Multiple Choice questions – Making notes.

Speaking - Role play activity

Reading – Note making. Note-Taking.

Writing: Guided Writing (developing hints)

Email

Grammar: Vocabulary – Worksheets – Games.

UNIT 2

Listening-

Process Descriptions (Processes of Condensation and Evaporation./Process of Measuring the thickness of a wire using a Screw -Gauge./process of Exaction of sugar from sugarcane)

Speaking – Role Play

Reading – Multiple choice questions - Evaluative answers – Classifying and labeling

Writing - Picture description – Description of natural phenomena (rainbow, earthquake, volcanic eruption, erosion, natural disasters in 150 to 200 words).

Vocabulary: Expansion of compound nouns

UNIT 3

Listening- Gap fill exercises – Listening comprehension

Speaking -Debates

Reading -Reading comprehension

Writing – Essay Writing

Grammar - Vocabulary, Activities, Worksheets & Games.

UNIT 4

Listening - Note taking (of listening & viewing items) - Filling a table based on the listening item.

Speaking – JAM, Presentations. (PPT-TECHNICAL)

Reading-Reading comprehension

Writing– Difference between recommendations and instructions
Questions/MCQs based on graphs/flow diagrams/charts

Grammar: Vocabulary – Activities, Worksheets & Games.

UNIT 5

Listening – Radio News/ TV-News telecast /

Speaking - Watch or listen to documentaries and ask questions

Reading - Reading motivational stories (success stories in subject area)

Writing - Essay writing.

Grammar -Vocabulary –Activities, Worksheets & Games

ENVIRONMENT & SUSTAINABILITY

First Year	**PART-IV**	**Semester-II**
	ENVIRONMENTAL STUDIES	
Code: 22UGCES	**(Theory)**	**Credit: 2**

COURSE OBJECTIVES:

- To appreciate the scope of Environmental Studies, Community ecology and the interdisciplinary nature of environmental issues
- To have a basic knowledge of Natural resources its classification, concepts, and natural resources of India.
- The course designed to gain knowledge on values of biodiversity and conservation on global, national, and local scales
- To study about sources and effects of environmental pollution like air, water, soil, thermal, marine, nuclear and noise
- To understand the concerns related to Sustainable Development on environment and health
- To introduce the students in the field of Law and Policies and Acts both at the national and international level relating to environment.

UNIT-1: The Multidisciplinary nature of environmental studies
Definition, scope and importance. (2 lectures)
Need for public awareness

UNIT-2: Natural Resources:
Renewable and non-renewable resources:
Natural resources and associated problems.

a) Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resources, land degradation, man induced Landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit: 3 Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession.
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem:-
- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit: 4 Biodiversity and its conservation

- Introduction – Definition : Genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Biological Diversity Act 2002/ BD Rules, 2004

(8 lectures)

Unit: 5 Environmental Pollution

Definition

Causes, effects and control measures of :

a. Air Pollution
b. Water Pollution
c. Soil Pollution
d. Marine Pollution
e. Noise pollution
f. Thermal Pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.
- Ill-Effects of Fireworks: Firework and Celebrations, Health Hazards, Types of Fire, Firework and Safety

(8 lectures)

Unit: 6 Social Issues and the Environment

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns.

Case studies

- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation
- Public awareness.

(7 lectures)

Unit: 7 Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Programmes
- Environment and human health

- Human Rights - Value Education
- HIV/ AIDS - Women and Child Welfare
- Role of Information Technology in Environment and human health
- Case studies.

Unit: 8 Field Work

- Visit to a local area to document environmental assets-river / forest/ grassland/ hill / mountain

References:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt ltd, Ahamedabad – 380013, India, E-mail: mapin@icenet.net(R)
3. Brunner R.C. 1989, Hazardous Waste Incineration, McGraw Hill Inc 480 p
4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani E & Hepworth, M.T. 2001.
6. De A.K. Environmental Chemistry, Wiley Eastern Ltd
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford University, Press 473p.
9. Hawkins, R.E. Encyclopedia of India Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press 1140 p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition 639 p.
13. Mhaskar A.K. Matter Hazardous, Techno-Science Publications (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p
16. Rao MN & Datta, A.K. 1987 Waste Water treatment, Oxford & IBH Publication Co. Pvt Ltd 345 p.
17. Sharma B.K. 2001 Environmental chemistry Goel Publ House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C. Harper, J and Michael Begon, Essentials of Ecology, Blackwell science (TB)
20. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB).
22. Wagner K.D. 1998 Environmental Management. W.B. Saunders Co. Philadelphia USA

499 p(M) Magazine (R) Reference (TB) Textbook

23. http://nbaindia.org/uploaded/Biodiversityindia/Legal/33%20Biological%20Diversity%20Rules,%202004.pdf.

COURSE OUTCOMES:

- Understand the environmental importance including interactions across local to global scales.
- The learners to update and analyze environmental relationships and interactions of environmental components
- The student to gain knowledge on importance of natural resources in a systematic way.

- The course content is introduce the concept of renewable and non-renewable energy resources and its scenario in India and at global level
- The students will know the relationship between biodiversity and ecosystem functions, direct and indirect values of biodiversity resources and their bioprospecting opportunities.
- The learners can gain awareness related on environmental pollution, causes and pollution control with case studies.
- Student to obtain the environmental ethics and gain knowledge about the sustainable development.
- Learners should realize the environmental legislation and policies of national and international regime and know the regulations applicable to industries and other organizations with significant Environmental aspects

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PROFESSIONAL ETHICS

Second Year **CORE COURSE V** **Semester III**

CLASSICAL ALGEBRA AND THEORY OF NUMBERS

Code:22SCCMM5 **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To lay a good foundation for the study of Theory of Equations.
- To train the students in operative algebra.

UNIT – I:

Relation between roots & coefficients of Polynomial Equations – Symmetric functions – Sum of the r^{th} Powers of the Roots

UNIT – II:

Newton's theorem on the sum of the power of the roots-Transformations of Equations – Diminishing, Increasing & Multiplying the roots by a constant - Reciprocal equations - To increase or decrease the roots of an equation by a given quantity.

UNIT – III:

Form of the quotient and remainder – Removal of terms – To form an equation whose roots are of any power – Transformation in general – Descarte's rule of sign.

UNIT – IV:

Inequalities – elementary principles – Geometric & Arithmetic means – Weirstrass inequalities – Cauchy inequality – Applications to Maxima & Minima.

UNIT – V:

Theory of Numbers – Prime & Composite numbers – divisors of a given number N – Euler's Function $\phi(N)$ and its value – The highest Power of a prime P contained in N! – Congruences – Fermat's, Wilson's & Lagrange's Theorems.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Linear Diophantine equation

REFERENCES:

1. T.K. Manickavasagam Pillai & others, Algebra Volume I, S.V. Publications – 1985Revised Edition.
2. T.K. Manickavasagam Pillai & others, Algebra Volume II, S.V. Publications – 1985Revised Edition.
   UNIT – I : Chapter 6 Section 11 to 13 of (1)

   UNIT – II : Chapter 6 Section 14 to 17 of (1)

UNIT – III : Chapter 6 Section 18- 21 & 24 of
(1)UNIT – IV : Chapter 4 of (2)

UNIT – V : Chapter 5 of (2)

3. H.S. Hall and S.R. Knight, Higher Algebra, Prentice Hall of India, New Delhi.

COURSE OUTCOMES: After completing this course, the students will be able to

- Know the foundation of Theory of Equations.
- Applying the skills to solve problems in operative algebra.

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PROFESSIONAL ETHICS

Second Year **CORE COURSE VI** **Semester III**

SEQUENCES AND SERIES

Code:22SCCMM6 **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- Learn to work with infinite sequences and series.
- Learn to work with infinite bounded sequences.
- Learn to work with an infinite monotonic sequences.
- Learn to work with an infinite convergent or divergent sequences.
- Find the sequences of partial sums of an infinite series.
- Determine if a geometric series is convergent or divergent.
- Find the sum of a convergent geometric series.

UNIT – I:

Sequences – Bounded Sequences – Monotonic Sequences – ConvergentSequences – Divergent Sequences – Oscillating sequences

UNIT – II:

Algebra of Limits – Behavior of Monotonic functions

UNIT – III:

Some theorems on limits – subsequences – limit points – Cauchy sequences.

UNIT – IV:

Series – infinite series – Cauchy's general principal of convergence – Comparison – test theorem and test of convergence using comparison test (comparison teststatement only, no proof).

UNIT – V:

Test of convergence using dAlembert's ratio test – Cauchy's root test – Alternating Series – Absolute Convergence (Statement only for all tests).

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

An introduction Power series.

REFERENCES:

1. Dr. S. Arumugam & Mr. A. Thangapandi Isaac Sequences and Series – NewGamma Publishing House, 2002 Edition.
   UNIT – I : Chapter 3 Sections 3.0 – 3.5 Page No : 39-55
   UNIT – II : Chapter 3 Sections 3.6, 3.7 Page No:56 – 82
   UNIT – III: Chapter 3 Sections 3.8-3.11, Page No:82-102

UNIT – IV: Chapter 4 Sections (4.1 & 4.2) Page No : 112-128.
UNIT – V : Relevant part of Chapter 4 and Chapter 5: Sec. 5.1 & 5.2 Page No:157-167.

2. Algebra – Prof. S. Surya Narayan Iyer
3. Algebra – Prof. M.I. Francis Raj

Course Outcomes: After completing this course, the students will be able to

- Determine if an infinite sequence is bounded.
- Determine if an infinite sequence is monotonic.
- Determine if an infinite sequence is convergent or divergent.
- Find the sequence of partial sums of an infinite series.
- Determine if a geometric series is convergent or divergent.
- Find the sum of a convergent geometric series.
- Determine if an infinite series is convergent or divergent by selecting the appropriate test.
- Determine if an infinite series converges absolutely or conditionally.

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PROFESSIONAL ETHICS

Second Year | **ALLIED COURSE I** | **Semester :III**

MATHEMATICAL STATISTICS I

Code:22SCACMS1 | **(Theory)** | **Credit: 4**

COURSE OBJECTIVES:

- To learn the basic concepts of statistics
- To learn the basic ideas of statistical data

UNIT – I:

Statistical data – Primary data and Secondary data(definitions only), Formation of frequency distribution, various measures of central tendency – mean ,median, mode, geometric mean harmonic mean – simple problems – properties of above measures.

UNIT – II:

Measures of dispersion – Range quartile deviation mean deviation, standard deviation – their coefficients- merits and demerits (simple problems) – Skewness and kutosis Karlpearson‘s coefficients- Bowley‘s coefficients- simple problems.

UNIT – III:

Probability- Definition, axiomatic approach to probability - Additive and Multiplicative laws of Probability (two variables only) and Conditional probability
– simple problems- Concept of random variables – discrete and continuous random variables - Distribution function, pmf and pdf and their properties- simple problems.

UNIT – IV:

Mathematical Expectation – addition and multiplication theorems (two variables only) – Moment generating and characteristics functions, their properties – Conditional expectation and conditional variance (simple problems).

UNIT – V:

Binomial and Poisson distributions – moments, moment generating function cumulant generating function (Simple problems)- fitting of binomial and poisson distribution.

UNIT – VICURRENT CONTOURS (For Continuous Internal Assessment Only):

An introduction to SPSS software

REFERENCES:

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics,Sultan Chand & Sons.
2. S.P. Gupta , Statistical Methods (Revised edition 2001)
   UNIT – I : Chapter I, II Sec 2.1-2.9 of (1)
   UNIT – II : Chapter III Sec 3.1-3.7, 3.13,3.14 of (1)
   UNIT – III : Part – II Chapter 1 of (2)
   UNIT – IV : Chapter VI Sec 6.1-6.4,6.9,6.10,6.12 of (1)
   UNIT – V : Chapter VII Sec 7.1,7.3
3. Gupta S.C. and Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons.
4. R.S.N. Pillai and Bagavathi, Practical statistics, Second edition (2013)

COURSE OUTCOMES:

After completing this course, the students will be able to

- Understand random variables and probability distributions.
- Know the difference between continuous and random variables.
- Acquire the knowledge by using Binomial and Poisson distribution.

PROFESSIONAL ETHICS, HUMAN VALUES

Second Year **CORE COURSE VII** **Semester III**

Professional English for Physical Sciences - II

(Theory)

Code: 22PELPS2 **Credit: 4**

Objectives:

The Professional Communication Skills Course is intended to help Learners in Arts and Science colleges

- Develop their competence in the use of English with particular reference to the workplace situation.
- Enhance the creativity of the students, which will enable nthem to think of innovative ways to solve issues in the workplace.
- Develop their competence and competitiveness and there by improve their employability skills.
- Help students with a research bent of mind develop their skills in writing reports and research proposals.

Unit1-CommunicativeCompetence **(18hrs)**

Listening – Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions)

Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions

Reading: Two subject-based reading texts followed by comprehension activities/exercises

Writing: Summary writing based on the reading passages.

Grammar and vocabulary exercises/tasks to be designed based on the discourse patterns of the listening and reading texts in the book. This is applicable for all the units.

Unit 2- Persuasive Communication **(18hrs)**

Listening: listening to a product launch- sensitizing learners to the nuances of persuasive communication

Speaking: debates–Just-A Minute Activities

Reading: reading texts on advertisements (on products relevant to the subject areas) and answering inferential questions

Writing: dialogue writing-writing an argumentative / persuasive essay.

Unit3-DigitalCompetence (18hrs)

Listening to interviews(subject related)

Speaking: Interviews with subjects pecialists (using video conferencing skills)

Creating Vlogs (How to become a vlogger and use vlogging to nurture interests – subject related)

Reading: Selected sample of Web Page (subject area) Writing: Creating

Web Pages

Reading Comprehension: Essay on Digital Competence for Academic and Professional Life.

The essay will address all aspects of digital competence in relation to MS Office and how they can be utilized in relation to work in the subject area

Unit4-CreativityandImagination (18hrs)

Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites – E.g. https://www.youtube.com/watch?v=tpvicScuDy0)

Speaking: Making oral presentations through short films–subject based

Reading: Essay on Creativity and Imagination (subject based)

Writing–Basic Script Writing for short films(subject based)

- Creating blogs, flyers and brochures(subject based)
- Poster making–writing slogans/captions(subject based

Unit 5 - Workplace Communication & Basics of Academic Writing (18 hrs)

Speaking: Short academic presentation using PowerPoint

Reading & Writing: Product Profiles, Circulars, Minutes of Meeting. Writing an introduction,

paraphrasing

Punctuation (period, question mark, exclamation point, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotation marks, and ellipsis)

Capitalization (use of upper case)

Outcomes of the Course.

At the end of the course, learners will be able to,

- Attend interviews with boldness and confidence.
- Adapt easily into the workplace context, having become communicatively competent.
- Apply to the Research & Development organizations / sections in companies and offices with winning proposals.

Instruction to Course Writers:

1. **Acquisition of subject-related vocabulary should not be over looked**. Textboxes with relevant vocabulary may be strategically placed as a Pre Task or in Summing Up
2. Grammar may be included if the text lends itself to the teaching of a Grammatical item. However, testing and evaluation does not include Grammar.

PROFESSIONAL ETHICS

Second Year	**NON MAJOR ELECTIVE COURSE – I HUMAN RIGHTS**	**Semester-III**
Code:22ANMESW1	**(Theory)**	**Credit:2**

OBJECTIVES:

- To make students to perceive the meaning of human rights and related aspects.
- To enlighten students on the universal declaration of human rights.
- To inform and explain students about the Indian constitutional guarantee of humanrights.
- To sensitise students about the violation of human rights.
- To impart students about role of voluntary and government organizations ensuringhuman rights of the people.

COURSE CONTENTS

UNIT-I HUMAN RIGHTS:

Meaning of Human Rights – Kinds of Human Rights – Theories of human Rights – Human Rights in Ancient Thoughts The Concept of Human Rights – The concept of Liberty and Equality – Promotion and Protection of Human Rights By the United nations. History and Development of Human Rights Concepts.

UNIT-II UNIVERSAL DECLARATION OF HUMAN RIGHTS:

The Universal Declaration of Human rights – Preparation – Preamble and Enumeration of Rights in the Declaration – India and the Universal Declaration.

UNIT-III CONSTITUTION:

Indian Constitutional Guarantee of Human Rights – Preamble, Fundamental Rights – Fundamental Duties-Directive Principles of State Policy – Recent Amendments of Indian Constitution.

UNIT-IV VIOLATION:

Violation of Human Rights – Women – Children – Workers – Prisoners –Scheduled Caste and Tribes.

UNIT-V AGENCIES WORK FOR HUMAN RIGHTS:

Human Rights and Voluntary Organization at international, National and State Level – Human Rights Commissions in India – National Human Rights Commission – Its Constitution – Power and Functions – Human Rights Court in Districts.

UNIT - VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Analyse the functions of Human Rights Commission – State/National

TEXTBOOKS :

1. Rashee, Jain, 2016. Text Book on Human Rights Law and Practice, Universal Law Publishing - An imprint of LexisNexis; Third edition**.** New Delhi.

2. Agarwal. H.O, 2020. Human Rights. Central Law Publications. Allahabad.

REFERENCES :

1. Richard Juck, 1979 Natural Rights Theroies, Cambridge University.
2. Sieghart, Paul. The international law of human rights. Oxford University Press, 1983.
3. Jermy Waldrom, 1984 Theories of Rights, Oxford University Press, New Delhi
4. Bajwan G.S and D.K. Bajwa Human Rights in India Implementation and Violations NewDelhi D.K. Publishers 1996
5. Jones, Peter. & quot; Human rights, group rights, and peoples' rights. & quot; Human Rights Quarterly 21.1 (1999): 80-107.
6. AlfabAlam(ed), 2000 Human Rights in India Raj Publication, New Delhi
7. Vijay Kumar 2003, Human Rights Dimensions and Issues, Anmol Publications, NewDelhi
8. Jack Donnelly, 2005, Universal Human Rights in Theory and Practices, Manas Publication, New Delhi
9. Agarwal, HariOm. International Law & Human Rights. Central law publications,2008.
10. Donnelly, Jack. Universal human rights in theory and practice. Cornell UniversityPress, 2013.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To perceive the basic concepts of Human Rights
- To explain the Universal Declaration of Human Rights
- To have familiarity with Constitution
- To know about the violations of Human Rights against vulnerable
- To discuss about role of agencies protecting Human Rights

Second Year **CORE COURSE VII** **Semester IV**

VECTOR CALCULUS AND LAPLACE TRANSFORMS

Code: 22SCCMM7 **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- Understand the fundamental concepts of vector differentiation.
- Compute line, Surface & volume integral by using Green's, Stokes & Gauss Divergence theorem.
- Apply Laplace Transform to solve differential equations

UNIT – I:

Vector differentiation –velocity & acceleration-Vector & scalar fields –Gradient of a vector- Directional derivative – divergence & curl of a vector solinoidal & irrotational vectors – Laplacian double operator –simple problems.

UNIT – II:

Vector integration –Tangential line integral –Conservative force field –scalar potential-Work done by a force - Normal surface integral- Volume integral – simple problems.

UNIT – III:

Gauss Divergence Theorem – Stoke's Theorem- Green's Theorem – Simple problems and Verification of the theorems for simple problems.

UNIT –IV:

Laplace Transforms – Standard formulae – Laplace transform of Periodic functions – Some general theorems & simple applications.

UNIT – V:

Inverse Laplace Transforms – Use of Laplace Transforms in solving ODE with constant coefficients.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Z Transforms

REFERENCES:

1. M.L. Khanna, Vector Calculus, Jai Prakash Nath and Co., 8th Edition, 1986.
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt. Limited, and Vijay Nicole Imprints Pvt. Ltd, 2004.
   UNIT – I : Chapter 1 Section 1 & Chapter 2 Sections 2.3 to 2.6 , 3 , 4 , 5 , 7 of

[1]

UNIT – II : Chapter 3 Sections 1 , 2 , 4 of [1]

UNIT – III : Chapter 3 Sections 5 & 6 of [2]

UNIT – IV : Chapter 5 Section 1,2,3,4,5 of [2]

UNIT – V : Chapter 5 Section 6,7,8 of [2]

3. P. Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emarald Publishers (1986).
4. Dr. S. Arumugam and Prof. A. Thangapandi Issac, Fourier series, New Gamma Publishing House (Nov 12).

COURSE OUTCOMES: After completing this course, the students will be able to

- Learn the basic knowledge of vector differentiation and vector integration
- Solve vector differentiation and integration problems.
- Introduce the basic concepts of Laplace Transforms.
- Solve a differential equation by using Laplace Transforms

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PROFESSIONAL ETHICS

Second Year | **CORE COURSE VIII ABSTRACT ALGEBRA (Theory)** | **Semester IV**

Code: 22SCCMM8 | **Credit: 4**

COURSE OBJECTIVES:

- To introduce the basic concepts of modern algebra.
- To introduce the concepts of group theory and rings.

UNIT – I:

Groups: Definition and Examples – Elementary Properties of a Group – Equivalent Definitions of a Group.-Permutation Groups.

UNIT – II:

Subgroups – Cyclic Groups – Order of an Element – Cosets and Lagrange'sTheorem.

UNIT – III:

Normal Subgroups and Quotient Groups - Isomorphism –Homomorphism.

UNIT – IV:

Rings: Definitions and Examples - Elementary properties of rings –Isomorphism - Types of rings.-Characteristic of a ring – subrings – Ideals - Quotient rings.

UNIT – V:

Maximal and Prime Ideals - Homomorphism of rings – Field of quotient of anintegral domain – unique factorization domain – Euclidean domain.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Polynomial rings

REFERENCES:

1. S Arumugam and A. Thangapandi Isaac, Modern Algebra, SciTech Publications, Chennai, 2003.
   UNIT – I : Chapter 3 Sections 3.1-3.4
   UNIT – II : Chapter 3 Sections 3.5-3.8
   UNIT – III : Chapter 3 Sections 3.9-3.11
   UNIT – IV : Chapter 4 Sections 4.1-4.8
   UNIT – V : Chapter 4 Sections 4.9- 4.11, 4.13-14
2. N. Herstein, Topics in Algebra, John Wiley & Sons, Student 2nd edition, 1975.
3. Vijay, K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.

COURSE OUTCOMES: After completing this course, the students will be able to

- Demonstrate the abstract structures of algebra
- Prove standard theorems of groups and rings
- Check irreducibility of polynomial and verify whether a function is an isomorphism or not
- Determine cosets, automorphism, kernel, maximal and prime ideals
- Develop examples of groups and rings with specific criterions.
- Students will be able to determine whether a given group is abelian by checking the properties.
- Prove that a given subset of a group is a subgroup by applying the properties.
- Describe all elements in a cyclic subgroup by using generators.

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PROFESSIONAL ETHICS

Second Year	**ALLIED COURSE III**	**Semester : IV**
	MATHEMATICAL STATISTICS II	
Code: 22SCACMA3	**(Theory)**	**Credit: 4**

COURSE OBJECTIVES:

- To learn the basic concepts of Discrete continuous distributions
- To learn the test of significance

UNIT – I:

Normal distribution – derivation of normal from binomial – chief characteristics – M.G.F & C.G.F of normal distributions – Moments of normal distributions – areaproperty – fitting of normal distributions.

UNIT – II:

Continuous distributions – Rectangular, Gamma, Beta, exponential – distributions -sampling distributions, 't' , F' and Chi-square distributions.

UNIT – III:

Correlation – Rank correlation, Karl Pearson's correlation co-efficient and its properties. Linear regression and its properties, concept of multiple and partial correlation for three variables only.

UNIT – IV:

Test of significance – Definition of null hypothesis, alternative hypothesis, sampling distribution, standard error and critical region. Type I and Type II errors, one tailed and two tailed tests. Large sample test for single mean, Difference between means, single proportion and difference between proportions.

UNIT – V:

Small sample tests – _t' test for single mean. Difference between means. Paired _t' test, Chi- square test for goodness of fit and independence of attributes.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

An introduction to Data science.

REFERENCES:

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics,Sultan Chand & Sons.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second edition (2013).
3. S.P. Gupta, Statistical Methods (Revised edition 2001).

COURSE OUTCOME:

After completing this course, the students will be able to

- Understand the meaning of correlation, regression and its properties.
- Apply the concepts of t, F, z distributions and its applications.
- Apply the concepts of sampling techniques and procedure of testing of hypothesis for large samples.

PROFESSIONAL ETHICS

Second Year | **ALLIED PRACTICAL MATHEMATICAL STATISTICS (Practical)** | **Semester : IV**

Code: 22SCACMS1P | **Credit: 2**

25 marks for records and 75 marks for Practical ExaminationPassing minimum for Record – 10 marks (out of 25 marks) Practical Examination – 30 marks (out of 75 marks)

COURSE OBJECTIVES:

- To train the students in solving statistical problems

UNIT – I:

Moments of central tendency- A.M, median, G.M and H.M- Measures of Dispersion- quartile deviation, standard deviation and co-efficient of variation measures of skewness - calculations of first four moments, Central moments, B_1,
B_2.

UNIT – II:

Bivariate discrete probability distribution- marginal distribution and conditional distribution – Calculation of mean, variance, covariance, correlation coefficient, expectation - conditional expectations and conditional variance.

UNIT – III:

Fitting of binomial, poisson and normal distributions (area method only).

UNIT – IV:

Calculation of Karl pearson‘s coefficient of correlation, Spearman‘s rank correlation and regression equations.

UNIT – V:

Large sample tests- Test of single mean- Difference between means – single proposion and Difference between proposion. Exact simple test- t‘ test for single mean, Difference between means, paired t - test - chi square test for goodness offit and independence of attributes.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

An introduction to R package

REFERENCES:

1. R.S.N. Pillai and Bagavathi, Practical statistics, Second edition (2013).
   UNIT – I : Chapter 3, 4 & 5
   UNIT – II: Chapter 12
   UNIT – III: Chapter 13
   UNIT – IV: Chapter 6 & 7
   UNIT – V: Chapter 14 & 15
2. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics,Sultan Chand & Sons.
3. S.P. Gupta, Statistical Methods (Revised edition 2001).

COURSE OUTCOMES:

After completing this course, the students will be able to

- Understand and critically discuss the issues surrounding sampling andsignificance.
- Check the given data are correlated or not using Karl Pearson‘s coefficient ofcorrelation or Spearman‘s rank correlation.

PROFESSIONAL ETHICS HUMAN VALUES

Second Year | **NON MAJOR ELECTIVE COURSE – II CONTEMPORARY SOCIAL ISSUES AND PROBLEMS** | **Semester-IV**

Code: 22ANMESW2 | **(Theory)** | **Credit: 2**

OBJECTIVES:

- To enable the students to understand the impact of social problems on social life.
- Understand how social problems and their processes interacts with and can maintain,social inequalities in society.
- Identify and assess social problems related to deviance, such as substance abuse andcrime.

UNIT- I POVERTY:

Definition Poverty. Factors Responsible for Poverty Measures to Eradicate in India. Women's Issues – Dowry, Separation, Female Infanticide/Foeticide, Sexual Harassment in India.

UNIT- II BEGGARY:

Definition – Causes of Beggary – Types, Ways and Means of Preventing Beggary. Rehabilitation Measures of the Government.

UNIT-III PROSTITUTION:

Definition, Types, Causes – Implications of Prostitution and Rehabilitative Measures. Transgender Issues – Factors Responsible for the Issues – Govt Schemes – Programs for their Development.

UNIT- IV ALCOHOLISM AND DRUG ADDICTION:

Alcoholism – Causes/Implications of Drinking and Prevention, Drug Addiction – Types of Drugs – Causes of Addiction and Teenagers – Effects - Remedial Measures. Role of Drug De-Addiction Centres.

UNIT – V JUVENILE DELINQUENCY:

Definition –Causes – Consequences of Juvenile Delinquency, Vagrancy, Truancy, Street Children – Prevention – Reformation of Delinquents.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Self-Study: To understand current issues and practice debates regarding social problems inthe community during field work training.

TEXTBOOK:

1.Ahuja, Ram (2021). Social Problem in India. Rawat Publications, 4th Edition. Jaipur.

REFERENCES:

1. Ahuja, Ram (1992) Social Problems in India, Rawat Publications, Jaipur
2. Madan.G.R. (2002) Indian Social Problems – Vol – 1, Seventh edition, AlliedPublishing, New Delhi.
3. Shankar Rao C. N (2015) Indian Social Problems – A Sociological Perspective, S.Chand & Company Pvt Ltd.
4. Merton, Robert.K and Nisbet Robert Lemert, Contemporary Social Problems Ny:Hard Course Brace 1965.
5. Lemert, Social Pathology Ny, Hard Couse Brace 1962. (1978 Reprint).
6. Threya, Venkatesh B Sheela Rani Chuukkath. Literacy and Empowerment SagePublishing, New Delhi, 1996.
7. Williams Kornblum, Joseph Julian, Social Problems, 8th Edition, Prentice Hall Inc.,1975.
8. Sunil, Social Problems in India – Issues & Perspectives, Regency Publications House,New Delhi, 1990.
9. Bharti Sharma, Juvenile Delinquents and their social culture, Uppal Publishing House,New Delhi, 1990.
10. Bhattacharya. S.K. Social Problems in India – Issues and Perspectives, published byRegency Publications, New Delhi.

E-BOOKS/E-MATERIALS:

1. https://en.wikipedia.org/wiki/Poverty
2. https://unesdoc.unesco.org/ark:/48223/pf0000151826
3. http://ddceutkal.ac.in/Syllabus/MSW/Paper_07.pdf
4. https://www.goodreads.com/book/show/8908426-juvenile-delinquency
5. https://aa-netherlands.org/big-book-online/

COURSE OUTCOMES:

- To be able to trace the evolution of a given social problem to understand the historical, economic, cultural and political reasons that an issue has come to be defined as a social problem.
- To critically assess how social problems are presented to the public by the media, including how the various sides of the debate surrounding a social problem and possible solutions are reported in both Consider alternative explanations and solutions for contemporary social issues.

PROFESSIONAL ETICS

Third Year | **CORE COURSE IX** | **Semester V**

NUMERICAL METHODS AND MATLAB

Code: 22SCCMM9 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To introduce the exciting world of programming to the students through MATLAB.
- To introduce the techniques of Numerical methods.
- To solve numerical problems using MATLAB programming

UNIT – I:

MATLAB Environment: Getting Started – Solving Problems in MATLAB – Saving your works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices – Computational Limitations-Special Values and Functions.

UNIT – II:

Plotting: Introduction to Two Dimensional Plotting – Three Dimensional Plotting –Editing Plots from the Menu Bar – Creating Plots from the Workshop Window.

Programming in MATLAB: Introduction – Problems with Two Variables –Input/Functions – Statement level Control Structures.

UNIT – III:

Numerical Techniques: Introduction – Curve Fitting: Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration –Numerical Differentiation.

UNIT – IV:

Curve Fitting – Fitting Linear and parabolic curves by the method of least squares principles Solving algebraic and transcendental equations-Bisection method, false position method and Newton Raphson method – Solving simultaneous algebraic equations – Guass-seidal method – Guass elimination method.

UNIT – V:

Interpolation – Newton's forward and backward difference formulae – Lagrange's interpolation formula – Numerical integrations using Trapezoidal and Simpson's one – third rules – solution of ODE's – Euler method and Runge-Kutta fourth order method.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Error analysis of Numerical Methods

REFERENCES:

1. Delores M. Etter, David C. Kuncicky, Holly Moore. Introduction to MATLAB, Published by Dorling Kindersley (India) Pvt. Ltd., licenses of Pearson Education in South Asia.
2. M.K. Venkatraman, Numerical methods in Science and Engineering, National Publisher Company, Fifth Edition, 2001 (For Units IV and V).
UNIT – I : Chapter 2 & 3 of [1]
UNIT – II : Chapter 4 & 5 of [1]
UNIT – III : Chapter 8 of [1]
UNIT – IV : Chapter 1, Sections 1.7-1.8, Chapter 3, Sections 2, 4 and 5, Chapter 4, Sections 2, 6 of [2]
UNIT – V : Chapter 6, Sections 3 & 4, Chapter 8 Section 4, Chapter 9 Sections 8 & 10, Chapter 11 Sections 10 & 16 of [2].
3. Yashavant. P. Kanetkar, Let us 'C', BPB Publications, 2002.
4. Rajaraman, Computer oriented numerical methods, Prentice-Hall of India,1971.

COURSE OUTCOMES:

After completing this course, the students will be able to

- Understanding the exciting world of programming through MATLAB.
- Know the techniques of Numerical Methods.
- Apply the MATLAB programming to solve numerical problems.

PROFESSIONAL ETICS

Third Year	**CORE COURSE X**	**Semester V**
	REAL ANALYSIS	
Code: 22SCCMM10	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To understand the axioms of the real numbers, supremum, infimum, upper limits.
- To know open and closed sets in $\mathbb{R}$, continuity and differentiability of functions, L'Hôpital's Rule, Taylor's and the Mean Value Theorems and metric spaces.
- To develop in a rigorous and self-contained manner the elements of real variable functions.
- To enable students to learn functions of bounded variation, grasp basic concepts about the connectedness, compact metric spaces.

UNIT – I:

Introduction – Sets and functions – Countable and Uncountable sets –Inequalities of Holder and Minkowski – Metric spaces – Definition and Examples –Bounded sets in a metric space – Open Ball in a Metric space – Open sets.

UNIT – II:

Subspace – Interior of a set – Closed sets – Closure – Limit point – Dense sets –Completeness – Baire's Category theorem.

UNIT – III:
Continuity – Homeomorphism – Uniform Continuity.

UNIT – IV:
Connectedness – Definition and examples – Connected subsets of R – Connectedness & Continuity.

UNIT – V:
Compact Metric spaces – Compact subsets of R – Equivalent Characterization for Compactness – Compactness and Continuity.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Introduction to Basic topology

REFERENCES:

1. Dr. S. Arumugam & Mr. A. Thangapandi Issac, Modern Analysis, New Gamma Publishing House, Palayamkottai, Fourth reprint 2021.
UNIT – I : Chapter 1 Sections 1.1 to 1.4, Chapter 2 Sections 2.1 to 2.5
UNIT – II : Chapter 2 Sections 2.6 to 2.11 & Chapter 3
UNIT – III : Chapter 4 Sections 4.1 to 4.4
UNIT – IV : Chapter 5
UNIT – V : Chapter 6
2. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

COURSE OUTCOMES:

After completing this course, the students will be able to

- Explain the concepts such as real valued functions, continuity,connectedness, compactness, etc.
- Prove standard theorems in real analysis
- Distinguish between upper bound and lower bound; continuity and uniform continuity of a function; limit point and interior point; and bounded and totally bounded.
- Characterize structures of connected sets, nowhere dense sets, continuity of afunction, compact sets and category of sets.
- Generate sets and functions of required nature.

PROFESSIONAL ETICS

Third Year	**CORE COURSE XI STATICS**	**Semester V**
Code: 22SCCMM11	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES

To provide the basic knowledge of equilibrium of a particle.
To develop a working knowledge to handle practical problems.

UNIT – I:

Introduction – Forces acting at a point: Triangle of forces – Resolving of a force – Condition of equilibrium.

UNIT – II:

Parallel forces and Moments: Resultant of parallel forces – Theorems on Moments – Moment about an axis – couples.

UNIT – III:

Equilibrium of three forces acting on a rigid body: Conditions of equilibrium – Trigonometrical theorems and problems - Coplanar forces: Reduction of Coplanar forces– Equation of Line of action of the resultant – Conditions of equilibrium.

UNIT – IV:

Friction: Introduction – Laws of Friction – Definitions – Equilibrium of a particle on a rough inclined plane.

UNIT – V:

Equilibrium of strings: Equation of the Common Catenary -Parabolic Catenary.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only): Introduction to Virtual work

REFERENCES:

1. M.K. Venkataraman, Statics, Agasthiyar Publications, 17th edition, 2014.
UNIT – I : Chapter1, Chapter2.
UNIT – II : Chapter 3, Chapter 4.
UNIT – III : Chapter 5 (Section 1-6), Chapter 6 (Section 1-12).
UNIT – IV : Chapter 7 (Section 1-13) Pages: 206 – 238.
UNIT – V : Chapter 9 (Section 1- 8)
2. A.V. Dharmapadham, Statics, S. Viswanathan Publishers Pvt.Ltd, 2006.
3. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics S. Chand& Company PVT, LTD, 2014.
4. S.L. Lony, Elements of Statics and Dynamics, Part-I, A.I.T.B.S. Publishers, 2007.

COURSE OUTCOMES: After completing this course, the students will be able to

- The course deals the study of internal and external forces in a structure.
- Provide the basic knowledge of Equilibrium of a particle.
- Develop a working knowledge to handle practical problems.

PROFESSIONAL ETICS

Third Year	**CORE PRACTICAL I**	**Semester V**
	MATLAB PROGRAMMING LAB	
Code: 22SCCMM1P	**(Practical)**	**Credit: 4**

COURSE OBJECTIVES:

- To solve numerical problems using MATLAB programming.

LIST OF PRACTICALS

1. Linear Interpolation
2. Linear Regression
3. Curve Fitting
4. Trapezoidal rule of Integration
5. Simpson's 1/3 rule of Integration
6. Newton – Raphson method of solving equations
7. Gauss Elimination method of solving simultaneous equations
8. Gauss – Seidal method of solving simultaneous equations
9. R-K fourth order method of solving differential equations
10. Lagrange's method of interpolation

COURSE OUTCOMES:

After completing this course, the students will be able to

- Experience the programming skills through numerical methods.
- Know basic commands in MATLAB programming.
- Solve numerical problems using MATLAB programming.

PROFESSIONAL ETICS

Third Year	**MAJOR BASED ELECTIVE I OPERATIONS RESEARCH**	**Semester V**
Code: 22SMBEMM1A	**(Theory)**	**Credit: 4**

COURSE OBJECTIVES:

- The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.
- This module aims to introduce students to use quantitative methods and techniques for effective decision–making; model formulation and applications that are used in solving business decision problems.
- To know Linear Programming (LP) and allocation of resources, LP definition, Linearity requirement
- To know and solve Maximization and Minimization problems.
- To know Graphical LP Minimization solution, Introduction, Simplex method definition, formulating the Simplex model.
- To learn Linear Programming – Simplex Method for Maximizing.

UNIT – I:

Linear programming problem - Mathematical formulation – Illustrations on Mathematical formulation on Linear Programming Problems – Graphical solution method - some exceptional cases - Canonical and standard forms of Linear Programming Problem - Simplex method.

UNIT – II:

Use of Artificial Variables (Big M method - Two phase method) – Duality in Linear Programming - General primal-dual pair - Formulating a Dual problem - Primaldual pair in matrix form -Dual simplex method.

UNIT – III:

Transportation problem - LP formulation of the TP - Solution of a TP - Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP - Transportation Algorithm (MODI Method) - Assignment problem – Solution methods of assignment problem – special cases in assignment problem.

UNIT – IV:

Queuing theory - Queuing system - Classification of Queuing models – Poisson Queuing systems Model I (M/M/1)(∞/FIFO) only - Games and Strategies – Two person zero sum – Some basic terms - the maximin-minimax principle –Games without saddle points-Mixed strategies - graphic solution $2 \times n$ and $m \times 2$ games.

UNIT – V:

PERT and CPM – Basic components – logical sequencing - Rules of network construction- Critical path analysis - Probability considerations in PERT.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Applications of OR in Financial Management, Budgeting and Investments

REFERENCES:

1. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, 13th edition, Sultan Chand and Sons, 2007.
UNIT – I: Chapter 2 Sections 2.1 to 2.4, Chapter 3 Sections 3.1 to 3.5, Chapter 4 Sections 4.1 , 4.3
UNIT – II: Chapter 4 Section 4.4, Chapter 5 Sections 5.1 to 5.4, 5.9
UNIT – III: Chapter 10 Sections 10.1, 10.2, 10.8, 10.9, 10.12 & 10.13, Chapter 11 Sections 11.1 to 11.4
UNIT – IV: Chapter 21 Sections 21.1, 21.2, 21.7 to 21.9, Chapter 17 Sec 17.1 to 17.6
UNIT – V: Chapter 25 Sections 25.1 to 25.4, 25.6, 25.7
2. Sundaresan. V, Ganapathy Subramanian. K.S. and Ganesan. K, Resource Management Techniques, A.R. Publications, 2002.
3. Taha H.A., Operations Research: An introduction, 7th edition, Pearson Prentice Hall, 2002.

COURSE OUTCOMES: After completing this course, the students will be able to

- Demonstrate the basic concepts of LPP, game theory, queuing models and networks
- Make use of different methods to get optimality in LPP, TP, AP and games
- Check the existence of alternate / infeasible / unbounded solutions
- Evaluate the solution of primal using duality, optimal solution by characteristics of queuing system
- Convert possible real life problems into OR model.

PROFESSIONAL ETICS

Third Year | **SKILL BASED ELECTIVE I** | **Semester V**

INTRODUCTION TO LATEX

Code: 22SSBEMM1 | **(Theory)** | **Credit: 4**

COURSE OBJECTIVES:

- To make the students learn the art of typing mathematics text on their own.
- To inculcate professional training required to become a scholar in mathematics.

UNIT – I:

Basic Structure of Latex 2e - Input file structure - Layout -Editors - Forward Search - Inverse Search - Compiling - Conversion to various formats.

UNIT – II:

Typesetting simple documents - sectioning - Titles- page layout - listing – enumerating - quote - letter formats.

UNIT – III:

Using package amsmath typing equations labeling and referring.

UNIT – IV:

Figure inclusion - Table inclusion.

UNIT – V:

Bibliography - Index typing - Beamer presentation Styles.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only):
Type a mathematical article using various journal style files

REFERENCES:

1. Leslie Lamport. LATEX: A Document Preparation System, Addison- Wesley, Reading, Massachusetts, second edition, 1994.
2. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl., The (Not So) Short Introduction to LATEX2e, Samurai Media Limited (or available online at http://mirrors.ctan.org/info/lshort/english/lshort.pdf)
3. LATEX Tutorials - A Primer, Indian TeX Users Group, available online at https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf
4. H. J. Greenberg. A Simplified introduction to LATEX, available online at https://www.ctan.org/tex-archive/info/simplified34latex/
5. Using Kile - KDE Documentation, https://docs.kde.org/trunk4/en/extragear_office/kile/quickusing.html
6. Amsmath and geometry package available in Ctan.org.

COURSE OUTCOMES:

At the end of the course, students will be able to
1. Type their own mathematical article/notes/book/journal paper/project work.
2. Meticulously prepare their own mathematical notes.
3. Understand basic structure of Latex 2e and conversions of them to various formats.
4. Typeset and compile documents with titles, sectioning and enumeration etc.
5. Use various style files and in particular amsmath, amsfonts, amsthm.
6. Understand how to align math equations, matrices etc.
7. Include the figures in various formats into their latex document and compile it successfully.
8. Utilize bibtex feature of including bibliographies and indexes.

PROFESSIONAL ETICS & HUMANVALUES

Third Year	**PART-IV**	**Semester-V**
	SOFT SKILLS DEVELOPMENT	
Code: 22UGSDC	**(Theory)**	**Credit: 2**

OBJECTIVES :

- To Develop communicative competence among the Students.
- To enhance the learner's soft skills by giving adequate exposure in LSRW and sub skills.
- To enable learners to put the life skills into practice with confidence.

UNIT- I KNOW THYSELF / UNDERSTANDING SELF:

Introduction to Soft skills-Self discovery-Developing positive attitude-Improving perceptions- Forming values.

UNIT -II INTERPERSONAL SKILLS/ UNDERSTANDING OTHERS:
Developing interpersonal relationship-Team building-group dynamics-Net working- Improved work relationship

UNIT -III COMMUNICATION SKILLS / COMMUNICATION WITH OTHERS:

Art of listening –Art of reading –Art of speaking –Art of writing-Art of writing e-mails e mail etiquette.

UNIT- IV CORPORATE SKILLS / WORKING WITH OTHERS

Oral Presentation – Memos- Note taking - Note making and preparing Minutes- Reports, Proposals, Abstracts - Technical Writing.

UNIT -V SELLING SELF / JOB HUNTING

Writing resume/cv-interview skills-Group discussion- Mock interview-Mock GD – Goal setting - Career planning

UNIT - VI: CURRENT CONTOURS: (for continuous internal assessment only):

REFERENCES:

1. N. Krishnasamy, Manju Dhariwel and Lalitha Krishnasamy(2015). Mastering Communication Skills and Soft Skills – Bloomburg.
2. Meena.K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills : A Road Map to Success), P.R. Publishers & Distributors,
3. Meera Banerjee and Krishna Mohan: Developing Communication Skills, Trinity Publishers-(Lakshmi Publications.
4. Alex K. (2012) Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi- 110 055.

COURSE OUTCOMES:

- Develop listening, speaking, reading and writing skills in English.
- Enhance soft skills and engage in a range of communicative tasks and activities
- Comprehend a text and identify specific and global information
- Promote communicative ability in both spoken and written form of the language
- Develop interpersonal skills to maintain human relationship
- Develop corporate skills to promote leadership qualities and team spirit.

PROFESSIONAL ETICS

Third Year	**CORE COURSE XII**	**Semester VI**
	LINEAR ALGEBRA	
Code: 22SCCMM12	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:
To inculcate vector space, linear independence, linear transformations, matrix operations, determinants, Eigen values and Eigen vectors, and applications.

UNIT – I:

Vector spaces: Vector spaces – Definition and examples – Subspaces-linear transformation – Span of a set.

UNIT – II:

Basis and Dimension: Linear Independence – Basis and Dimension –Rank and Nullity.

UNIT – III:

Matrix and Inner product space: Matrix of a linear transformation -Inner product space – Definition and examples – Orthogonality– Gram Schmidt orthogonalisation process – Orthogonal Complement.

UNIT – IV:

Theory of Matrices: Algebra of Matrices - Types of Matrices – The Inverse of a Matrix –Elementary Transformations – Rank of a matrix.

UNIT – V:

Characteristic equation: Characteristic equation and Cayley -Hamilton theorem – Eigen values and Eigen vectors.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
The algebra of polynomials

REFERENCES:
1. Arumugam S and Thangapandi Isaac A, Modern Algebra, SciTech Publications (India) Ltd., Chennai, Edition 2012.

UNIT – I : Chapter 5, Sec 5.1 to 5.4
UNIT – II : Chapter 5, Sec 5.5 to 5.7
UNIT – III : Chapter 5,Sec 5.8, Chapter 6, Sec 6.1 to 6.3
UNIT – IV : Chapter 7 Sec 7.1 to 7.5
UNIT – V : Chapter 7, Sec 7.7, 7.8
2. I.N. Herstein, Topics in Algebra, Second Edition, John Wiley & Sons(Asia), 1975

COURSE OUTCOMES:

After completing this course, the students will be able to

- Define basic concepts of vector spaces, linear transformations, inner product spaces.
- Prove standard theorems in Linear Algebra
- Distinguish linear independence and dependence; singular and nonsingular linear transformations; quadratic and diagonal forms.
- Determine basis and dimension of vector space, orthogonal basis, eigen values, eigen vector and posets.
- Construct orthonormal basis from a given basis; to reduce a quadratic form to diagonal form.

PROFESSIONAL ETICS

Third Year	CORE COURSE XIII COMPLEX ANALYSIS	Semester VI
Code: 22SCCMM13	(Theory)	Credit: 5

COURSE OBJECTIVES:

- To introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of the fundamental concepts of Complex Analysis such as analytic functions.
- Understand the concepts of complex integration and series expansions such as Cauchy's integral formula and its derivative, Taylor's series, Laurent's series and singularities.
- To acquire the knowledge and develop manipulation skills in the use of Rouche's theorem.
- Understand and learn to use Argument Principle and the principal of Analytic Continuation and the concerned results.

UNIT – I:

Functions of a Complex variable –Limits-Theorems on Limits –Continuous functions – Differentiability – Cauchy-Riemann equations – Analytic functions – Harmonic functions.

UNIT – II:

Elementary transformations - Bilinear transformations – Cross ratio – fixed points of Bilinear Transformation – Some special bilinear transformations.

UNIT – III:

Complex integration - definite integral – Cauchy's Theorem –Cauchy's integral formula –Higher derivatives.

UNIT – IV:

Series expansions – Taylor's series – Laurant's Series – Zeroes of an analytic functions – Singularities.

UNIT – V:

Residues – Cauchy's Residue Theorem –Evaluation of definite integrals.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Harmonic Functions

REFERENCES:

1. S. Arumugam, A. Thangapandi Isaac, & A. Somasundaram, Complex Analysis, New Scitech Publications (India) Pvt. Ltd, 2002.

UNIT – I : Chapter 2 section 2.1 to 2.8
UNIT – II : Chapter 3 Sections 3.1 to 3.5
UNIT – III : Chapter 6 sections 6.1 to 6.4
UNIT –IV : Chapter 7 Sections 7.1 to 7.4
UNIT – V : Chapter 8 Sections 8.1 to 8.3

2. J.N. Sharma, Functions of a Complex variable, Krishna Prakasan Media(P) Ltd, 13th Edition, 1996-97.

3. T.K. Manickavachaagam Pillai, Complex Analysis, S. Viswanathan Publishers Pvt. Ltd, 1994.

COURSE OUTCOMES:

After completing this course, the students will be able to

- Becoming familiar with the concepts Complex numbers and their properties and operations with Complex number.
- Finding domain and range of complex functions and sketching their graphs.
- Evaluating limits and checking the continuity of complex function.
- Checking differentiability and Analyticity of functions.
- Evaluate Complex integrals and applying Cauchy integral.

PROFESSIONAL ETICS

Third Year	**CORE COURSE XIV DYNAMICS**	**Semester VI**
Code: 22SCCMM14	**(Theory)**	**Credit: 4**

COURSE OBJECTIVES:

- Understand the fundamental concepts of velocity and acceleration.
- Understand the work done in stretching an elastic string Simple Harmonic motion.
- Study the motion of projectiles, impact of sphere and central orbits.

UNIT – I:

Introduction-Kinematics: Velocity-Relative Velocity-Angular Velocity-Acceleration-Relative Acceleration-Motion in a straight line under uniform acceleration.

UNIT – II:

Projectile: Projectile-Path of a projectile-Characteristics-Horizontal projection-Projectile up/down in an inclined plane.

UNIT – III:

Collision of Elastic Bodies: Introduction-Definitions-Fundamental Laws of impact-Impact of a smooth sphere on a fixed smooth plane-Direct impact of two smooth spheres-Oblique impact of two smooth spheres-Dissipation of energy due to impact-Compression and Restitution-Impact of a particle on a rough plane.

UNIT – IV:

Simple Harmonic Motion: Introduction-S.H.M. in straight line-Compositions of simple harmonic motions of the same period.

UNIT – V:

Motion Under The action Of Central Forces: Velocity and acceleration in polar coordinates-Equiangular spiral-Differential Equation of central orbits-Pedal Equation of the central orbit-Two-fold problems in central orbits.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only): Impulsive forces

REFERENCES:

1. Dr. M.K. Venkataraman, Dynamics, Agasthiyar Publications, Thirteenth Edition, July 2009.
UNIT – I : Chapter 2, Chapter 3, Section 3.1-3.22
UNIT – II : Chapter 6, Sections 6.1-6.16
UNIT – III : Chapter 8, Sections 8.1-8.11
UNIT – IV : Chapter 10, Sections 10.1-10.13
UNIT – V : Chapter 11, Sections 11.1-11.11
2. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics S. Chand & Company Pvt. Ltd., 2014.
3. A.V. Dharmapadham, Dynamics, S. Viswanathan Publishers Pvt. Ltd. 2006.

COURSE OUTCOMES:

After completing this course, the students will be able to

- Acquire knowledge about the basic concepts of kinematics.
- Analyze the motion of Projectiles and their results.
- Critique the concepts of Central Orbits, differential equation of a central orbit.

PROFESSIONAL ETICS

Third Year	**MAJOR BASED ELECTIVE II GRAPH THEORY**	**Semester VI**
Code: 22SMBEMM2A	**(Theory)**	**Credit: 4**

COURSE OBJECTIVES:

- To introduce the notion of graph theory and its applications.
- To introduce some of the most important notions of Graph Theory and develop their skills and solving basic exercises.

UNIT – I:

Introduction - The Konigsberg Bridge Problem - Graphs and subgraphs: Definition and Examples - Degrees - Subgraphs - Isomorphism – independent sets and coverings.

UNIT – II:

Matrices - Operations on Graphs - Walks, Trails and Paths –Connectedness and Components - Eulerian Graphs.

UNIT – III:

Hamiltonian Graphs (Omit Chavatal Theorem) - Characterization of Trees - Centre of a Tree.

UNIT – IV:

Planarity: Introduction - Definition and Properties - Characterization of Planar Graphs.

UNIT – V:

Directed Graphs: Introduction - Definitions and Basic Properties – Some Applications: Connector Problem - Kruskal's algorithm - Shortest PathProblem – Dijkstra's algorithm.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Independent Sets and Matchings

REFERENCES:

1. S. Arumugam and S. Ramachandran, Invitation to Graph Theory, SciTech Publications (India) Pvt. Ltd., Chennai, 2006.
UNIT – I : Chapter-1 Sec 1.0, 1.1 and Chapter -2 Sec 2.0, 2.1, 2.2, 2.3, 2.4.2.6
UNIT – II: Chapter-2 Sec 2.8,2.9 ,Chapter-4 Sec 4.1,4.2 and Chapter-5 Sec 5.0,5.1
UNIT – III: Chapter-5 Sec 5.2, Chapter-6 Sec 6.0,6.1,6.2.
UNIT – IV: Chapter-8 Sec 8.0,8.1,8.2.

UNIT – V: Chapter-10 Sec 10.0, 10.1 Chapter-11 Sec 11.0,11.1,11.2

2. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, Prentice Hall of India, 2004.
3. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata Mc Graw-Hill Edition, 2004.

COURSE OUTCOMES:

After completing this course, the students will be able to

- To understand and apply the fundamental concepts in graph theory.
- To apply graph theory based tools in solving practical problems
- To understand the trees
- The students will be able to know the planarity.
- To explain the Kruskal's algorithm and Dijkstra's algorithm.

PROFESSIONAL ETICS

Third Year	**MAJOR BASED ELECTIVE III NUMBER THEORY**	**Semester VI**
Code: 22SMBEMM3B	**(Theory)**	**Credit: 3**

COURSE OBJECTIVES:

- To highlight the niceties and nuances in the world of numbers.
- To prepare the students for coding through congruences.

UNIT – I:

Euclid's Division Lemma – Divisibility – The Linear Diophantine Equation – The Fundamental Theorem of Arithmetic.

UNIT – II:

Permutations and Combinations – Fermat's Little Theorem – Wilson's Theorem – Generating Functions.

UNIT – III:

Basic Properties of Congruences Residue Systems. Linear Congruences – The Theorems of Fermat and Wilson Revisited.

UNIT – IV:

The Chinese Remainder Theorem – Polynomial Congruences – Combinational Study of F(n).

UNIT – V:

Formulae for d(n) and s(n) – Multiplicative Arithmetic Function – The Mobius Inversion Formula.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):
Prime number theorem and its applications.

REFERENCES:

1. Number Theory by George E. Andrews, Hindustan Publishing Corporation – 1984, Edition.
UNIT – I : Chapter - 2 Sec. 2.1 – 2.4 pages 12-29
UNIT – II: Chapter – 3 Sec. 3.1, 3.4 pages 30-44
UNIT – III: Chapter – 4Sec. 4.1 – 4.2 Pages 49 – 55, Sec. 5.1- 5.2 Pages 58-65
UNIT – IV: Chapter – 4 Sec. 5.3 – 5.4 pages 66-74, Sec. 6.1 Pages 75-81
UNIT – V: Chapter – 5 Sec. 6.2 – 6.3 Pages 82-92
2. Basic Number Theory by S.B. Malik, Vikas Publishing House Pvt. Ltd.,
3. A First Course Theory of Numbers by K.C. Chowdhury. Asian Books Pvt. Ltd., I Edition (2004)

COURSE OUTCOMES:

After completing this course, the students will be able to

- Understand the concepts of divisibility and fundamental theorem of arithmetic

PROFESSIONAL ETICS

Third Year | **SKILL BASED ELECTIVE II MATHEMATICS FOR COMPETITIVE EXAMINATIONS** | **Semester VI**

Code: 22SSBEMM2 | **(Theory)** | **Credit: 2**

COURSE OBJECTIVES:

- To gain quantitative aptitude required in the present scenario.
- To emphasize the right perceptive needed to crack such problems and understand the recurring pattern in those problems.

UNIT – I:

Problems on Numbers- Average-Problems on Ages.

UNIT – II:

Percentage-Profit & Loss-Simple Interest-Compound Interest.

UNIT – III:

Ratio & Proportion-Partnership-Calender-Clocks.

UNIT – IV:

Time and work-Pipes & Cistern.

UNIT – V:

Time & Distance-Problems on Trains-Boats and Streams.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Simple problems using sets, functions, group theory etc.

REFERENCES:

Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Pearson Education, 3 edition, 2015.

Course Outcomes:

At the end of the course, students will be able toFace competitive examinations with confidence.

- Solve a lot of problems on numbers and averages and problems on ages.
- Get a lot of training on percentage, profit and loss.
- Crack problems on calculating simple interest and compound Interest.
- Work on a plenty of problems on time and work.
- Get working knowledge on ratios and proportions.
- Calculate time, distance, speed given the other two and solve lot of problems.
- Acquire problem solving ideas on trains, boats and streams.

PROFESSIONAL ETICS , GENDER & HUMANVALUES

Third Year	**PART-V**	**Semester-VI**
	GENDER STUDIES	
Code: 22UGGS	**(Theory)**	**Credit: 2**

OBJECTIVES:

- To make students to aware of Gender constructions and gendering Process
- To explore existing gender biases in the society and to understand the need to work towards
- the inclusive society
- To inculcate sensitivity and build gender perspectives.
- To use the course to bring attitudinal cum behavioral changes towards gender neutral ambience and promote the humanistic values

UNIT- I INTRODUCTION TO GENDER STUDIES CONCEPTS

Gender Spectrum.-Sex – Gender distinction – Biological Determinism – Patriarchy – Feminism –Gender Socialization and Stereotyping-Gender Discrimination – Gender Division of labour and roles– Gender Sensitivity and awareness – Gender Equity – Equality – Gender Main streaming and Gender Analysis.

UNIT- II UGC INITIATIVES ON WOMEN'S STUDIES

Definition of Women's Studies –Gender Studies –UGC Initiatives and guidelines on Women's Studies - Beijing Conference, UN Initiatives – Convention on Elimination of All forms of Discrimination Against Women (CEDAW)- Sustainable Development Goals on Gender Equality (SDG 5) and targets

UNIT- III AREAS OF GENDER DISCRIMINATION

Gender Socialization- Sex Ratio– Health and Nutrition– – Literacy and Education - Employment- Governance – participation in decision making- politics- property rights and access to credit- gender based violence- Social institutions –Family, Caste, Class, religion, gender, State. Market – Media – Politics – Judiciary

UNIT -IV WOMEN DEVELOPMENT AND GENDER EMPOWERMENT

Towards Equality Report of Status of Women in India 1974 – International Women's Decade – International Women's Year – National Policy for Empowerment of Women 2001

UNIT -V WOMEN'S MOVEMENTS AND SAFEGUARDING MECHANISM :

In India National /State Commission for Women(NCW) – All Women Police Station – Family Court Legislations safeguarding women –Transgender Policy—Constitutional amendments for women's political participation

UNIT - VI CURRENT CONTOURS: (for continuous internal assessment only):
Tamil Nadu State Policy for Women 2021- National Policy for Women 2015 – Prevention of Sexual Harassment at Work places Act 2013- Protection of Children from Sexual Offences Act, 2012 - Analysis of regressive and progressive High court and supreme court judgments- women proactive policies, programmes, interventions

REFERENCE :

1. Bhasin Kamala, Understanding Gender : Gender Basics , New Delhi : Women Unlimited , 2004
2. Bhasin Kamala, Exploring Masculinity: Gender Basics , New Delhi: Women Unlimited,2004
3. Bhasin Kamala , What is Patriarchy? : Gender Basics, New Delhi :Women Unlimited ,1993
4. Arya Sadhna Women ,Gender Equality and the State ,New Delhi :Deep & Deep Publication,2000
5. பாலியலை புரிந்து கொள்வோம் மதுரை ஏக் தா
6. Mishra .O.P,Law Relating to Women &Child ,Allahabad :Central Law Agency ,2001
7. Uma Chakravarti, Gendering Caste Through a Feminist Lens, Sage Publication 2003
8. Bhattacharya Malini , Sexual Violence and Law ,Kolkata; West Bengala Commission for Women ,2002
9. Sexual Harassment at the Workplace – A Guide , New Delhi ;Sakshi,1999
10. அஜித்தா குடும்ப வன்முறையிலிருந்து பெண்களை பாதுகாக்கும் சட்டம் 2005 மதுரை ஏக் தா 2005
11. பொன் கிருஷ்ணசாமி ஜே பால் பாஸ்கர் & ஆ ஜான் வின்சென்ட் பெண்களும் உச்ச நீதிமன்றமும் மதுரை சொகோ வாசகர் வட்டம் ,2004
12. குடும்ப வன்முறையிலிருந்து பெண்களை பாதுகாக்கும் சட்டம் 2005 Women's Integrated National Development Trust
13. https://www.schooloflegaleducation.com/women-and-law-in-india-e-book/

COURSE OUTCOMES:

- Students would have gained a perspective and understood the social reality of gender society

understood the differences of gender and sex and may resort to building alternative perspectives and critical thinking.

- Gained knowledge on the various social institutions governing gender and the intersectionality.
- Exposed to the kind of initiatives of the State towards gender equality

M.Sc. Mathematics

PROFESSIONAL ETHICS

First Year	**CORE COURSE I ALGEBRA**	**Semester: I**
Code: P22MACC11	**(Theory)**	**Credit: 5**

OBJECTIVES:

- To give foundation in Algebraic structures like Groups ,Rings
- To train the students in problem solving in Algebra

UNIT – I:

Set Theory – Mappings – Group – Subgroups – A counting Principle - NormalSubgroups and Quotient groups.

UNIT – II:

Homomorphism – Cayley's theorem – Permutation groups – Another countingprinciple – Sylow's theorems.

UNIT – III:

Homomorphisms -Ideals and quotient rings – More ideals and quotient rings –Euclidean Rings-A particular Euclidean Ring.

UNIT – IV:

Polynomial rings – Polynomials over the rational field – polynomials over commutative Rings -Inner Product spaces.

UNIT – V:

FIELDS: Extension fields – Roots of Polynomials – More about roots – Theelements of Galois theory– Finite fields.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only):

Classification of finite Groups - Commutative rings, Applications of field theory to coding theory.

REFERENCES:

1. I.N. Herstein, Topics in Algebra, Second Edn, Wiley Eastern Limited.
   UNIT – I - Chapter 1: Sec 1.1, 1.2 Chapter 2: Sec 2.1 – 2.6
   UNIT – II - Chapter 2: Sec 2.7, 2.9, 2.10, 2.11, 2.12
   UNIT – III - Chapter 3: Sec 3.3, 3.4, 3.5, 3.7, 3.8.
   UNIT – IV - Chapter 3: 3.9, 3.10, 3.11 Chapter 4: 4.4
   UNIT – V - Chapter 5: Sec 5.1, 5.3, 5.5, 5.6 Chapter 7: Sec 7.1
2. David S. Dummit and Richard M. Foote, Abstract Algebra, Third Edition, Wiley Student Edition, 2015.
3. John, B. Fraleigh, A First Course in Abstract Algebra, Addison-Wesley Publishing Company.
4. Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 1993.
5. Joseph A. Gallian, Contemporary Abstract Algebra, Fourth Edition, Narosa publishing House, 1999.
6. http://www.math.stonybrook.edu/~irwin/algbk.pdf
7. https://www.math.usm.edu/perry/old_classes/mat423fa11/notes_25aug2011.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Gain expertise in the basic concepts of group theory with the help of numerous examples.
- Discuss in detail about permutation groups and Normal subgroups anddiscuss on counting tricks in algebra.
- Bring out the key steps involved in proving Sylow theorems and use Sylow'stheorems to classify groups of finite order upto 120.
- Learn the fundamental concept in field theory of field extensions and would seethe idea of generating new fields.
- Have clear cut idea in the notions of Galois groups, normal extensions and separable extensions and illustrate them with various examples.
- Able to understand the Fundamental theorem of Galois theory.

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PROFESSIONAL ETHICS

First Year	**CORE COURSE II** **REAL ANALYSIS**	**Semester: I**
Code: P22MACC12	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To enable the students to learn the basic concepts of Real Analysis and techniques in Analysis to prepare for the advanced courses like Functional Analysis and Advanced Analysis.

UNIT – I:

The Real and Complex Number Systems: Introduction – Ordered sets – Fields–The Real Field – Extended Real Number system–The Complex Field – Euclidean Spaces. Basic topology: Finite, countable and uncountable sets – Metric Spaces –Compact sets – Perfect sets – Connected sets.

UNIT – II:

Numerical Sequences: Convergent Sequences – Sub-sequences – Cauchy Sequences – Upper and Lower Limits – Some Special Sequences – Series– Seriesof Non-Negative Terms. Numerical Series: The Number e – The Root and Ratio Test – Power Series – Summation by Parts – Absolute Convergence- Addition and Multiplication of Series - Rearrangements.

UNIT – III:

Continuity: Limits of Functions - Continuous Functions – Continuity andCompactness – Continuity and Connectedness – Discontinuities – Monotonic Functions – Infinite Limits and Limits at Infinity. Differentiation: The Derivative of a Real Function – Mean Value Theorems – The Continuity of Derivatives – L'Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem – Differentiation of Vector Valued Functions.

UNIT – IV:

The Riemann-Stieltjes Integral: Definition and existence of the integral – Properties of the Integral – Integration and Differentiation – Integration and vector valued functions – Rectifiable curves.

UNIT – V:

Sequence and Series of Functions: Sequence of Functions – Discussion of Main Problem– Uniform Convergence and Continuity –Uniform Convergence and Integration – Uniform Convergence and Differentiation. Families of Functions: Equi continuous Families of Functions – The Stone – Weierstrass Theorem.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Generalizations to topological spaces, Calculus on Manifolds.

REFERENCES:

1. Walter Rudin, Principles of Mathematical Analysis, 3rd Edition Tata McGraw-Hill 1985.
   UNIT – I - Chapter 1: Sec 1.1 – 1.38 & Chapter 2: Sec 2.1 – 2.47
   UNIT – II - Chapter 3: Sec 3.1 – 3.55
   UNIT – III - Chapter 4: Sec 4.1 – 4.34Chapter 5: Sec 5.1 – 5.19
   UNIT – IV - Chapter 6: Sec 6.1 – 6.27
   UNIT – V - Chapter 7: Sec 7.1 – 7.33
2. Tom. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
3. R. G. Bartle, D. R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, New York, 1982.
4. Kenneth A. Ross, Elementary Analysis: The Theory of Calculus, Springer NewYork, 2004.
5. N. L.Carothers, Real Analysis, Cambridge University Press, UK, 2000.
6. S. C. Malik, Mathematical Analysis,Willey Eastern Ltd, NewDelhi, 1985.
7. K. R. Stromberg, An Introduction to Classical Real Analysis, Wadsworth,1981.
8. H. L. Royden, Real Analysis, Third Edition, Macmillan Publishing Company, New Delhi, 1988.
9. https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/Real-Analysis-4th-Ed-Royden.pdf
10. http://www.freebookcentre.net/maths-books-download/gotoweb.php?id=9633

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
- Demonstrate an understanding of limits ad how that are used in sequences.
- Demonstrate an understanding of limits ad how that are used in series.
- Demonstrate an understanding of limits ad how that are used in sequences Examine and recognize the continuity of real functions.
- Demonstrate an intuitive and computational understanding of set theory, Continuity and solving application problems. This will be assessed through homework, class quizzes and tests, and a final exam.

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PROFESSIONAL ETHICS

First Year	CORE COURSE III ORDINARY DIFFERENTIAL EQUATIONS	Semester: I
Code: P22MACC13	(Theory)	Credit: 5

COURSE OBJECTIVES:

- To give an in-depth knowledge of differential equations and their applications.
- To study the existence, uniqueness, stability behavior of the solutions of the ODE.

UNIT – I:

The general solution of the homogeneous equation– he use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series– Series solutions of first order equations – Second order linear equations; Ordinary points.

UNIT – II:

Regular Singular Points – Gauss's hypergeometric equation – The Point at infinity - Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.

UNIT – III:

Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.

UNIT – IV:

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions – Sturm Comparison Theorems – Eigen values, Eigen functions and the Vibrating String.

UNIT – V:

Nonlinear equations: Autonomous Systems; the phase plane and its phenomena – Types of critical points; Stability – critical points and stability for linear systems – Stability by Liapunov's direct method – Simple critical points of nonlinear systems.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

System of ode and using Canonical forms to solve.

REFERENCES:

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 1984.
   UNIT – I - Chapter 3: Sections 15, 16, 19 and Chapter 5: Sections 25 to 27
   UNIT – II - Chapter 5: Sections 28 to 31 and Chapter 6: Sections 32 to 35
   UNIT – III - Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56UNIT – IV - Chapter 4: Sections 22 to 24
   UNIT – V - Chapter 8: Sections 42 to 44
2. W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, New York, 1971.
3. E.A. Coddingtonand N. Levinson, Theory of Ordinary Differential Equaitons, McGraw Hill Publishing Company, New York, 1955.
4. http://www.freebookcentre.net/maths-books-download/gotoweb.php?id=8714
5. https://s3.amazonaws.com/open-bookshelf-content/Open+Textbook+Library/URI/urn%3Auuid%3Ae46a68f9-3e84-4999- b9f6-18c3dfb2faca/Ordinary+Differential+Equations.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Find the general solution of the first order linear homogeneous equations.
2. Understand the utility of the theory of power series which is studied in Real Analysis course through solving various second order differential equations.
3. Get introduced to the Hypergeometricfunctions which arises in connection with solutions of the second order ordinary differential equations with regular singular points.
4. Solve the problems arises in Mathematical physics using properties of special functions.
5. Understand the importance of studying well-posedness of the problem namely existence, uniqueness and continuous dependence of first order differential equations through Picard's theorem.
6. Understand the utility of the concepts from linear algebra and analysis in the study of system of first order equations.
7. Discuss the Qualitative properties of solutions of first and second orderequations. Also they will be able to work on numerous problems usingcomparison theorem in Sturm Liouville problems.
8. Learn the nature of solutions which involves critical points and phase portrait of nonlinear equations.

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PROFESSIONAL ETHICS

First Year	**CORE CHOICE COURSE I CLASSICAL DYNAMICS**	**Semester: I**
Code: P22MACC1A	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To give a detailed knowledge of the mechanical system of particles.
- To study the applications of Lagrange's and Hamilton's equations.

UNIT – I:

Introductory concepts: The mechanical system - Generalised Coordinates - constraints - virtual work - Energy and momentum.

UNIT – II:

Lagrange's equation: Derivation and examples - Integrals of the Motion - Small oscillations.

UNIT – III:

Special Applications of Lagrange's Equations: Rayleigh's dissipation function - impulsive motion - Gyroscopic systems - velocity dependent potentials.

UNIT – IV:

Hamilton's equations: Hamilton's principle - Hamilton's equations - Other variational principles - phase space.

UNIT – V:

Hamilton - Jacobi Theory: Hamilton's Principal Function – The Hamilton - Jacobi equation - Separability.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Introduction to relativity

REFERENCES:

1. Donald T. Greenwood, Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985.
   UNIT – I - Chapter 1: Sections 1.1-1.5
   UNIT – II - Chapter 2: Sections 2.1-2.4
   UNIT – III - Chapter 3: Sections 3.1-3.4
   UNIT – IV - Chapter 4: Sections 4.1-4.4

UNIT – V - Chapter 5: Sections 5.1-5.3

2. H. Goldstein, Classical Mechanics, (2nd Edition), Narosa Publishing House, New Delhi.
3. Narayan Chandra Rana&PromodSharad Chandra Joag, Classical Mechanics, Tata Mc Graw Hill, 1991.
4. https://www.pdfdrive.com/download.pdf?id=158582740&h=933106dae8af21f34ec9c7549706b1ed&u=cache&ext=pdf
5. https://www.pdfdrive.com/download.pdf?id=33509812&h=f116b9421b66220f909db64ed8661069&u=cache&ext=pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand the important definitions and introductory concepts like the ideasof virtualwork and d'Alembert's principle.
- Derive Lagrange's equations of motion using d'Alembert's principle.
- Understand the nature of equations of motion for holonomic and nonholonomic systems.
- Understand the idea of impulsive constraints.
- Compare dissipative systems and velocity dependent potentials.
- Understand the Hamiltonian view point of dynamics in canonical equations of motion and phase space.
- Understand the concepts of Hamilton - Jacobi theory.
- Obtain some concrete procedure for solving problems using the theory of canonical transformations.

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PROFESSIONAL ETHICS

First Year **ELECTIVE COURSE I** **Semester: I**

GRAPH THEORY(Theory)

Code:P22MAE1A **Credit: 4**

COURSE OBJECTIVES:

- To give a rigorous study of the basic concepts of Graph Theory.
- To study the applications of Graph Theory in other disciplines.

Note: Theorems, Propositions and results which are starred are to be omitted.

UNIT – I:

Basic Results: Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness- Operations on Graphs - Directed Graphs: Basic Concepts – Tournaments.

UNIT – II:

Connectivity: Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

UNIT – III:

Independent Sets and Matchings: Vertex Independent Sets and Vertex Coverings - Edge Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

UNIT – IV:

Graph Colourings: Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colouringsof Graphs - Chromatic Polynomials.

UNIT – V:

Planarity: Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

The Four Color Conjecture

TEXT BOOK(S):

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.
   UNIT I - Chapter I & II: 1.1 to 1.4, 1.7, 2.1, 2.2
   UNIT II - Chapter III & IV: 3.1, 3.2, 4.1, 4.3 to 4.4
   UNIT III - Chapter V & VI: 5.1 to 5.4, 6.1, 6.2
   UNIT IV - Chapter VII: 7.1 to 7.4, 7.7
   UNIT V - Chapter VIII: 8.1 to 8.6
2. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac MilanPress Ltd., 1976.
3. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph,CRC press,2010.
4. F.Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969.
5. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf
6. https://www.pdfdrive.com/download.pdf?id=188461519&h=0e27445c1a90d11918eeab7108536b09&u=cache&ext=pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand and work on the fundamental concepts of graphs.
- Apply graph theory based tools in solving practical problems.
- Understand basic concepts in Trees and discuss matching problems and its applications elsewhere.
- Comprehend and work on the concepts of planarity and discuss the dual of a plane graph.

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PROFESSIONAL ETHICS

First Year	**CORE COURSE IV COMPLEX ANALYSIS**	**Semester: II**
Code:P22MACC21	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To learn the various intrinsic concepts and the theory of Complex Analysis.
- To study the concept of Analyticity, Complex Integration and Infinite Productsin depth.

UNIT – I:

Elementary Point Set Topology: Sets and Elements – Metric Spaces – Connectedness – Compactness – Continuous Functions – Topological Spaces; Conformality: Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping – Length and Area; Linear Transformations: The Linear Group – The Cross Ratio – Symmetry.

UNIT – II:

Fundamental theorems in complex integration: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk; Cauchy's Integral Formula: The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

UNIT – III:

Local Properties of Analytic Functions - Removable Singularities - Taylor's Theorem – Integral representation of the nth term - Zeros and Poles – Algebraic order of f(z) – Essential Singularity - The Local Mapping – The Open Mapping Theorem - The Maximum Principle.

UNIT – IV:

The General Form of Cauchy's Theorem: Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions; The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals.

UNIT – V:

Harmonic Functions: Definition and Basic Properties – The Mean-value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle; Power series expansions-Weierstrass's Theorem – The Taylor Series – The Laurent Series.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Analytic Continuation - Global version of Cauchy's theorem.

REFERENCES:

1. Lars V. Ahlfors, Complex Analysis, Third Ed. McGraw-Hill Book Company, Tokyo, 1979.
   UNIT – I - Chapter 3: 1.1-1.6, 2.1-2.4,3.1-3.3
   UNIT – II - Chapter 4: 1.1-1.5, 2.1-2.3
   UNIT – III - Chapter 4: 3.1, 3.2, 3.3,3.4
   UNIT – IV - Chapter 4: 4.1-4.7, 5.1-5.3
   UNIT – V - Chapter 4: 6.1-6.5 and Chapter 5: 1.1-1.3
2. Serge Lang, Complex Analysis, Addison Wesley, 1977.
3. S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, NewDelhi, 1997.
4. Karunakaran, Complex Analysis, Alpha Science international Ltd,Secondedition, 2005.
5. https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/John-M.-Howie-Complex-Analysis-Springer-Undergraduate-Mathematics-Series-Springer-2007.pdf
6. https://mccuan.math.gatech.edu/courses/6321/lars-ahlfors-complex-analysis-third-edition-mcgraw-hill-science_engineering_math-1979.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand the complex number system from geometric view point. Will gain mastery in arguments on C* and logarithms.
- Get expertise in the concept of convergence of sequences and series of complex numbers, continuity and differentiability of function on complex numbers. Also the students will be able to thoroughly understand and knowthe importance of power series in complex analysis.
- Workout the path integrals on the complex plane.
- Understand the central theme of Cauchy theory, viz., existence of local primitives and local power series expansion.
- Get acquainted with various techniques of proving fundamental theorem of algebra, open mapping theorem, maximum modulus theorem and Liouville's theorem.
- Classify singularities, compute poles and residues and understand the Laurent series expansion.
- Appreciate and work on the topology of extended complex plane.

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PROFESSIONAL ETHICS

First Year | **CORE COURSE V LINEAR ALGEBRA** | **Semester: II**

Code: P22MACC22 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To give the students a thorough knowledge of the various aspects of LinearAlgebra
- To train the students in problem-solving as a preparatory for competitiveexam.

UNIT – I:

Matrices: Systems of linear Equations - Matrices and Elementary Row operations -Row-reduced echelon Matrices - Matrix Multiplication - Invertible Matrices-Basesand Dimension. (Only revision of Vector spaces and subspaces).

UNIT – II:

Linear transformations: The algebra of linear transformations - Isomorphism of Vector Spaces -Representations of Linear Transformations by Matrices - Linear Functionals - The Double Dual - The Transpose of a Linear Transformation.

UNIT – III:

Algebra of polynomials: The algebra of polynomials - Lagrange Interpolation - Polynomial Ideals -The prime factorization of a polynomial - Commutative rings – Determinant functions.

UNIT – IV:

Determinants: Permutations and the uniqueness of determinants - Classical Adjoint of a (square) matrix - Inverse of an invertible matrix using determinants - Characteristic values - Annihilating polynomials.

UNIT – V:

Diagonalization: Invariant subspaces - Simultaneous triangulation and simultaneous Diagonalization Direct-sum Decompositions - Invariant Direct sums – Primary Decomposition theorem.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Introduction to Module theory

REFERENCES:

1. Kenneth Hoffman and Ray Alden Kunze, Linear Algebra, Second Edition, Prentice Hall of India Private Limited, New Delhi, 1975.
   UNIT – I - Chapter 1 & 2 1.2-1.6 and 2.3

UNIT – II - Chapter 3
UNIT – III - Chapter 4 & 5 4.1 - 4.5 and 5.1 - 5.2
UNIT – IV - Chapter 5 & 6 5.3, 5.4 and 6.1 - 6.3
UNIT – V - Chapter 6 6.4 - 6.8

2. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice-Hall of India Ltd, 2004.
3. V. Krishnamurthy, V.P. Mainra, J.L. Arora, Introduction to Linear Algebra,East West Press Ltd, 1985.
4. A.R. Rao, P. Bhimashankaram, Linear Algebra, Second Edition, Tata McGraw Hill, 2000.
5. Edgar G.Goodaire,Linear Algebra-Pure & Applied World Scientific,Cambridge University Press India Ltd, 2014.
6. https://joshua.smcvt.edu/linearalgebra/book.pdf
7. https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2012/02/Linear-Algebra-Kuttler-1-30-11-OTC.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Realise that the subject evolves as a generalization of solving a system of linear equations.
- Discuss in detail the basic concepts of Linear dependence, basis and dimension of a vector space. The students will be able to demonstrate how the geometric ideas turn into rigorous proofs.
- Master the dimension formula and rank and nullity theorem which are often exploited.
- Capture the idea of producing lot of structure preserving maps (Linear transformations). Further the study of algebras of linear maps would beaccomplished.
- Having got trained in numerous examples the student realizes the isomorphic theory of linear transformations and matrices.
- Learn the theory of determinants and put them in practice.
- Understand that the central theme of structure theory of linear maps is to decompose the given vector space as a direct sum of generalized the Eigen spaces using the given map on it.
- Understand that linear Algebra plays a fundamental role in many areas of mathematics including Algebra, Geometry, Functional analysis and which finds widest application in Physics, Chemistry and elsewhere.

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PROFESSIONAL ETHICS

First Year	**CORE CHOICE COURSE II PARTIAL DIFFERENTIAL EQUATIONS**	**Semester: II**
Code: P22MACC2A	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To give an in-depth knowledge of solving partial differential equations andapply them in scientific and engineering problems.
- To study the other aspects of PDE.

UNIT – I:

Partial differential equations- origins of first order Partial differential equations- Cauchy's problem for first order equations- Linear equations of the first order- Integral surfaces Passing through a Given curve- surfaces Orthogonal to a given system of surfaces - Nonlinear Partial differential equations of the first order.

UNIT – II:

Cauchy's method of characteristics- compatible systems of first order equations- Charpits method- Special types of first order equations- Solutions satisfying given conditions- Jacobi's method.

UNIT – III:

Partial differential equations of the second order: The origin of second order equations – second order equations in Physics – Higher order equations in Physics
- Linear partial differential equations with constant co-efficient- Equations with variable coefficients-Characteristic curves of second order equations.

UNIT – IV:

Characteristics of equations in three variables- The solution of Linear Hyperbolic equations-Separation of variables.The method of Integral Transforms – Non Linear equations of the second order.

UNIT – V:

Laplace equation: Elementary solutions of Laplace's equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables – Problems with Axial Symmetry.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Greens function - Theory of distributions.

REFERENCES:

1. Ian N. Sneddon,Elements of Partial differential equations, Dover Publication – INC, New York, 2006.
   UNIT – I - Chapter II Sections 1 to 7.
   UNIT – II - Chapter II Sections 8 to 13
   UNIT – III - Chapter III Sections 1 to 6
   UNIT – IV- Chapter III Sections 7 to 11
   UNIT – V - Chapter IV Sections 2 to 6
2. M.D. Raisinghania, Advanced Differential Equations, S. Chand and company Ltd., New Delhi,2001.
3. E.T. Copson, Partial Differential Equations, Cambridge University Press.
4. https://s2pnd-matematika.fkip.unpatti.ac.id/wp- content/uploads/2019/03/Walter-A-Strauss-Partial-differential-equations- - an-introduction-Wiley-2009.pdf
5. http://web.math.ucsb.edu/~moore/pde.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Classify first order partial differential equations and their solutions.
- Solve first order equations and nonlinear partial differential equations using various methods.
- Use the method of characteristics to solve first order partial differentialequations.
- Identify and solve the three main classes of second order equations, elliptic, parabolic and hyperbolic.
- Solve one dimensional wave equations using method of separation of variables.
- Classify the boundary value problems and analyse its solutions.
- Solve Heat conduction problem using Fourier series and cosines.
- Illustrate the use of PDE in problems from Engineering and Biological Sciences.

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PROFESSIONAL ETHICS

First Year | **ELECTIVE COURSE II STOCHASTIC PROCESSES (Theory)** | **Semester: II**

Code: P22MAE2C | **Credit: 4**

COURSE OBJECTIVES:

- Acquire the knowledge about the concept of Markov Chain and Queuingsystem.
- Understand the methods of birth and death queues with finite and infinite capacity.
- Develop the ability of Standard Brownian Motion

UNIT – I:

Stochastic Processes: Some notions – Specification of Stochastic processes – Stationary processes – Markov Chains – Definitions and examples – Higher Transition probabilities – Generalization of independent Bernoulli trails.

UNIT – II:

Markov chains: Classification of states and chains – determination of Higher transition probabilities – stability of a Markov system – Reducible chains –Markov chains with continuous state space.

UNIT – III:

Markov processes with Discrete state space: Poisson processes and their extensions – Poisson process and related distribution – Generalization of Poisson process- Birth and Death process – Markov processes with discrete state space (continuous time Markov Chains).

UNIT – IV:

Renewal processes and theory: Renewal process – Renewal processes in continuous time – Renewal equation – stopping time – Wald's equation – Renewal theorems.

UNIT – V:

Branching Processes: Introduction – Properties of generating functions of Branching process – Probability of extinction – Distribution of the total number of progeny – Conditional Limit Laws due to Kolmogrov and due to Yaglom – Classical Galton-Watson Process - Bellman-Harris Process

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Stochastic integration and functional limit theorems.

REFERENCES:

1. J. Medhi, Stochastic Processes, New age International Publishers, New Delhi– Second edition.
   UNIT I Chapter 2 Sec 2.1-2.3, Chapter III Sec 3.1-3.3
   UNIT II Chapter 3 Sec 3.4-3.6, 3.8, 3.9,3.11
   UNIT III Chapter 4 Sec 4.1-4.5
   UNIT IV Chapter 6 Sec 6.1-6.5
   UNIT V Chapter 9 Sec 9.1-9.8
2. Samuel Karlin, Howard M. Taylor, A first course in stochastic processes, Academic press, Second Edition, 1975.
3. Narayan Bhat, Elements of Applied Stochastic Processes, John Wiley, 1972.
4. S.K. Srinivasan and K. Mehata, Stochastic Processes, Tata McGraw Hill,1976.
5. N.V. Prabhu, Stochastic Processes, Macmillan (NY).
6. Robert G. Gallager, Stochastic Processes: Theory for Applications, Cambridge University Press, 2013.
7. http://home.ustc.edu.cn/~alex2014/SPpdf/Stochastic%20Processes%20SM. pdf
8. https://www.pdfdrive.com/download.pdf?id=187079740&h=9e25b152bf6e3cd7ad9c4e54c836b4fc&u=cache&ext=pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Acquire adequate knowledge about Continuous Time Markov chain and Queuing system.
2. Gain understanding on the Renewal process, Cumulative process and Semi-Markov process.
3. Apply different methods to solve birth and death queues.
4. Examine the computations of renewal process and theory.
5. Conclude the idea of Branching process.

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PROFESSIONAL ETHICS

First Year **NON-MAJOR ELECTIVE COURSE I** **Semester II**

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Code: P22ITNME1 **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To understand the revolution in computers and communications
- To know about various application software
- To understand the information systems and software development

UNIT – I INFORMATION TECHNOLOGY:

Introduction – Information systems – Definition of computer and system – Software and Data - IT in business and Industry – IT in the Home and at Play – It in Education and Training – IT in Entertainment and the Arts – IT in Science, Engineering, and Mathematics – Global Positioning System.

UNIT – II INTRODUCTION TO COMPUTERS:

History of computers, Types of computers, Characteristics of computers, Basic Anatomy of a computer, Applications of computer – Memory – Memory types.

UNIT – III SOFTWARE:

Kinds of Software - The five types of Applications software - Word processing – Spreadsheets - Database software, Presentation graphics software - Communications software System Software – Operating system - functions

UNIT – IV COMPUTER NETWORKS:

Introduction – Definition Computer Networks - Types of Networks – Local Area Network – Metropolitan Area Network - Wide Area Network – Personal Area Network - internet – Intranet – firewalls - Network Topology – Bus – Ring – Hybrid – Star

UNIT – V BASIC INTERNET CONCEPTS:

Analog and Digital Signals - modems and communication Software, ISDN lines, and Cable Modems - Definition of Internet - The World Wide Web - Connecting to the Internet
– Browsing the web – Web browser – Uniform Resource Locator (URL) – E-mail communication.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCES:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.
2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology –Brief Version
3. A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011
4. James O'Brien – Introduction to Information systems. 16th edition, 2005.
5. The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works, Douglas E. Comer, Pearson, 2000
6. https://www.javatpoint.com/internet
7. http://www.steves-internet-guide.com/networking/

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- To know the latest trends in information technology
- To understand the fundamentals of computers
- To gain knowledge about networks
- To acquire knowledge about different software
- To understand Internet basics

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PROFESSIONAL ETHICS

First Year | **VALUE ADDED COURSE I INTRODUCTION TO MAT LAB** | **Semester: II**

Code: P22MAVAC1B | **(Theory)** | **Credit: 2**

COURSE OBJECTIVES:

- To learn features of MATLAB as a programming tool.
- To promote new teaching model that will help to develop programming skillsand technique to solve mathematical problems.
- To understand MATLAB graphic feature and its applications.
- To use MATLAB as a simulation tool.

UNIT – I:

Starting with MATLAB, MATLAB windows – Working in command window - Arithmetic operations with scalars – Display Formats - Elementary math built-in functions – Defining scalar variables - Useful commands for managing variables - Script files.

UNIT – II:

Creating Arrays – Variables - Transpose Operator - Array addressing - Adding elements to existing variables - Deleting elements - Built-in functions for handling arrays - strings and strings as variables.

UNIT – III:

Mathematical Operations with Arrays: Addition and Subtraction – Multiplication – Division - Element-by-element operations - Built-in math functions - Built-in functions for analysing arrays - Generation of random numbers.

UNIT – IV:

MATLAB workspace and the workspace window – Script file – Output commands – save and load commands – Importing and exporting commands.

UNIT – V:

plot command – fplot command - Plotting multiple graphs in the same plot – Formatting a plot – Plots with Logarithmic axes – Plots with error bars – Plots with special graphics.

UNIT – VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Programming in MATLAB

REFERENCES:

1. Amos Gilat, MATLAB An Introduction with Applications, John Wiley & Sons, 2011.
2. Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, A Guide to MATLAB - for Beginners and Experienced Users, 2nd Edition, Cambridge University Press, 2006.
3. Stephen J. Chapman, Essentials of MATLAB Programming, Cengage Learning, 2009.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Understand the main features of the MATLAB development environment.
2. Use the MATLAB GUI effectively.
3. Design simple algorithms to solve problems.
4. Write simple programs in MATLAB to solve scientific and mathematical problems.

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PROFESSIONAL ETICS

Second Year	**CORE COURSEVI TOPOLOGY**	**Semester: III**
Code: P22MACC31	**(Theory)**	**Credit:5**

COURSE OBJECTIVES:

- To stimulate the analytical mind of the students
- Enable them to acquire sufficient knowledge and skill in the subject that will make them competent in various areas of Mathematics.

UNIT–I:

Metric Spaces: The Definition and some Examples – Open sets – Closed sets – Convergence, Completeness and Baire's theorem, Continuous mappings –Spaces of continuous functions – Euclidean and Unitary Spaces.

UNIT–II:

Topological Spaces : The Definition and some Examples – elementary concepts – open bases and open sub bases – weak topologies –The function algebra C (X,R) and C X, C).

UNIT–III:

Compactness: Compact spaces – Product of spaces – Tychnoff's theorem and locally compact spaces – Compactness for Metric spaces – Ascoli's theorem.

UNIT–IV:

Separation: T_1-spaces and Hausdorff spaces – Completely regular spaces and normal spaces - The Urysohn lemma and Tietze Extension Theorem - TheUrysohn imbedding theorem – The Stone-Cechcompactification.

UNIT–V:

Connectedness and Approximation: Connected spaces – The components of aspace – Totally disconnected spaces - Local connected spaces – The Weierstrass approximation theorem – The Stone-Weierstrass theorem.

UNIT–VI CURRENTCONTOURS (For Continuous Internal Assessment Only):

Elementary concepts from Algebraic topology.

REFERENCES:

1. George F. Simmons, "Introduction to Topology and Modern Analysis", McGraw Hill Book Company 1963.

   UNIT I Chapter2: Page:9-15
   UNIT II Chapter3: Page:16-20
   UNIT III Chapter 4: Page:21-25

UNIT IV Chapter5: Page:26-30
UNITV Chapter6,7: Page:31-36
2. James.R.Munkres,“Topology”,secondEdition,PrenticeHallofIndiaPvt., Ltd., New Delhi 2005
3. J.Dugundji,“Topology”PrenticehallofIndia,NewDelhi1975.
4. J.L.Kelly,“ General topology”, Van No strand Reinhold Co., New York.
5. M.G.Murdeswar“GeneralTopology”,Academicpress,1964
6. K.D.Joshi“IntroductiontoGeneralTopology”,Addison-Wesley,1994.
7. S.Kumaresan,“TopologyofMetricSpaces”AlphaScienceInternationalLtd. Harrow, U.K.
8. https://ocw.mit.edu/courses/18-901-introduction-to-topology-fall-2004/pages/lecture-notes/
9. https://www.topologywithouttears.net/topbook.pdf

COURSEOUTCOMES:

At the end of the course, students will be able to:

1. Study and Understand the concepts of metric spaces, topological spaces
2. Understand the concepts of open bases and open sub bases
3. Understand the concepts of Compactness, connectedness and separation axioms
4. Provide patience to grapple with life outside the campus.

PROFESSIONAL ETHICS

Second Year	CORE COURSE VII MEASURE THEORYAND INTEGRATION	Semester: III
Code: P22MACC32	(Theory)	Credit:5

COURSEOBJECTIVES:

- This course will enable the students to Study financial mathematics through various models and various aspects of financial mathematics

UNIT–I:

Measure on Real line: Lebesgue outer measure - Measurable sets - Regularity- Measurable function - Borel and Lebesgue measurability.

UNIT–II:

Integration of non-negative functions: The General integral - Integration of series - Riemann and Lebesgue integrals.

UNIT–III:

Abstract Measure spaces: Measures and outer measures- Completion of measures- Measure spaces- Integration with respect to a measure.

UNIT–IV:

Convergence in Measure: Almost uniform convergence- Signed Measures and HalinDecomposition–TheJordanDecomposition–MeasurabilityinaProduct space–The product Measure and Fubini's Theorem.

UNIT–V:

The Classical Banach spaces: LP spaces – Minkowski and Holder's inequality– Completeness–Approximation in LP spaces.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Riesz- Markov Kakutani Theorem.

REFERENCES:

1. G.DeBarra,Measure Theory and Integration, New age international l(p)Limited.
2. H. L. Royden, Real Analysis, 3rd Edition, PHI Ltd.
   UNIT – I Chapter II: Sec 2.1 to 2.5 of (1)
   UNIT – II Chapter III: Sec 3.1 to 3.4 of (1)
   UNIT – III Chapter V: Sec 5.1 to 5.6 of (1)

UNIT– IV ChapterVII: Sec7.1,7.2Chapter VIII: Sec8.1,8.2
Chapter X: Sec 10.1,10.2 of (1)
UNIT–V ChapterVI: Sec6.1to6.4of(2)

3. M.E. Munroe, Measure and Integration, by Addison- Wesley Publishing Company, Second Edition, 1971.
4. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986, Reprint 2000.
5. Richard L. Wheeden and AntoniZygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
6. Inder, K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.
7. https://www.pdfdrive.com/download.pdf?id=161198423&h=e1440b6a787714e507bfa8eeedb5b4d4&u=cache&ext=pdf
8. https://www.pdfdrive.com/download.pdf?id=183696899&h=fcc838426bc7fc49a384dd10730fe715&u=cache&ext=pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Learn the basic concepts of measure and integration.
- Comprehend the differences between different types of convergences.
- Understand the concepts of Classical Banach Spaces
- Learn completeness and approximation in L_p-spaces.
- An over view of the central results of the theory of Lebesgue integration.

PROFESSIONAL ETHICS

Second Year **CORE CHOICE COURSE III** **Semester: III**

ALGEBRAIC NUMBER THEORY

Code: P22MACC3B **(Theory)** **Credit:5**

COURSEOBJECTIVES:

- To expose the students to the charm, niceties and nuances in the world of numbers.
- To highlight some of the Applications of the Theory of Numbers.

UNIT–I:

Introduction – Divisibility–Primes–The Binomial Theorem– Congruences– Euler's totient-Fermat's, Euler's and Wilson's Theorems– Solutions of congruences –The Chinese Remainder theorem.

UNIT–II:

Techniques of numerical calculations – Public key cryptography – Prime power Moduli– Primitive roots and Power Residues – Congruences of degree two.

UNIT–III:

Number theory from an Algebraic View point–Groups, rings and fields– Quadratic Residues-The Legendre symbol (a/r) where r is an odd prime– Quadratic Reciprocity–The Jacobi Symbol(P/q)where q is an odd positive integer.

UNIT–IV:

Binary Quadratic Forms–Equivalence and Reduction of Binary Quadratic Forms–Sums of three squares – Positive Definite Binary Quadratic forms – Greatest integer Function – Arithmetic Functions – The Mobius Inversion Formula – Recurrence Functions– Combinatorial number theory.

UNIT–V:

Diophantine Equations–The equation ax + by=c – Simultaneous Linear Diophantine Equations– Pythagorean Triangles– Assorted examples.

UNIT–VI CURRENTCONTOURS (For Continuous Internal Assessment Only):

Prime Number Theorem and its applications.

REFERENCES:

1. Ivan Niven, Herbert S, Zuckerman and Hugh L, Montgomery, An Introduction to the Theory of Numbers, Fifthedn.,John Wiley & SonsInc,2004.
   UNIT I Chapter1andChapter2: Sec2.1to2.3
   UNIT II Chapter2: Sec2.4to2.9

UNIT III Chapter2: Sec2.10,2.11 Chapter 3: Sec3.1to3.3

UNIT IV Chapter3: Sec3.4to3.7andChapter4

UNIT V Chapter5: Sec5.1to5.4.

2. Elementary Number Theory, David M. Burton W.M.C. Brown Publishers, Dubuque, Lawa, 1989.
3. Number Theory, George Andrews, Courier Dover Publications,1994.
4. Fundamentals of Number Theory, William J. Leveque Addison-Wesley Publishing Company, Phillipines, 1977.
5. http://www.math.toronto.edu/~ila/Neukirch_Algebraic_number_theory.pdf
6. https://www.pdfdrive.com/download.pdf?id=188938191&h=4d0f9c871d3eb049e961899e1123111b&u=cache&ext=pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understandandworknumerousproblemsonconceptsofdivisibilityandprimes.
- Gain expertise in Euler's totient, Fermat's, Euler's and Wilson's Theorems and work on applications illustrating them.
- Solve congruences as application of Chinese remainder Theorem.
- Understand number theory from algebraic point of view there by improving their sense of abstraction.
- Discuss Quadratic residue and Jacobi symbol and work on sum of two squares problems.
- Attained mastery in the fundamentals of greatest integer function and recurrence functions and attacking combinatorial problems using them.
- Solve simple simultaneous linear Diophant in equations.

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PROFESSIONAL ETHICS

Second Year **ELECTIVE COURSE III** **Semester :III**

INTEGRAL EQUATIONS AND CALCULUS OF VARIATIONS

Code: P22MAE3A **(Theory)** **Credit:4**

COURSE OBJECTIVES:

- To obtain thorough analysis of various aspects of calculus of variations.
- To acquire the knowledge of solving problems in the fields of mechanics and mathematical physics.

CALCULUS OF VARIATIONS

UNIT–I:

Problems with fixed boundaries.

UNIT–II:

Problems with moving boundaries- Externals with corners- One sided variations.

UNIT–III:

Sufficient conditions for Extremum- Conditional Extremum Problems.

INTEGRAL EQUATIONS

UNIT–IV:

Linear Integral Equations-Definition, Regularity conditions-special kind of kernels - eigen values and eigen functions - convolution Integral - the inner andscalar product of two functions - Notation - reduction to a system of Algebraic equations- examples–Fredholm alternative- examples- an approximate method.

UNIT–V:

Method of successive approximations: Iterative scheme - examples -Volterra Integral equation - examples - some results about the resolvent kernel. Classical Fredholm Theory :the method of solution of Fredholm- Fredholm's first theorem- second theorem - third theorem.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Variational problems in fluid flow and Heat transfer.

REFERENCES:

- Ram.P.Kanwal- Linear Integral Equations Theory and Practice, Birkhauser Boston, 2012.L. Elsgolts, Differential equations and the calculus of variations, University Press of the Pacific, 2003.
  UNIT–I Chapter6of(2)
  UNIT – II Chapter 7,8 of (2)
  UNIT – III Chapter 9,10 of (2)
  UNIT – IV Chapter 1,2 of (1)
  UNIT – V Chapter 3,4 of (1)
- S.J. Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
- I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.
- https://www.researchgate.net/file.PostFileLoader.html?id=56c4564d5cd9e3c21f8b457e&assetKey=AS:330076274085892@1455707725045
- https://www.researchgate.net/profile/Andrei-Polyanin/publication/275518932_Handbook_of_Integral_Equations_Second_Edition/links/5657321b08aeafc2aac0c490/Handbook-of-Integral-Equations-Second-Edition.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand the concepts of variation and its properties.
- Use Euler's equation to solve various types of variation problems with fixed boundaries.
- Modify the Euler's formula for a class of curves with moving boundary points.
- Solve problems related with reflection and refraction, diffraction of light rays.
- Derive sufficient conditions based on second variation.
- Classify Fredholm, Volterra and singular type integral equations.
- Solve integral equations using Fredholm theorem, Fredholm Alternative theorem and method of successive approximations.
- Understand the classical Fredholm theory.

PROFESSIONAL ETHICS

Second Year | **VALUE ADDED COURSEII** | **Semester :III**

INTRODUCTION TO SAGEMATH

Code: P22MAVAC2B | **(Theory)** | **Credit:2**

COURSE OBJECTIVES:

- To learn one of the powerful open source software
- To visualize the mathematical concepts
- To train the students to become a professional mathematician

UNIT–I:

Using sagemath as an advanced engineering calculator. Evaluation of elementary functions (polynomials, square root, trigonometric, exponential, logarithmic etc.) Basic usage in Combinatorics & Number theory.

UNIT–II:

Plotting: simple plots of known functions, polar plotting, plotting implicit functions, contour plots, level sets, parametric 2D plotting, vector fields plotting, gradients.

UNIT–III:

Advanced plotting 3D plots.

UNIT–IV:

Basic usage in Linear Algebra and Vector Calculus.

UNIT–V:

Basic usage in Real Analysis and Algebra.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Learning advanced computing in topics selected areas like numerical analysis, linear algebra, number theory, coding theory, cryptography, and graph theory.

REFERENCES:

1. Gregory V. Bard. Sage for Undergraduates, American Mathematical Society, available online at http://www.gregorybard.com/Sage.html
2. TuanA.LeandHieuD.Nguyen.SageMathAdviceForCalculusavailableonline at http://users.rowan.edu/~nguyen/sage/SageMathAdviceforCalculus.pdf

COURSEOUTCOMES:

At the end of the course, students will be able to:

- Students will be comprehend the theoretical concept and visualizethem in much better way.
- Plotting tools helps students to get easier plots and include it in their project cum paper work.
- Evaluate elementary functions such as polynomials, square root, trigonometric, exponential, logarithmic etc.
- Work on basic number theoretic on cepts such as checking whether a number is prime, performing congruences etc.
- Attain mastery in various 2d and 3d plots, viz., simple plot, polar plot, implicit plot etc.
- Use the plotting ideas and others to work on basic real analysis problems.
- Gain expertise on the computations involving matrices and linear algebrain general.
- Compute the basic group theoretic examples in algebra.

PROFESSIONAL ETHICS

Second Year	**NON MAJOR ELECTIVE II FUNDAMENTALS OF INTERNET**	**Semester :III**
Code: P22ITNME2	**(Theory)**	**Credit:2**

OBJECTIVES:

To understand the revolution in Internet Technology

- To know about various applications of Internet
- To learn the basic HTML tags

UNIT - I : Fundamentals of Internet : Networking Concepts, Data Communication – Types of Networking, Internet and its Services, Internet Addressing – Internet Applications – Computer Viruses and its types – Browser –Types of Browsers.

UNIT - II: Internet applications: Using Internet Explorer, Standard Internet Explorer Buttons, Entering a Web Site Address, Searching the Internet – Introduction to Social Networking: twitter, tumbler, LinkedIn, face book, flicker, Skype, yahoo, Google+, YouTube, WhatsApp, etc.

UNIT - III : E-mail :Definition of E-mail - Advantages and Disadvantages – User-Ids, Passwords, Email Addresses, Domain Names, Mailers, Message Components, Message Composition, Mail Management.

UNIT - IV: WWW- Web Applications, Web Terminologies, Web Browsers, URL – Components of URL, Searching WWW – Search Engines

UNIT - V: Basic HTML: Basic HTML – Web Terminology – Structure of a HTML Document – HTML, Head and Body tags –Heading, Font, Image and Anchor Tags –Different types of Lists using tags – Table Tags, Image formats – Creation of simple HTML Documents.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

REFERENCE BOOKS:

1. Fundamentals of the Internet and the World Wide Web, 2/e – by Raymond

Greenlaw and Ellen Hepp, Publishers : TMH 60

2. Learning Internet & Email, 4th Revised Rdition, Ramesh Bangia, Khanna Book Publishing Co Pvt Ltd.

3. Internet & Ecommerce, C. Nellai Kannan, NELS Publications.

4. https://www.tutorialspoint.com/email 5. https://www.javatpoint.com/blog

COURSE OUTCOMES:

At the end of the course, the students will be able:

To acquire knowledge about Domain name system

- To understand Internet Applications
- To know the E-mail usages
- To know the different types of browsers
- To Gain the knowledge about basic HTML

PROFESSIONAL ETICS

Second Year | **CORE COURSEVIII FUNCTIONAL ANALYSIS (Theory)** | **Semester: IV**

Code: P22MACC41 | **Credit:5**

COURSE OBJECTIVES:

- To introduce Banach spaces and Hilbert spaces.
- To study fundamental theorems of functional analysis that includes Hahn Banach theorem, Open mapping theorem and Uniform boundedness principle and introduce operator theory and Banach algebras leading to the spectral theory of operators.

UNIT–I:

Banach Spaces: The definition and some examples – Continuous linear transformations– The Hahn- Banach theorem.

UNIT–II:

Banach Spaces: The natural embedding of N in N**–The open mapping theorem – The conjugate of an operator.

UNIT–III:

Hilbert Spaces: The definition and some simple properties –Orthogonal complements– Ortho normal sets–The conjugate space H*.

UNIT–IV:

Hilbert Spaces: The adjoint of an operator – Self- adjoint operators – Normal and unitary operators – Projections.

UNIT–V:

General Preliminaries on Banach Algebras: The Definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum– The formula for the spectral radius–The radial and semi-simplicity.

UNIT – VI CURRENT CONTOURS

(For Continuous Internal Assessment Only) : Generating topologies -Weak and

Weak Topologies - Banach-Alaoglu Theorem.

REFERENCES:

1. G.F. Simmons, Introduction to Topology and Modern Analysis, Tata Mc Graw -Hill,2004.

UNIT–I Chapter9Sec46to48
UNIT–II Chapter9Sec49to51
UNIT–III Chapter 10 Sec 52 to 55
UNIT– IV Chapter 10 Sec 56 to 59
UNIT–V Chapter 12 Sec 302 to 317.

2. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley& sons, 1978.
3. G. Bachman and Lawrence Narici, Functional Analysis, Dover Publications, 2000.
4. H.C.Goffmanand G. Fedrick, First course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
5. E. Taylor and D. C. Lay, Introduction to Functional Analysis, second edition, John Wiley & Sons, 1980.
6. Bollabas, Linear Analysis-An introductory course, Cambridge University Press (Indian edition), 1999.
7. V. Limaye, Functional Analysis, Revised Third Edition, New Age International, 2017.
8. M. Thamban Nair, Functional Analysis - A First Course, Prentice Hall of India, 2010.
9. S. Ponnusamy, Foundations of Functional Analysis, Narosa Publishing House, 2002.
10. https://59clc.files.wordpress.com/2012/08/functional-analysis-_-rudin-2th.pdf
11. https://people.math.ethz.ch/~salamon/PREPRINTS/funcana.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Identify Banach spaces and analyse their properties with other types of spaces.
- Examine and identify properties of complex Banach spaces- Hilbert spaces.
- Apply the analytical techniques and theoretical knowledge in Hilbert Spaces. Find out and determine orthonormal sets.
- Explain various properties of Hilbert spaces.
- Attain knowledge and experience of working with many pure mathematical problems.

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PROFESSIONAL ETHICS

Second Year **CORE COURSE IX** **Semester: IV**

DIFFERENTIAL GEOMETRY

Code: P22MACC42 **(Theory)** **Credit: 5 COURSE**

OBJECTIVES:

- To introduce the notion of surfaces and their properties.
- To study geodesics and differentia lgeometry of surfaces.

UNIT–I:

Space Curves: Definition of a space curve - Arc length - tangent - normal and binormal - curvature and torsion - contact between curves and surfaces-tangent surface- involutes and evolutes- Intrinsic equations - Fundamental Existence Theoremfor space curves- Helics.

UNIT–II:

Intrinsic Properties of a Surface: Definition of a surface - curves on a surface- Surfaceofrevolution-Helicoids-Metric-Directioncoefficients-familiesof curves- Isometric correspondence- Intrinsic properties.

UNIT–III:

Geodesics: Geodesics - Canonical geodesic equations - Normal property of geodesics-ExistenceTheorems-Geodesicparallels-Geodesicscurvature-Gauss- Bonnet Theorem - Gaussian curvature- surface of constant curvature.

UNIT–IV:

Non Intrinsic Properties of a Surface: The second fundamental form-Principal curvature - Lines of curvature - Developable – Developable associated withspace curves and with curves on surface - Minimal surfaces - Ruled surfaces.

UNIT–V:

Differential Geometry of Surfaces: Compact surfaces whose points are umblics- Hilbert's lemma - Compact surface of constant curvature - Complete surface andtheircharacterization-Hilbert'sTheorem-Conjugatepointsongeodesics.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Elementary concepts from commutative algebra. The Gauss Bonet theorems.

REFERENCES:

1. T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press, (17th Impression) New Delhi 2002. (Indian Print).
   UNIT – I Chapter I: Sections 1 to 9.
   UNIT – II Chapter II: Sections 1 to 9.
   UNIT – III Chapter II: Sections 10 to 18.
   UNIT – IV Chapter III: Section1 to 8.
   UNIT–V ChapterIV:Sections1to8.
2. Struik, D.T. Lectures on Classical Differential Geometry, Addison-Wesley, Mass. 1950.
3. Kobayashi S. and Nomizu. K. Foundations of Differential Geometry, Inter science Publishers, 1963.
4. Wihelm Klingen berg: A course in Differential Geometry, Graduate Textsin Mathematics,SpringerVerlag,1978.
5. J.A.Thorpe Elementary topics in Differential Geometry, Under-graduate Texts in Mathematics, Springer - Verlag 1979.
6. https://www.pdfdrive.com/download.pdf?id=5949406&h=ec626392725b62c68c495d75f553f7fa&u=cache&ext=pdf
7. https://archive.org/details/differentialgeom003681mbp

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Have a solid understanding of the subjects, linear algebra, multivariable calculus and differential equations and a basic knowledge of theoretical physics.
- Sketch and workout graphs, level sets, tangent space and surfaces ofgiven smooth maps.
- Good knowledge on calculus of vector fields.
- Understand how Gauss map helps to identify the surfaces that are mapped onto the unit n-sphere.
- Describe surfaces as a solution sets of differential equations.
- Exhibit geodesicson surfaces.
- Learn how parametrizations of plane curves can be used to evaluate integrals over the curve.
- Compute the Gaussian curvature of various surfaces.

PROFESSIONAL ETHICS

Second Year	**CORE COURSE X FLUID DYNAMICS**	**Semester: IV**
Code: P22MACC43	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To give the students an introduction to the behavior of fluids in motion.
- To give the students a feel of the applications of Complex Analysis in the analysis of the flow of liquids.

UNIT–I:

Real Fluids and Ideal Fluids- Velocity of a Fluid at a point – Streamlines and Path lines: Steady and Unsteady Flows – The Velocity potential – The Vorticity vector – Local and Particle Rates of Change–The Equation of continuity–Worked examples–Acceleration of a Fluid– Conditionsatarigidboundary–Generalanalysisoffluidmotion–Pressure at a point in a Fluid at Rest–Pressure at a point in Moving Fluid– Conditions at a Boundary of Two Inviscid Immiscible Fluids – Euler's equation of motion – Bernoulli's equation – Worked examples.

UNIT–II:

Discussions of a case of steady motion under conservative body forces – Some potential theorems–Some Flows Involving Axial Symmetry – Some special two-Dimensional Flows - Impulsive Motion. Some three -dimensional

Flows: Introduction– Sources, Sinks and Doublets – Images in a Rigid infinite Plane – Axi-Symmetric Flows; Stokes stream function.

UNIT–III:

Some Two- Dimensional Flows: Meaning of a Two- Dimensional Flow – Use of cylindrical polar co-ordinates – The stream function – The Complex Potential for Two- Dimensional, Irrotational, Incompressible Flow – complex velocity potentials for Standard Two Dimensional Flows – Some worked examples – The Milne- Thomson circle theorem and applications – The theorem of Blasius.

UNIT–IV:

The use of conformal Transformation and Hydro dynamical Aspects – Vortex rows. Viscous flow Stress components in a real fluid- relations between Cartesian components of stress-Translational Motion of Fluid element–The Rate of Strain Quadraic and Principle Stresses – Some further properties of the rate of strain quardric- Stress analysis influid motion–Relations between stress and rate of strain-The coefficient of viscosity and laminar flow – The Navier-Stokes equations of motion of a viscous fluid.

UNIT–V:

Some solvable problems in viscous flow – Steady viscous flow in tubes of uniform cross section – Diffusion of vorticity – Energy Dissipation due to viscosity – Steady Flow past a Fixed Sphere–Dimensional Analysis; Reynolds Number–Prandtl's Boundary Layer.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Gas Dynamics and Magneto hydro dynamics.

REFERENCES:

1. Text Book of Fluid Dynamics by F. Chorlton, CBS Publishers & Distributors, New Delhi ,1985.
   UNIT – I Chapter 2 and Chapter 3: Sections 3.1 to 3.6 UNIT – II Chapter 3: Sections 3.7 to 3.11 and

   Chapter4: Sections4.1,4.2,4.3,4.5

   UNIT–III Chapter5: Sections:5.1to5.9except5.7

   UNIT–IV Chapter5: Section5.10,5.12and

   Chapter8: Sections8.1to8.9

   UNIT–V Chapter8: Sections8.10to8.16.

2. Computational Fluid Dynamics: An Introduction, J.F.Wendt J.D. Anderson, G. Degrez and E. Dick, Springer – Verlag, 1996.
3. Computational Fluid Dynamics, The Basics with Applicatios, D.Anderson, McGraw Hill, 1995.
4. An Introduction to Fluid Mechanics, Foundation Books, G.K.Batchelor, New Delhi, 1984.
5. A Mathematical Introduction to Fluid Dynamics, A.J.Chorinand A.Marsden, Springer- Verlag,NewYork,1993.
6. Foundations of Fluid Mechanics, S. W. Yuan, Prentice Hall of India Pvt Limited, New Delhi, 1976.
7. An Introduction to Fluid Dynamics, R.K .Rathy Oxford and IBH Publishing Company, New Delhi, 1976.
8. http://home.iitk.ac.in/~nikhilk/Book.pdf
9. http://www.issp.ac.ru/ebooks/books/open/Advanced_Fluid_Dynamics.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand the basic idea so fluid velocity, stream lines and rotational and irrotational flows.
- Understand them eanings of fundamental terms like pressure and body force.
- Develop special mathematical methods involving images and complex variables for incompressible fluids.
- Derive images in three dimension.
- Solve problems using Milne-Thoms on circle theorem.
- Understand Navier's stokes of motion
- Unify many developed principles.
- Solve problems related with cosmic electro dynamics and nuclear engineering.

PROFESSIONAL ETICS

Second Year **ELECTIVE COURSE IV** **Semester: IV**

THEORY OF PROBABILITY

Code: P22MAE4A **(Theory)** **Credit:4**

COURSE OBJECTIVES:

- To make the students to understand about fields, σ-fields and random variables.
- To enable the students to learn about expectations, convergence in random variables and distribution functions.

UNIT–I:

Fields and σ Fields: Class of events –Functions and Inverse functions – Random variables – Limits of random variables.

UNIT–II:

Probability Space: Definition of probability – some simple properties – discrete probabilityspace–Generalprobabilityspace–Inducedprobabilityspace.

UNIT–III:

Distribution functions: Distribution functions of a random variable– Decomposition of distributive functions-Distributive functions of vector random variables – Correspondence theorem.

UNIT–IV:

Expectation and Moments: Definition of Expectation –Properties of expectation – Moments, Inequalities.

UNIT–V:

Convergence of Random Variables: Convergence in Probability – Convergence almost surely – Convergence in distribution –Convergence in the rth mean- Convergence theorems for Expectations.

UNIT–VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Usage of package R,Measure theoretic introduction to probability theory.

REFERENCES:

1. B.R. Bhat (2007), Modern Probability Theory, 3rd edition, New Age International private ltd, New Delhi.
   UNIT I - Chapter 1 and 2 Omit
   (1.1&1.2) UNIT II - Chapter 3
   (Omit 3.6)
   UNITIII -Chapter4
   UNITIV -Chapter5
   UNITV -Chapter6(6.1-6.5)
2. ChandraT. K and ChatterjeeD.(2003),Afirstcourseinprobability,2nd Edition, Narosa Publishing House, New Delhi.
3. Kailai Chung and Farid Aitsahlia, Elementary Probability, Springer Verlag 2003, New York.
4. Marek Capinski and Thomasz Zastawniak (2003),
5. Probability through problems, Springer Verlag, New York.
6. Sharma.T.K. (2005), A text book of probability and theoretical distribution, Discovery publishing house, New Delhi.
7. https://faculty.math.illinois.edu/~r-ash/BPT/BPT.pdf
8. http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/101_06_Feller_An-Introduction-to-Probability-Theory-and-Its-Applications-Vol.-2.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

- Understand Probability axioms and find conditional probabilities for lot of cases
- Compute expectations and moments on a number of distributions.
- Gain mastery in the important probability distributions, viz., Binomial, Poisson and Normal.