பகுதி – I, **தமிழ்முதல்பருவம்** **19LSU101 :**

தமிழ்முதல்தாள் 4-H,4-C

(இளநிலைஅறிவியல்பட்டவகுப்புகளுக்குரியது)

பாடத்திட்டப் பொதுநோக்கம்

- *கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.*
- *ஆய்வுநோக்கை மேம்படுத்துதல்.*
- *இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.*
- *மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.*
- *வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.*
- *அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.*

பாடத்திட்டப் பயன் விளைவு

1. *இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.*
2. *கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.*
3. *தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.*
4. *வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .*
5. *சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.*
6. *மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்*

அலகு – I :இக்காலஇலக்கியம்: **(10 மணிநேரம்)**

1. *மகாகவிபாரதியார்* – *பரம்பொருள்வாழ்த்து .*
2. *புரட்சிக்கவிஞன்பாரதிதாசன்* – *தமிழின்இனிமை.*
3. *கவிமணிதேசிகவிநாயகம்பிள்ளை* – *கோவில்வழிபாடு.*
4. *கவிக்கோ. அப்துல்ரகுமான்* – *பாருக்குள்ளே நல்ல நாடு.*
5. *சிற்பிபாலசுப்பிரமணியன்* – *காலம்.*
6. *கவிஞர்தாமரை* – *தொலைந்துபோனேன்.*

அலகு – II :அறஇலக்கியம்: **(8 மணிநேரம்)**

1. *ஔவையார்–கொன்றைவேந்தன்* (1- 50 *பாடல்கள்*)
   அன்னையும்பிதாவும் – புலையும்கொலையும்களவும்தவிர்
2. *வேதநாயகம்பிள்ளை - நீதிநூல் – (5 பாடல்கள்)*
   சின்னவோர்பொருள், கடவுளைவருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்
3. *திருவள்ளுவர்- திருக்குறள்–பண்புடைமை, வினைத்திட்பம்*
4. *முன்றுறையரையனார்–பழமொழிநானூறு5 பாடல்கள்*

உணற்குஇனிய, பரந்ததிறலாரை, நெடியதுகாண்கிலாய், இனியாரும், உரைசான்ற

அலகு –III :சிற்றிலக்கியம்: **(8 மணிநேரம்)**

1. *முக்கூடற்பள்ளு- 2 பாடல்கள் - சித்திரக்காலிவாலான் (நெல்வகைகள்)*
   குற்றாலத்திரிகூடமால்வரை (மீன்வகைகள்)
2. *நந்திகலம்பகம்- 5 பாடல்கள்- என்னையேபுகழ்ந்தேன், பதிதொறுபுயல்பொழி,*
   இந்தப்புவியில், அடிவிளக்கும்துகில், வானுறுமதியை
3. *மதுரைச்சொக்கநாதர்தமிழ்விடுதூது–தமிழின்சிறப்பு*
   பாடியருளபத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு – IV :*சிறுகதை***:** **(8 மணிநேரம்)**

1. *மகாமசானம்* – *புதுமைப்பித்தன்*
2. *அப்பாவின்வேஷ்டி* – *பிரபஞ்சன்*
3. *அந்நியர்கள்* – *ஆர். சூடாமணி*

4. இந்நாட்டுமன்னர் – நாஞ்சில்நாடன்

அலகு– V : மொழிப்பயிற்சி: **(6 மணிநேரம்)**

1. பொருத்தமானதமிழ்ச்சொற்களைப்பயன்படுத்துதல்
2. செய்யுள்பொருளுணர்திறன்
3. மொழிபெயர்ப்புப்பயிற்சிகள்
4. கடிதங்கள்மற்றும்விண்ணப்பங்கள்எழுதுதல்

பாடநூல்:கற்பகச்சோலை – தமிழ்ஏடு.

கற்பகம்உயர்கல்வி கலைக்கழகத்தமிழ்த்துறைவெளியீடு.

Semester – I

19ENU101 **ENGLISH** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

- To train students to acquire proficiency in English.
- To explore different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.
- To inculcate moral values through literature.
- To develop ethical values.
- To give basic grammar knowledge.

Course Outcome:

1. Develop the knowledge of interpersonal skills.
2. Establish and maintain social relationships.
3. Genres of literature will give moral values of life.
4. Develop communication skills in business environment
5. Communication skills will get developed.
6. Develop to have language competence.

UNIT - I :PROSE

1. Morals in the Indian Context - Francis Nicholas Chelliah
2. How Comic Books help us to relive our Childhood - Benoit Peeters
3. Let's Do What India Needs From Us -Dr.A.P.J. Abdul Kalam

UNIT - II :POEM

1. The Stolen Boat - William Wordsworth
2. Telephone Conversation- Wole Soyinka
3. A River - A.K. Ramanujan

UNIT - III :SHORT STORIES

1. Rapunzel - Brothers Grimm
2. The Ant and The Grasshopper- W. Somerset Maugham
3. The Nightingale and the Rose - Oscar Wilde.

UNIT - IV: DRAMA

1. The Merchant of Venice- Act 4-Scence 1
2. The Death Trap- Saki

UNIT - V: GRAMMAR AND COMPOSITION

GRAMMAR : 1. Tenses
2. Articles
3. Auxiliaries (Primary and Modal)
4. Tag Questions

Composition:

1. Reading to Comprehend
2. Letter Writing
3. Resume Writing
4. General Essay

Prescribed Text: Reminisce, Published by the Department of English, Karpagam Academy of Higher Education.

Suggested Reading: Hewings Martin,1999 Advanced English Grammar, Cambridge University Press

Semester – I

19MMU101 **CALCULUS** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The concepts of essentials of concavity, inflection points and its geometrical applications.
- The Higher order derivatives and its applications in business, economics and life sciences.
- The Leibniz rule and its applications in exponential and trigonometric.
- The concepts of volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations and parameterizing a curve.
- The concepts of vector functions, operations with vector-valued functions, limits and continuity of vector functions.
- Recognize the appropriate tools of calculus to solve applied problems.

Course Outcomes (COs)

On successful completion of this course, the students will be able to

1. Understand the concepts of hyperbolic functions.
2. Explore the concept of reduction formula and calculate limits in indeterminate forms by a repeated use of L'Hospital rule.
3. Use single and multiple integration to calculate the arc length, area and volume.
4. Understand the techniques of sketching conics and properties of conics.
5. Know about the knowledge on application of vector functions.
6. Acquire the knowledge on application of Kepler's second law.

UNIT – I

DIFFERENTIAL CALCULUS

Hyperbolic functions- Higher order derivatives- Leibniz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$ and $(ax+b)^n\cos x$.

UNIT II

INTEGRAL CALCULUS

Reduction formulae- Derivations and illustrations of reduction formulae of the type $\int \sin nx\,dx$, $\int \cos nx dx$, $\int \tan nx\,dx$, $\int \sec nx\,dx$, $\int \log x^n\,dx$, $\int \sin^n x \sin^m x\,dx$. Curve tracing in Cartesian coordinates- Tracing in polar coordinates of standard curves-L'Hospital's rule- Applications in business, economics and life sciences.

UNIT III

APPLICATIONS OF INTEGRATION

Volumes by slicing- Disks and washers methods- Volumes by cylindrical shells- Parametric equations- Parameterizing a curve- Arc length- Arc length of parametric curves- Area of surface of revolution.

UNIT IV

CURVE SKETCHING

Curve sketchingConcavity and Inflection points- Asymptotes. Techniques of sketching conics- Reflection properties of conics- Rotation of axes and second degree equations- Classification into conics using the discriminant- Polar equations of conics.

UNIT V

VECTOR FUNCTIONS

Introduction to vector functions- Operations with vector valued functions-Limits and continuity of vector functions- Differentiation and integration of vector functions- Tangent and normal components of acceleration- Modeling ballistics and planetary motion-Kepler's second law.

SUGGESTED READINGS

1. Thomas G.B., and Finney R.L., (2008).Calculus, Ninth Edition, Pearson Education, Delhi.
2. Anton H., Bivens I., and Davis S.,(2017). Calculus, Tenth Edition, John Wiley and Sons (Asia) P. Ltd., Singapore.
3. Strauss M.J., Bradley G.L.,and Smith K. J., (2007). Calculus, Third Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
4. Courant R., and John F., (2000). Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York.

Semester – I

19MMU102 **ALGEBRA** **7H – 6C**

Instruction Hours / week: L: 6 T: 1 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The functions, relations, systems of linear equations and linear transformations.
- How to identify, evaluate and simplify algebraic expressions using the correct operations.
- The basic concepts of linear algebra.
- The concepts of principles of mathematical induction.
- The solution and application of linear systems.
- The application of matrix, inverse of matrix and system of linear equations.

Course Outcomes (COs)

On successful completion of this course, the students will be able to

1. Know about the basic concepts of set theory.
2. Describe the categories of functions.
3. Understand the algorithms on operation.
4. Use matrix operations to solve system of linear equations.
5. Learn how to find characteristic equation, eigen value and eigen vector for matrix.
6. Know about the applications of linear systems and linear independence.

UNIT I
BASICS OF SETS &FUNCTIONS
Sets –Finite and infinite sets-Equality sets-Subsets-Comparability -Proper subsets-Axiomatic development of set theory-Set operations. Equivalence relations- Functions- Composition of functions- Invertible functions- One to one Correspondence and cardinality of a set.

UNIT II
DIVISIBILITY AND CONGRUENCE RELATIONS
Division algorithm- Divisibility and Euclidean algorithm- Congruence relation between integers- Principles of Mathematical Induction- Statement of Fundamental Theorem of Arithmetic.

UNIT III
SYSTEM OF LINEAR EQUATIONS
Systems of linear equations - Row reduction and echelon forms - Vector equations - The matrix equation Ax=b - Solution sets of linear systems - Applications of linear systems – Linear independence.

UNIT IV
THEORY OF EQUATIONS
Roots of an equation- Relations connecting the roots and coefficients- Transformations of equations - Character and position of roots-Descarte's rule of signs-Symmetric function of roots-Reciprocal equations.

UNIT V

THEORY OF EQUATIONS (CONTINUITY)

Multiple roots-Rolle's theorem - Position of real roots of f(x) =0 – Newton's method ofapproximation to a root – Horner's method.

SUGGESTED READINGS

1. Edgar G. Goodaire and Michael M. Parmenter,(2015)**.**Discrete Mathematics with Graph Theory, 3rd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint.
2. David C. Lay., (2008). Linear Algebra and its Applications, Third Edition, Pearson Education Asia, Indian Reprint.
3. Kenneth Hoffman., Ray Kunze., (2015).Linear Algebra, Second edition, Prentice Hall of India Pvt Ltd, New Delhi.
4. T.K.Manicavasagom Pillai, T.Natarajan, K.S.Ganapathy,(2006),Algebra,S.Viswanatham(Printer & publishers) Private Ltd.

Semester – I

19MMU103	**PHYSICS I**	**4H – 4C**
Instruction Hours / week: L: 4 T: 0 P: 0	**Marks: Internal: 40**	**External: 60 Total: 100**
		End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic theories and experiments in Physics.
- The fundamentals of physics.
- About the electronic component like Diode, transistor etc.
- The analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
- The graphical relationship of resistance, capacitor and inductor.
- About the circuit connection.

Course Outcomes (COs)

On successful completion of this course, the students will be able to

1. Demonstrate proficiency in mathematics and the mathematical concepts to understand physics.
2. Design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes.
3. Demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
4. Know about the Laws of thermodynamics.
5. Know about the Intrinsic and extrinsic semiconductor.
6. Understand the graphical relationship of resistance, capacitor and inductor.

UNIT-I
PROPERTIES OF MATTER

Elastic constants of an isotropic solid -Stress – Strain - Relations connecting them - Poisson's ratio - Bending of beams - Uniform and non-uniform bending - Bending moment of a bent beam - cantilever - Static and dynamic methods - Torsion in a wire - Rigidity modulus determination by Static and dynamic methods. Surface tension and Surface energy- Pressure difference across a spherical surface- Pressure difference across a curved surface.

UNIT-II
MECHANICS

Motion of bodies in 2–D - Newton's laws - projectile motion – range- maximum height – projectile from space flight- Rotational motion – Rotation with constant angular acceleration – angular momentum of particles – rigid body – spinning top – conservation of angular momentum – Planetary motion – Kepler's laws – universal law of gravitation.

UNIT-III
THERMAL PHYSICS

Laws of thermodynamics – Reversible and irreversible process – Heat engine – Carnot's theorem.Black body – Stefan's law – Newton's law of cooling – Newton's

law of cooling from Stefan's law – Experimental determination of Stefan's constant – Wien's displacement law – Rayleigh – Jean's law – Planck's law.

UNIT-IV

OPTICS AND LASER PHYSICS

Reflection – Refraction – Snell's law – Total internal reflection – Interference – Diffraction – Polarization – Coherence.Stimulated emission and absorption – Einstein's theory of radiation - population inversion – optical pumping – meta stable state – conditions for laser actions – Ruby laser – Helium – neon laser – applications of lasers – Raman effect – Raman shift – stokes and anti-stokes lines.

UNIT-V

BASIC ELECTRONICS

Intrinsic and extrinsic semiconductor – PN Junction diode – Biasing of PN junction – V-I characteristics of junction diode – Rectifiers – Half wave – Full wave and bridge rectifiers – Zener diode – Characteristics of Zener diode – Voltage regulator – Transistor – Characteristics of transistor – CB, CE mode – Transistors as an amplifier.

SUGGESTED READINGS

1. Murugesan. R., Modern Physics, S.Chand& Co, New Delhi.
2. Brijlal and N. Subramanyam, (2004). Properties of matter, S. Chand & Company, New Delhi.
3. Aruldhas and P.Rajagopal, Modern Physics, Prentice Hall of India, New Delhi.
4. Mathur. D.S., (2003). Elements of properties of matter - Shyamlal Charitable Trust, New Delhi.
5. V K Mehta and Rohit Mehta,(2008).Principles of Electronics, S.Chand& Company Ltd. Revised Eleventh Edition
6. F. W. Sears and G. L. Salinger,(1998).Thermodynamics, Kinetic theory, and Statistical Thermodynamics, IIIrd ed., Narosa Publishing House
7. Ghatak and Thygarajan,(1984).Lasers, Theory and applications, Macmillan IndiaLtd., New Delhi.

		Semester – I
19MMU111	**CALCULUS - PRACTICAL**	**3H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- To demonstrate comprehension in relevant area of calculus
- Problem solving through (computer language) programming.
- The basic structure of the programme, declaration and usage of variables.
- The basic MATLAB (matrix laboratory) programme.
- The usage of MATLAB in order to facilitate understanding and visualization of mathematical problems
- The practical preparation knowledge to apply the acquired knowledge and skills.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Familiarize with the programming environment.
2. Acquire the problem solving skills through computer programming.
3. Understand to write diversified solutions using programming language.
4. Plot of graphs of functions (exponential, logarithmic, trigonometric).
5. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).
6. Deal with different input/output methods.

List of Practical (**Any 8 programs)**

1. Plotting of graphs of function $e^{ax + b}$, log(ax + b), 1/(ax + b), sin(ax + b), cos(ax + b), |ax + b| and to illustrate the effect of a and b on the graph.

2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

3. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).

4. Obtaining surface of revolution of curves.

5. Tracing of conics in cartesian coordinates/ polar coordinates.

6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, hyperbolicparaboloid using cartesian coordinates.

7. Matrix addition.

8. Matrix multiplication.

9. Inverse of a matrix.

10. Transpose of a matrix

Semester – I

19MMU112 **Physics I-Practical** **4H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The basic understanding of laboratory technique and to educate and motivate the students in the field of Physics.
- A deep knowledge of fundamentals of optics.
- The practical knowledge by applying the experimental methods to correlate with the Physics theory.
- The usage of electrical and optical systems for various measurements.
- The intellectual communication skills and discuss the basic principles of scientific concepts in a group.
- The physical Principles and applications of Electronics.

Course Outcomes (COs)

Students can able to

1. Perform basic experiments in mechanics and electricity and analyze the data.
2. Acquire engineering skills and Practical knowledge, which help the student in their everyday life.
3. Know the physical Principles and applications of Electronics.
4. Apply the analytical techniques and graphical analysis to the experimental data.
5. Apply the various procedures and techniques for the experiments.
6. Use the different measuring devices and meters to record the data with precision.

ANY EIGHT EXPERIMENTS

1. Young's Modulus-Non-Uniform Bending-Pin and Microscope
2. Young's Modulus-Static cantilever
3. Acceleration due to gravity-Compound pendulum
4. Determination of spring constant of the given spring.
5. Determine the radius of capillary tube using microscope.
6. Refractive Index of a solid prism (I-d) curve-Spectrometer
7. Co-efficient of thermal conductivity-Lee's disc method
8. Wavelength of spectral lines -Grating-minimum deviation method-Spectrometer.
9. Characteristics of a Zener and Junction diode
10. μ of a lens-Newton's ring method
11. Thickness of a thin wire-Air wedge method
12. Determine the surface tension - Drop weight method
13. Determine the wavelength of He-Ne laser.
14. Determination of the Coefficient of Viscosity of a given liquid using Burette method

15. Construct a single stage amplifier using transistor

SUGGESTED READINGS:

1. Ouseph C.C., U.J. Rao and V. Vijayendran 2007, Practical Physics and Electronics, S.Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai
2. Singh S.P., 2003, Advanced Practical Physics – 1, 13th Edition, PragathiPrakashan, Meerut
3. Singh S.P., 2000, Advanced Practical Physics – 2, 12th Edition, PragathiPrakashan, Meerut

பகுதி – I, **தமிழ்இரண்டாம்பருவம்**

19LSU201 தமிழ்இரண்டாம்தாள் 4-H,4-C

(இளநிலைஅறிவியல்பட்டவகுப்புகளுக்குரியது)

பாடத்திட்டப் பொதுநோக்கம்

- *கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.*
- *ஆய்வுநோக்கை மேம்படுத்துதல்.*
- *இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.*
- *மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.*
- *வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.*
- *அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.*

பாடத்திட்டப் பயன் விளைவு

1. *இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.*
2. *கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.*
3. *தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.*
4. *வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .*
5. *சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.*
6. *மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்*

அலகு – I :பக்திஇலக்கியம் (7 மணிநேரம்)

சைவ, வைணவஇலக்கியங்கள் -தோற்றம் ,வளர்ச்சி, வரலாறு.

1. **சைவம்- (15பாடல்கள்)***பெரியபுராணம் – திருமூலநாயனார்புராணம் - அந்திஇளம்பிறைக்கண்ணி, மற்றுஅவர்தாம்அணிமா, காவிரிநீர்பெருந்தீர்த்தம், அந்நிலைமைத்தானத்தை, அந்தணர்தம்சாத்தனூர், மற்றுஅதன்தன்உடம்பினை, இவன்உயிர்பெற்றெழில், பாய்த்தியபின்திருமூலராய், வெய்யசுடர்கதிரவனும், அங்கவளும், பித்துஉற்றமையல்அன்று, இந்தநிலைமையில், ஆவடுதண்துறை, ஊன்உடம்பில், முன்னியஅப்பொருள்.*
2. **வைணவம் – ஆண்டாள்நாச்சியார்திருப்பாவை: (11 பாடல்கள்):***மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கிஉலகளந்த, ஆழிமழைக்கண்ணா, மாயனைமன்னுவடமதுரை, சிற்றம்சிறுகாலே, ஒருத்திமகனாய், மாலேமணிவண்ணா, கூடாரைவெல்லும், கறவைகள்பின்சென்று, வங்கக்கடல்கடைந்த.*

அலகு – II :சங்கஇலக்கியம் (14 மணிநேரம்)

சங்கஇலக்கியங்கள் -அறிமுகம்

அ).எட்டுத்தொகை

நற்றிணை:கொண்டல்மாமழை – குறிஞ்சி – தலைவன் - 140

குறுந்தொகை : வாரார்ஆயினும், வரினும் –முல்லை– தலைவி - 110

ஐங்குறுநூறு :மருதம் –தோழி -வேட்கைப்பத்து: வாழிஆதன்வாழிஅவனி - 6

பதிற்றுப்பத்து: சிதைந்ததுமன்ற- 27

பரிபாடல்: பரிபாடல்திரட்டு-வையை –10: மலைவரைமாலை-கரைநண்ணி 10:1-25, ஆங்கஅணிநிலைமாடத்து-நீகானும்போன்ம் 10: 41-55, இலம்படுபுலவர்- ஏத்தினர்தொழுவே 10: 126-130.

கலித்தொகை:பாலைக்கலி-செவிலி – எறித்தரு கதிர்தாங்கி-9

அகநானூறு:*அன்னைஅறியினும்அறிக – தோழி - நெய்தல் -* 110
புறநானூறு :*யாதும்ஊரேயாவருங்கேளிர் –பொதுவியல்-* 192
ஆ).பத்துப்பாட்டு: நெடுநல்வாடை - கார்காலச்சிறப்பு : *வையகம்பனிப்ப* -1-70

அலகு - III :காப்பியம் (6 மணிநேரம்)

(அ). சிலப்பதிகாரம்:
மங்கலவாழ்த்துப்பாடல்: (21-29)-*நாகநீள்நகரொடு-கண்ணகிஎன்பாண்மன்னோ .*
வழக்குரைகாதை, (48-56) - *நீர்வார்கண்ணை-புகாரென்பதியே .*
வஞ்சினமாலை: (5-34) - *வன்னிமரமும் – பிறந்தபதிப்பிறந்தேன்.*
நடுகற்காதை: (207-234) - *அருத்திறலரசர் – மன்னவரேறென்,.*
வாழ்த்துக்காதை: (9) - *என்னேயிஃதென்னே – மீவிசும்பிற்றோன்றுமால்.*
(ஆ). மணிமேகலை:
பசியின்கொடுமை: பாத்திரம்பெற்றகாதை:
'போதிநீழல்' - 'பெருகியதன்றோ', 'ஆற்றுநர்க்களிப்போர்' - 'நல்லறம்கண்டனை' (73-98).
சிறைக்கோட்டம்அறக்கோட்டமாக்கியகாதை:*மாவண்கிள்ளிக்குகாவலன்உரைத்தவை:*
'பைஞ்சேறுமெழுகாப்பசும்பொன்மண்டபத்து -
அரவோர்க்காக்கினன்அரசாள்வேந்தன்' (116-163).

அலகு – IV :கட்டுரைகள் (8 மணிநேரம்)

1. ***தமிழிசைஇயக்கம்*** – பேரா. க. வெள்ளைவாரணர்
2. ***தனிப்பாடல்கள்*** - பேரா. வ. சுப. மாணிக்கனார்
3. ***கலைச்சிறப்பு*** - முத்தமிழ்க்காவலர்கி.ஆ.பெ. விசுவநாதம்
4. ***காளத்திவேடனும்கங்கைவேடனும்*** –சொல்லின்செல்வர்ரா.பி.சேதுப்பிள்ளை
5. ***ஏட்டில்இல்லாதஇலக்கியம்*** – ஔவைதுரைசாமி

அலகு- V :மொழிப்பயிற்சி (5 மணிநேரம்)

(பேச்சுப்பயிற்சி&படைப்பாக்கப்பயிற்சி)
படைப்பிலக்கியப் பயிற்சிகள் (கதை, கவிதை, கட்டுரை, உரைநடைஎழுதுதல், நேர்காணல்)மொழிபெயர்ப்பு

பாடநூல்:கற்பகச்சோலை – தமிழ்ஏடு.
கற்பகம்உயர்கல்விகலைக்கழகத்தமிழ்த்துறைவெளியீடு.

Semester – II

19MMU201 **DIFFERENTIAL EQUATIONS** **5H – 5C**

Instruction Hours / week: L: 5 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

Course Objectives

This course enables the students to learn

- First order exact differential equations, linear homogeneous and non homogeneous equations of higher order with constant coefficients.
- The complete solution of a non-homogeneous differential equation with constant coefficients by the method of undetermined coefficients.
- The transform of a periodic function.
- The applications of the inverse Laplace transform.
- The Euler's equations, method of variation of parameters.
- The predatory-prey model and its analysis, epidemic model of influenza and its analysis.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the concepts of explicit, implicit and singular solutions of a differential equation.
2. Acquire knowledge on linear and bernoulli's equaitons.
3. Know the concepts of population model.
4. Understand the method of solving differential equation using variation of parameters. Identify the applications of differential equations.
5. Know about the concepts of Laplace Transform.
6. Understand the concept of inverse Laplace transform.

UNIT I
DIFFERENTIAL EQUATIONS
Differential equations and mathematical models. General,particular, explicit, implicit and singular solutions of a differential equation.

UNIT II
TYPES OF DIFFERENTIAL EQUATIONS
Exact differential equations and integrating factors - Separable equations and equations reducible to this form - Linear equation and Bernoulli equations - Special integrating factors and transformations.

UNIT III
SECOND ORDER LINEAR EQUATIONS
General solution of homogeneous equation of second order - Principle of super position for homogeneous equation –Wronskian: its properties and applications - Linear homogeneous andnon-homogeneous equations of higher order with constant coefficients - Euler's equation - Method of undetermined coefficients - Method of variation of parameters.

UNIT IV

LAPLACE TRANSFORMS

Definition-Sufficient conditions for the existence of the Laplace Transform - Laplace Transform of periodic functions- Some general theorems-Evaluation of integrals using Laplace Transform.

UNIT V

INVERSE LAPLACE TRANSFORMS

Solving ordinary differential equations with constant coefficients using Laplace Transforms-Solving a system of differential equations using Laplace Transforms.

SUGGESTED READINGS

1. Ross S.L., (2016). Differential Equations, Third Edition, John Wiley and Sons, India.
2. Martha L Abell., and James P Braselton., (2004). Differential Equations with MATHEMATICA, Third Edition, Elsevier Academic Press.
3.Sneddon I.,(2006). Elements of Partial Differential Equations, McGraw-Hill, International Edition, New Delhi.

Semester – II

19MMU202 **REAL ANALYSIS** **7H – 6C**

Instruction Hours / week: L: 6 T: 1 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The fundamental properties of the real numbers that underpin the formal development of real analysis
- About the extreme points, Root test, Ratio test.
- The alternating series, and series of functions.
- The concepts of real Sequence, Bounded sequence, Cauchy convergence criterion for sequences.
- The basic theorems on monotone sequences and their convergence.
- About the Power series and radius of convergence.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand about the categories of sets.
2. Acquire the knowledge on limits and convergence of sequences.
3. Know the types of test of convergence for series.
4. Familiarize about the basic theorems on monotone sequences.
5. Know about the radius of convergence.
6. Understand the Power series and radius of convergence.

UNIT I
THE REAL NUMBERS

Finite and infinite sets - Examples of countable and uncountable sets.Real line- Bounded sets - Suprema and infima - Completeness property of $\mathbb{R}$ - Archimedean property of $\mathbb{R}$ - Intervals.

UNIT II
SEQUENCES

Real sequence - Bounded sequence - Cauchy convergence criterion for sequences. Limit of a sequence. Limit Theorems. Cauchy'stheorem on limits - Order preservation and squeeze theorem – Monotone sequences and their convergence (monotone convergence theorem without proof).

UNIT III
SERIES

Infinite series. Cauchy convergence criterion for series - Positive term series - Geometric series - Comparison test - Convergence of p-series - Root test - Ratio test - Alternating series - Leibnitz's test(Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

UNIT IV

MONOTONE SEQUENCES

Monotone Sequences - Monotone Convergence Theorem. Subsequences - Divergence Criteria - Monotone Subsequence theorem - Bolzano Weierstrass theorem for Sequences.

UNIT V

CAUCHY SEQUENCES

Cauchy sequence - Cauchy's Convergence Criterion. Concept of cluster points and BolzanoWeierstrass theorem-Properly Divergent Sequences. Introduction to infinite series.

SUGGESTED READINGS

1. Bartle R.G. and Sherbert D. R., 2000. Introduction to Real Analysis, John Wiley and Sons (Asia) Pvt. Ltd.
2. Fischer E., (2012). Intermediate Real Analysis, Springer Verlag.
3. Ross K.A., (2003).Elementary Analysis- The Theory of Calculus Series - Undergraduate Texts in Mathematics, Springer Verlag.
4. Apostol T. M., (2002). Calculus (Vol.I), John Wiley and Sons (Asia) P. Ltd.
5.Goldberg, R., (2012). Methods of Real Analysis, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

		Semester – II
19MMU203	**Physics II**	**4H – 4C**
Instruction Hours / week: L: 4 T: 0 P: 0	**Marks:** Internal: **40**	External: **60** Total: **100**
		End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Basic knowledge on material properties.
- Magnetism and digital electronics.
- To educate and motivate the students in the field of science.
- The unit cell for some crystal structure, be able to draw the atomic packing arrangement for a specific crystallographic plane.
- The use of X-ray diffraction measurements in determining crystalline structures.
- The relation in between Electromagnetic theory.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Explain how physics applies to phenomena in the world around them.
2. Recognize how and when physics methods and principles can help address problems in their major and then apply those methods and principles to solve problems.
3. Study the theory of Photoelectric effect.
4. List different types of atomic spectra.
5. Understand the importance of Mosley's law and Bragg's law.
6. Understand the concept of digital electronics.

UNIT -I

ELECTROSTATICS

Coulombs law – electric field – Gauss's law and its applications – potential – potential due to various charge distribution. Parallel plate capacitors – dielectrics- current – galvanometer – voltmeter – ammeter- potentiometric measurements.

UNIT - II

MAGNETISM

Magnetic field – BiotSavart's law – B due to a solenoid – Amperes law – Faradays law of induction – Lenz's law. Magnetic properties of matter –Dia, para and ferro - Cycle of magnetization – Hysteresis – B-H curve – Applications of B-H curve.

UNIT - III

MODERN PHYSICS

Einstein's Photoelectric effect-characteristics of photoelectron –laws of photoelectric emission-Einstein's photo electric equations- Compton effect-matter waves-De-Broglie Hypothesis. Heisenberg's uncertainty principle-Schrödinger's equation- particle in a box.

UNIT-IV
ATOMIC AND NUCLEAR PHYSICS

Atom Models :Sommerfield's and Vector atom Models – Pauli's exclusion Principle – Various quantum numbers and quantization of orbits. X-rays : Continuous and Characteristic X-rays – Mosley's Law and importance – Bragg's Law.

Nuclear forces –characteristics - nuclear structure by liquid drop model – Binding energy – mass defect – particle accelerators – cyclotron and betatron – nuclear Fission and nuclear Fusion.

UNIT - V
DIGITAL ELECTRONICS

Decimal – binary – octal and hexadecimal numbers– their representation, inter-conversion, addition and subtraction, negative numbers. Sum of products – product of sums – their conversion – Simplification of Boolean expressions - K-Map – min terms – max terms - (2, 3 and 4 variables). Basic logic gates – AND, OR, NOT, NAND, NOR and EXOR gates – NAND and NOR as universal building gates – Boolean Algebra – Laws of Boolean Algebra – De Morgan's Theorems – Their verifications using truth tables.

SUGGESTED READINGS

1. Narayanamurthi,(1988). Electricity and Magnetism, The National Publishing Co, First edition.

2. J. B. Rajam, Atomic Physics., (1990).S. Chand & Company Limited, New Delhi, First edition.

3. B. N. Srivastava,(2005) Basic Nuclear Physic, Pragati Prakashan, Meerut.

4. Albert Paul Malvino,(2002). Digital principles and Applications, McGraw-Hill International Editions,New York.

5. Floyd,Digital fundamentals(2006).Pearson education ,8th edition.

6. R. S. Sedha, (2004).A text book of Digital Electronics, S. Chand & Co, New Delhi, First edition.

Semester – II

19MMU211 **DIFFERENTIAL EQUATIONS -PRACTICAL** **3H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Problem-solving through programming.
- Hands-on training using lab components.
- Plotting of second order solution of differential equations and recursive sequences.
- Cauchy's root test and Ratio test by plotting the ratio.
- The exponential growth and decay, the population growth of species or the change in investment return over time.
- The usage of program to solve the differential equations.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Demonstrate comprehension in fundamental topics of computing, algorithms, computer organization and software systems.
2. Have applied knowledge of areas of computing to create solutions to challenging problems, including specify, design, implement and validate solutions for new problems.
3. Be aware of current research activity in computing through activities including reading papers, hearing research presentations.
4. Know about successfully planning and completing an individual research project in computing or its application.
5. Understand Cauchy's root test and Ratio test by plotting the ratio.
6. Acquire the knowledge on Growth model and Decay model.

List of Practical (Any 8 programs)

1. Plotting of second order solution family of differential equation.

2. Growth model (exponential case only).

3. Decay model (exponential case only).

4. Lake pollution model (with constant/seasonal flow and pollution concentration).

5. Case of single cold pill and a course of cold pills.

6. Limited growth of population (with and without harvesting).

7. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).

8. Plotting of recursive sequences.

9. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.

10. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.

11. Cauchy's root test by plotting nth roots.

12. Ratio test by plotting the ratio of nth and $(n+1)^{th}$ term.

Semester – II

19MMU212 **Physics II-Practical** **4H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The concepts in integrated chips.
- The optical and electronic properties of solids through experimentations.
- The usage of electrical and optical systems for various measurements.
- The intellectual communication skills and discuss the basic principles of scientific concepts in a group.
- The physical Principles and applications of Electronics.
- The various procedures and techniques for the experiments.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Perform basic experiments in mechanics, heat and electricity and analyze the data.
2. Acquire engineering skills and Practical knowledge, which help the student in their everyday life.
3. Know the physical Principles and applications of Electronics.
4. Apply the various procedures and techniques for the experiments.
5. Apply the mathematical concepts/equations to obtain quantitative results.
6. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Any 8 Experiments

1. Determine the magnetic dipole moment (m) of a bar magnet - Tan A
2. Determine the magnetic dipole moment (m) of a bar magnet - Tan B
3. Field Intensity-Circular coil- Vibration magnetometer
4. Moment of a magnet-Circular coil-Deflection Magnetometer
5. Study of logic gates using IC's.

6. Study of NOR gate as Universal building block.
7. Study of NAND gate as Universal building block.
8. Verification of Basic logic gates using discrete components.
9. To study the variation in current and voltage in a series LCR circuit
10. To study the variation in current and voltage in a parallel LCR circuit
11. Transistor characteristics – CE &CB

SUGGESTED READINGS

1. Ouseph C.C., U.J. Rao and V. Vijayendran 2007, Practical Physics and Electronics, S.Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai
2. Singh S.P., 2003, Advanced Practical Physics – 1, 13th Edition, PragathiPrakashan, Meerut
3. Singh S.P., 2000, Advanced Practical Physics – 2, 12th Edition, PragathiPrakashan, Meerut

Semester – II

19AEC201 **ENVIRONMENTAL STUDIES** **3H – 3C**

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The awareness about environmental problems among people.
- About various renewable and nonrenewable resources of the region.
- The appropriate judgments and decisions for the protection and improvement of the earth.
- The concept of Environmental Pollution, effects and control measures of urban and industrial wastes.
- About the concepts of Social Issues and the Environment.
- The causes and effects of Environmental pollution.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Create the awareness about environmental problems among people.
2. Develop an attitude of concern for the environment.
3. Motivate the public to participate in environment protection and improvement.
4. Know about the Role of Information Technology in environment and human health.
5. Investigate the Environmental Pollution, effects and control measures of urban and industrial wastes.
6. Solve Environment Protection Act, Wildlife Protection Act. Forest Conservation Act.

UNIT I

INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS

Environment Definition -Scope and importance; Ecosystem - Structure and functions of ecosystem.Energy flow - Food chains and food webs - Ecological succession.Classification of ecosystem.Forest ecosystem - Grassland Ecosystem - Desert ecosystem - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II

NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources - Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources - Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case

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

UNIT III

BIODIVERSITY AND ITS CONSERVATION

Levels of biological diversity - Genetic - Species and ecosystem diversity.Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India.Biodiversity patterns (global, National and local levels).Hot-spots of biodiversity.India as a mega-diversity nation.Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNITIV

ENVIRONMENTAL POLLUTION

Definition - Causes - Effects and control measures of Air pollution - Water pollution - Soil pollution - Noise pollution.Nuclear hazards and human health risks.Solid waste management and control measures of urban and industrial wastes.Role of an individual in prevention of pollution.Case studies.

UNIT V

SOCIAL ISSUES AND THE ENVIRONMENT

Concept of sustainability and sustainable development.Water conservation - Rain water harvesting, watershed management.Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture.Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act).International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Human population growth: Impacts on environment, human health and welfare.

SUGGESTED READINGS

1. Anonymous. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
2. AnubhaKaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Daniel, B. Botkin., and Edward, A. Keller. 1995. Environmental Science John Wiley and Sons, Inc., New York.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S.Chand& Company Pvt. Ltd., New Delhi.
6. Odum, E.P., Odum, H.T. and Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
7. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford University Press.

8. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
9. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources.Daya Publishing House, New Delhi.
10. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2^{nd}ed.). Vrianda Publications Private Ltd, New Delhi.
11. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
12. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

Semester – III

19MMU301 **PDE AND SYSTEMS OF ODE** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The various methods of solving Differential equations which is very much used in the field of Engineering.
- The Method of Separation of Variables for solving first order partial differential equations.
- The basic concepts of Reduction of second order Linear Equations to canonical forms
- The Systems of linear differential equations and its applications.
- The concept of second order linear homogeneous, non-homogeneous differential equations with constant coefficients.
- The application of The Euler method-The modified – Euler method -The Runge-Kutta method.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Understand the basic concepts partial differential equations.
2. Gain knowledge about forming the differential equations method of separation of Variables, Initial Boundary Value Problems and method of successive approximations.
3. Know about the Reduction of second order Linear Equations to canonical forms.
4. Study the Method of separation of variables and Solving the Vibrating String.
5. Understand the Basic Theory of linear systems in normal form.
6. Use the Numerical methods to solve the real world problems.

UNIT I
PARTIAL DIFFERENTIAL EQUATIONS

Basic concepts and Definitions -Mathematical Problems. First Order Equations: Classification - Construction and Geometrical Interpretation- Method of characteristics for obtaining General Solution of Quasi Linear Equations- Canonical Forms of First-order Linear Equations.

UNIT II
CLASSIFICATION OF SECOND ORDER LINEAR EQUATIONS

Method of Separation of Variables for solving first order partial differential equations. Derivation of Heat equation -Wave equation and Laplace equation. Classification of second order partial differential equations - linear equations as hyperbolic-Parabolic or Elliptic.

UNIT III

CAUCHY PROBLEM AND WAVE EQUATIONS

Reduction of second order Linear Equations to canonical forms- The Cauchy problem- The Cauchy-Kowalewskaya theorem -Cauchy problem of an infinite string - Initial Boundary Value Problems -Semi-Infinite String with a fixed end - Semi-Infinite String with a Free end- Equations with non-homogeneous boundary conditions -Non- Homogeneous Wave Equation.

UNIT IV

METHOD OF SEPARATION OF VARIABLES

Solving the Vibrating String problems- Solving the Heat Conduction problem - Systems of linear differential equations - Types of linear systems differential operators - An operator method for linear systems with constant coefficients.

UNIT V

BASIC THEORY OF LINEAR SYSTEMS IN NORMAL FORM

Homogeneous linear systems with constant coefficients -Two Equations in two unknown functions-The method of successive approximations-The Euler method-The modified – Euler method -The Runge-Kutta method.

SUGGESTED READINGS

1. TynMyint-U and LokenathDebnath., (2006).Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint.
2. Ross S.L., (2004). Differential equations,Third Edition, John Wiley and Sons, India.
3. Martha L Abell., James P Braselton, (2004). Differential equations with MATHEMATICA, Third Edition Elsevier Academic Press.

Semester – III

19MMU302 **GROUP THEORY I** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Group homomorphism, isomorphism, automorphism and its related properties.
- The concept of internal and external direct product.
- The properties of cyclic groups, permutations and cosets.
- The concepts Abelian groups, divisible and reduced groups and Torsion group.
- The extension of group structure to finite permutation groups.
- The basic concepts of group actions and their applications.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

1. Expertise on fundamental of groups.
2. Know about Subgroups and its properties.
3. Understand the concept of cyclic groups and its properties.
4. Acquire the knowledge on basic concepts of Permutation group.
5. Apply Cauchy's theorem for finite abelian groups.
6. Understand the concepts of Isomorphism.

UNIT I

GROUPS

Definition and Examples of Groups - Elementary Properties of Groups.

UNIT II

FINITE GROUPS AND SUBGROUPS

Terminology and Notation - Subgroup Tests -Examples of Subgroups

UNIT III

CYCLIC GROUPS

Properties of Cyclic Groups - Classification of Subgroups of Cyclic Groups

UNIT IV

PERMUTATION GROUPS

Definition and Notation - Cycle Notation - Properties of Permutations

UNIT V

ISOMORPHISMS

Definition and Examples- Cayley's theorem - Properties of isomorphisms – Automorphisms

SUGGESTED READINGS

1. Joseph A. Gallian., (2001). Contemporary Abstract Algebra, Fourth Edition.,Narosa Publishing House, New Delhi.
2. Fraleigh.J.B., (2004). A First Course in Abstract Algebra , Seventh edition , Pearson Education Ltd, Singapore.
3. David S. Dummit and Richard M. Foote, (2004).,Abstract Algebra,. Third Edition., John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
4. Herstein.I.N.,(2010). Topics in Algebra ,Second Edition, Willey and sons Pvt Ltd, Singapore.
5. Artin.M., (2008).Algebra, Prentice - Hall of India, New Delhi.

Semester –III

19MMU303A **LOGIC AND SETS** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- First-order formula of predicate logic is a tautology using a natural-deduction style formal system.
- The formal definitions of predicates, operations on sets and pertaining to relations.
- The concepts of Set operations and the laws of set theory and Venn diagrams.
- Composition of relations, Types of relations, Partitions, Partial ordering relations and n-ary relations.
- The enhancement of logical thinking and its application to computer science.
- The methods of mathematical logic.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Acquire the knowledge about propositions, conjunction, disjunction, logical equivalences and counting principle.
2. Identify between binding variables and negations.
3. Use the language of set theory, interpreting issues in different areas of mathematics.
4. Know the concepts Difference and Symmetric difference of two sets.
5. Mastery in the concepts of relations.
6. Study Composition of relations, Types of relations, Partitions, Partial ordering relations and n-ary relations.

UNIT I
LOGIC AND CONNECTIONS

Introduction - Propositions - Truth table - Negation - Conjunction and disjunction. Implications - Biconditional propositions - Converse - Contra positive and inverse propositions and precedence of logical operators.

UNIT II
PROPOSITIONAL EQUIVALENCE

Logical equivalences. Predicates and quantifiers: Introduction - Quantifiers - Binding variables and Negations.

UNIT III

SETS

Subsets - Set operations and the laws of set theory and Venn diagrams.Examples of finite and infinite sets.

UNIT IV

FINITE SETS AND COUNTING PRINCIPLE

Empty set - Properties of empty set. Standard set operations. Classes of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities - Generalized union and intersections.

UNIT V

RELATIONS

Product set - Composition of relations - Types of relations - Partitions. Equivalence relations with example of congruence modulo relation - Partial ordering relations - n-ary relations.

SUGGESTED READINGS

1. Grimaldi R.P.,(2004). Discrete Mathematics and Combinatorial Mathematics, Pearson Education, Pvt.Ltd, Singapore.
2. Bourbaki .N(2004),Theory of sets, Springer Pvt Ltd, Paris.
3. HalmosP.R.,(2011). Naive Set Theory, Springer Pvt Ltd, New Delhi.
4. Kamke E., (2010).Theory of Sets, Dover Publishers, New York.

Semester – III

19MMU303B **COMPUTER GRAPHICS** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The scope of this course is to provide students with distinguished knowledge in the field of two- and three-dimensional computer graphics for Animation.
- Different hardware used for graphical requirement.
- How to display 3D objects in a 2D display devices using projection techniques.
- How to create realistic images using color and shading techniques.
- Computer Animation and Design of Animation Sequences.
- Designing and implementing practical graphic solutions to challenging problems in different application domains.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Transfer to the students the skills required for designing and implementing practical graphic solutions to challenging problems in different application domains and make them a competent product.
2. Understand different hardware used for graphical requirement.
3. Perform visual computations for geometrical drawings.
4. Display 3D objects in a 2D display devices using projection techniques.
5. Create realistic images using color and shading techniques.
6. Developed Computer Animation and Design of Animation Sequences.

UNIT I

A SURVEY OF COMPUTER GRAPHICS

A Survey of Computer Graphics - Video Display Devices - Refresh Cathode Ray Tubes -Raster Scan Displays - Random Scan Displays - Color CRT Monitors - Direct –View Storage Tubes - Flat Panel Displays - Three Dimensional Viewing Devices – Raster Scan and Random Scan graphic storages Displays processors and Character generators, color display techniques.

UNIT II

INPUT DEVICES:

Keyboards - Mouse –Track Ball and Space ball – Joysticks - Data Glove – Digitizers - Image Scanners - Touch Panels - Light Pens - Voice Systems. Hard Copy Devices: Printers and Plotters, Interactive input/output devices.

Point, Lines And Curves:Scan conversion, Line Drawing Algorithms: DDA Algorithm - Bresenhams Line Algorithm. Circle Generating Algorithms: Mid Point Circle Algorithm, Ellipse Generating Algorithm, Conic-section generation, polygon filling anti aliasing.

UNIT III

TWO DIMENSIONAL GEOMETRIC TRANSFORMATIONS

Basic Transformations: Translation –Rotation – Scaling - Composite Transformations: Translations – Rotations - Scalings. General Pivot Point Rotation - General Fixed Point Scaling. Two – Dimensional Viewing: The Viewing Pipeline - Window to viewport Transformation - Clipping Operations: Point Clipping - Line Clipping Algorithms- Cohen Sutherland Line Clipping - Polygon Clipping: Sutherland – Hodgeman Polygon Clipping Algorithm - Text Clipping.

UNIT IV

THREE-DIMENSIONAL CONCEPTS

Three – Dimensional Display methods, Three – Dimensional Transformations : Translation – Rotation – Scaling, Three Dimensional viewing : Viewing pipeline - Viewing coordinates - Parallel Projection – . Perspective Projections.

UNIT V

VISIBLE SURFACE DETECTION METHODS

Classification of Visible Surface Detection Algorithms - Back Face Detection - Depth Buffer Method - Area Sub division Method. Computer Animation : Design of Animation Sequences- General Computer Animation functions – Raster Animations – Computer animation Languages – Key Frame Systems – Motion Specifications.

SUGGESTED READINGS

1. Donald Hearn and M. Pauline Baker, (2010).Computer Graphics - C Version, Second Edition, Pearson Education, New Delhi.
2. Amarendra N. Sinha,(2008). Computer Graphics, First Edition, Tata McGraw Hill, New Delhi.
3. Foley, Vandam, Feiner and Hughes, (1999). Computer Graphics Principles and Practices, Second Edition, Addison Wesley, Singapore.
4. Zhigang Xiang and Roy A. Plastock, (2002). Theory and Problems of Computer Graphics, Second Edition, Tata McGraw-Hill publishers, New Delhi.
5. William M. NewMan and Robert F. Sproull, (2007).Principles of Interactive Computer Graphics, Second Edition, Tata McGraw-Hill Publishers, New Delhi.
6. Rogers D.F., (2001). Procedural Elements in Computer Graphics, Second Edition, McGraw Hill Book Company, New Delhi.
7. Rogers D.F., Adams A.J., (1990). .Mathematical Elements in Computer Graphics, Second Edition, McGraw Hill Book Company, New Delhi.

WEBSITES

1. http://www.fileformat.info/mirror/egff/ch02_01.html
2. http://www.rw-designer.com/how-to
3. http://en.wikipedia.org/wiki/3D_computer_graphics

Semester – III

19MMU304 **INTRODUCTION TO ACCOUNTING** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The fundamental accounting concepts and principles.
- The capability to perform the basic accounting functions.
- The recognition, valuation, measurement and recording of the most common business transactions and the preparation of accounting statements.
- the "Fundamental Issues in Accounting" and comprises.
- How people analyze the corporate financial under different conditions and understand why people describe the financial statements in different manner.
- The Financial Statement Analysis associate with Financial Data in the organization.

Course Outcomes (COs)

On successful completion of this course, the student will be able to:

1. Use the fundamental accounting equation to analyze the effect of business transactions on an organization's accounting records and financial statements.
2. Enrich the ability to use a basic accounting system to create (record, classify, and summarize) the data needed to solve a variety of business problems.
3. Develop the ability to use accounting concepts, principles, and frameworks to analyze and effectively communicate information to a variety of audiences.
4. Promote the ability to use accounting information to solve a variety of business problems.
5. Demonstrate the applicability of the concept of Accounting to understand the managerial Decisions and financial statements.
6. Apply the Financial Statement Analysis associate with Financial Data in the organization.

UNIT I
INTRODUCTION TO ACCOUNTING

Meaning and Need for Accounting – Definition and Objectives of Accounting – Advantages and Limitations of Accounting – Accounting Rules – Bases of Accounting - Basic accounting concepts and conventions. Methods of Accounting – Double Entry system – Types of Accounts – Double Entry bookkeeping – Journals and Ledger Accounts.

UNIT II
SUBSIDIARY BOOKS

Purchase Book – Sales Book – Purchase return Book and Sales return Book – Cash Book Simple Cash Book – Two Column Cash Book – Three Columnar Cash Book – Trial balance – Errors – Rectifications of Errors – Bank Reconciliation Statement .

UNIT III
MANUFACTURING ACCOUNT

Trading Account – Profit & Loss Account – Balance sheet – Problems with simple Adjustments.

UNIT IV
AVERAGE DUE DATE AND ACCOUNT CURRENT

Determination of due date - Average due date as basis for calculation of interest. Account Current – Meaning and Definition – Procedure for calculating days of interest - Preparation of Account – Product Method – Red-ink Interest – Interest table method.

UNIT V
DEPRECIATION ACCOUNTING

Meaning and Characteristics – Causes and Objectives – Methods of providing Depreciation – Straight line Method – Diminishing Balance Method – Distinction between Straight line and Written Down Value Method – Annuity Method – Depreciation Fund or Sinking Fund Method .

SUGGESTED READINGS

1. Reddy.T.S.,& Dr. A. Moorthy,(2016). Financial Accounting, Margham Publications, Chennai
2. David Annand, &Henry Dauderis,(2017).Introduction to Financial Accounting (Athabasca University), U.S. GAAP Adaptation Lyryx .

Semester – III

19MMU311 **PDE AND SYSTEMS OF ODE - PRACTICAL** **4H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The various methods of solving Differential equations which is very much used in the field of Engineering.
- The Method of Separation of Variables for solving first order partial differential equations.
- The basic concepts of Reduction of second order Linear Equations to canonical forms
- The Systems of linear differential equations and its applications.
- The Equations with non-homogeneous boundary conditions.
- The Canonical Forms of First-order Linear Equations.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Gain knowledge about forming the differential equations method of separation of Variables, Initial Boundary Value Problems and method of successive approximations.
2. Understand the elementary theory of partial differential equations, and solve it using various techniques.
3. Determine solutions to second order linear homogeneous, non-homogeneous differential equations with constant coefficients.
4. Solve the Canonical Forms of First-order Linear Equations.
5. Understand the Equations with non-homogeneous boundary conditions.
6. Know the application of the Euler method, Modified – Euler method and Runge-Kutta method.

List of Practical

1. Solution of second order ordinary differential equations with initial conditions.
2. Solving Non-Homogeneous Wave Equation.
3. Solving the Heat Conduction Problem.
4. Solving two dimensional Laplace equations.
5. Solving system of linear differential Equations.

6. Solution of differential equation using Euler method.
7. Solution of differential equation using Modified Euler method.
8. Solution of differential equation using 4^{th} order Runge-Kutta method.

Semester – IV

19MMU401 **NUMERICAL METHODS** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic concepts of numerical methods.
- The Numerical integration and differentiation, numerical solution of ordinary differential equations.
- The Engineering problems which are impossible to solve by analytical means.
- Numerical methods to solve linear system of equations**.**
- The numerical solution of initial value problems and boundary value problems**.**
- The appropriate numerical methods to solve algebraic and transcendental equations.

Course Outcomes (COs)
On successful completion of the course, students will be able to:

1. Study the concept of Newton's Method.
2. Realize the system of linear algebraic eqution along with specified methods.
3. Know about the basic concepts of Interpolation.
4. Understand the Gregory forward and backward difference interpolation.
5. Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.
6. Use the solutions of differential equations by Runge-Kutta methods.

UNIT I
CONVERGENCE - ERRORS
Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method - Newton's method - False Position method - Secant method - Rate of convergence of these methods.

UNIT II
SYSTEM OF LINEAR ALGEBRAIC EQUATIONS

Gaussian Elimination - Gauss Jordan methods - Gauss

Jacobi method - Gauss Seidel method and their convergence analysis – LU decomposition - Power method.

UNIT III

INTERPOLATION

Lagrange and Newton's methods. Error bounds - Finite difference operators.
Gregory forward and backward difference interpolation – Newton's divided difference – Central difference – Lagrange and inverse Lagrange interpolation formula.

UNIT IV

NUMERICAL DIFFERENTIATION AND INTEGRATION

Gregory's Newton's forward and backward differentiation - Trapezoidal rule - Simpson's rule - Simpsons 3/8th rule - Boole's Rule. Midpoint rule - Composite Trapezoidal rule - Composite Simpson's rule.

UNIT V

ORDINARY DIFFERENTIAL EQUATIONS

Taylor's series - Euler's method – Modified Euler's method - Runge-Kutta methods of orders two and four.

SUGGESTED READINGS

1. Jain. M.K., Iyengar. S.R.K.,and Jain R.K., (2012). Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi .
2. Bradie B., (2007).A Friendly Introduction to Numerical Analysis, Pearson Education, India,
3. Gerald C.F., and Wheatley P.O., (2006). Applied Numerical Analysis, SixthEdition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

Semester – IV

19MMU402 **GROUP THEORY II** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Group homomorphism, isomorphism, automorphism and its related properties.
- Different types of groups such as normal subgroups, factor groups
- Familiar with various direct product of groups.
- Sylow's theorems, Cauchy's theorem and Index theorem.
- The concept of internal and external direct product.
- The applications of group actions and Generalized Cayley's theorem.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

1. Expertise on fundamental theorems of cosets and Lagrange's.
2. Know about external direct products and its developments.
3. Understand the concept of normal subgroups and factor groups.
4. Acquire the knowledge on basic concepts of group homomorphism.
5. Study about fundamental theorems of Abelian groups.
6. Understand the Isomorphism Classes of Abelian Groups

UNIT I
COSETS AND LAGRANGE'S THEOREM
Properties of Cosets - Lagrange's Theorem and Consequences - An Application of Cosets to Permutation Groups.

UNIT II
EXTERNAL DIRECT PRODUCTS
Definition and Examples - Properties of External Direct Products - The Group of Units Modulo*n*as an External Direct Product – Applications.

UNIT III
NORMAL SUBGROUPS AND FACTOR GROUPS
Normal Subgroups - Factor Groups - Applications of Factor Groups - Internal Direct Products.

UNIT IV

GROUP HOMOMORPHISMS

Definition and Examples - Properties of Homomorphisms - The First Isomorphism Theorem

UNIT V

FUNDAMENTAL THEOREM OF FINITEABELIAN GROUPS

The Fundamental Theorem - The Isomorphism Classes of Abelian Groups - Proof of the Fundamental Theorem.

SUGGESTED READINGS

1. Joseph A. Gallian., (2001). Contemporary Abstract Algebra, Fourth Edition.,Narosa Publishing House, New Delhi.
2. Fraleigh.J.B., (2004). A First Course in Abstract Algebra , Seventh edition , Pearson Education Ltd, Singapore.
3. David S. Dummit and Richard M. Foote, (2004),Abstract Algebra,. Third Edition., John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
4. Herstein.I.N.,(2010). Topics in Algebra ,Second Edition, Willey and sons Pvt Ltd, Singapore.
5. Artin.M., (2008).Algebra, Prentice - Hall of India, New Delhi

Semester – IV

19MMU403A **GRAPH THEORY** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Definitions and Basic properties of graphs.
- The fundamental concepts in graph theory.
- A blended method to prove theorems.
- The concept of Trees, spanning trees and its properties.
- Basic concepts in graph theory and a variety of different problems in Graph Theory.
- Gain the knowledge of various graphs algorithms will also be taught along with its analysis.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Understand and Apply the fundamental concepts in graph theory.
2. Understand basic results related with Eulerian and Hamiltonian graphs.
3. Study about Chromatic polynomial, Matching and Covering.
4. Know about the fundamental concepts of trees.
5. Understand the Spanning trees, rank and nullity.
6. Mastery in Dijkstra's algorithm-Floyd- Warshall algorithm

UNIT I
GRAPHS
Definition - Examples and basic properties of graphs -Directed Graphs - Types of Directed Graphs - Pseudo graphs - Complete graphs - Bipartite graphs - Isomorphism of graphs.

UNIT II
PATHS AND CIRCUITS
Paths and circuits - Strongly Connected Components -Eulerian circuits - Hamiltonian cycles Random graphs –Planargraphs -Networks.

UNIT III
GRAPH COLORING

The adjacency matrix - weighted graph -Incidence matrix–Submatrices –CircuitMatrix -Path Matrix - Chromatic Number - Chromatic polynomial – Matching - Covering - Four Color Problem

UNIT IV

TREES

Trees and its properties - Minimally connected graph -Pendant vertices in a tree -Distance and centers in a tree - Rooted and binary tree. Levels in binary tree - Height of a tree- Spanning trees - Rank and nullity.

UNIT V

APPLICATIONS OF GRAPHS

Travelling salesman's problem - Shortest path Dijkstra's algorithm, Floyd- Warshall algorithm.

SUGGESTED READINGS

1. Edgar G.Goodaire., and Michael M. Parmenter., (2003) .Discrete Mathematics with Graph Theory, Second Edition, Pearson Education (Singapore) P. Ltd.
2. Sundaresan V., Ganapathy Subramanian K.S., and Ganesan K., (2002) .Discrete Mathematics, A.R. Publications, Nagapatinam.
3. Jean Gallier, January 4, (2016) , Discrete Mathematics ., Second Edition, Springer.
4. Grimaldi R.P., (2004) .Discrete and Combinatorial Mathematics, Pearson Addison-Wesley, Boston
5. Davey B.A. and Priestley H.A., (2002) .Introduction to Lattices and Order, Cambridge University Press,Cambridge.

Semester – IV

19MMU403B	**OPERATING SYSTEM: LINUX**	**6H – 4C**
Instruction Hours / week: L: 4 T: 2 P: 0	**Marks:** Internal: **40**	External: **60** Total: **100**
		End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The main components of OS and their working.
- The memory allocation methods, page replacement algorithms, file allocation methods, multi-threading, process synchronization, and CPU scheduling.
- The basic components of a computer operating system, and the interactions among the various components.
- The capabilities and limitations of computer operating systems, process management, processor scheduling, deadlocks, memory management, secondary memory management, file management and I/O systems.
- Introduce the concepts of process and thread and their scheduling policies.
- Design the components of operating system.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Familiar with the memory allocation methods, page replacement algorithms, file allocation methods, multi-threading, process synchronization, and CPU scheduling.
2. Describe the main components of OS and their working.
3. Explain the concepts of process and thread and their scheduling policies.
4. Solve synchronization and deadlock issues.
5. Compare the different techniques for managing memory, I/O, disk and files.
6. Design components of operating system.

UNIT I
INTRODUCTION

Mainframe systems Desktop Systems – Multiprocessor systems – distributed systems – real time systems. Process: - Process concepts – Operation on process – cooperation process - Inter process Communication - Mutual Exclusion - Critical sections- primitives – Semaphores – Deadlock: System Model, Deadlock characterization, Deadlock prevention, avoidance, detection, recovery from deadlock.

UNIT II
STORAGE MANAGEMENT

Memory Management - swapping- Contiguous memory allocation – paging, segmentation – segmentation with paging – Virtual memory :Virtual storage organization – Demand Paging, Process Creation – Page replacement – Thrashing.

UNIT III

PROCESSOR SCHEDULING

preemptive scheduling : - Scheduling Criteria – Scheduling Algorithms – FCFS- SJF- Priority – RoundRobin –Multilevel Queue – Multilevel Feedback Queue . Multiprocess schedule: Real time schedule, Algorithm evaluation: Deterministic Modeling, Queue Model, Simulation

UNIT IV

FILE SYSTEMS

Introduction – File System Concepts – Access Methods – Directory structure – File Sharing – Allocation Methods – Free space management –Efficiency and performance – Recovery. Disk Performance Optimization: Introduction – Disk structure – Disk scheduling – Disk management

.

UNIT V

LINUX-THE OPERATING SYSTEM

Linux History, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux Architecture, Installation, Start up scripts, system process (an overview), Linux Security, The Ext2 and Ext3 File Systems: General characteristics of the Ext3 File System, File permissions, User Management: Types of users, the powers of Root, Managing users (adding and deleting) : using the command line and GUI Tools.

Resource Management in Linux: File and Directory management, system calls for files process management, Signals, IPC:Pipes, FIFOs, System V IPC, Message Queues, System calls for processes, Memory Management, Library and System calls for Memory.

SUGGESTED READINGS

1. Silberschatz Galvin Gagne. (2012). Operating system concepts, Ninth Edition, Wiley India (pvt), Ltd, New Delhi.
2. Deitel H.M. (2005). Operating systems, Third Edition, Addision Wesley Publication, New Delhi.
3. Pramod Chandra P. Bhatt. (2007). An Introduction to Operating Systems, Second Edition, Prentice Hall India, New Delhi.
4. Tanenbaum Woodhull. (2005) . Operating Systems., Second Edition, Pearson Education (LPE) , New Delhi.
5. William Stallings. (2010). Operating Systems internals and Design Principles, Sixth Edition, Prentice Hall India, New Delhi.
6. Arnold Robbins., (2008) ., Linux Programming by Examples The Fundamentals, Second Edition., Pearson Education,.
7. Cox K, (2009).Red Hat Linux Administrator's Guide,PHI.
8. Stevens R., (2009). UNIX Network Programming, Third Edition.,PHI.
9. Sumitabha Das, (2009).Unix Concepts and Applications, Fourth Edition., TMH.
10. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, (2009) . Linux in a Nutshell, Sixth Edition,O'Reilly Media.
11. Neil Matthew, Richard Stones, Alan Cox,(2004) Beginning Linux Programming,Third Edition.

WEBSITES

1. www.cs.columbia.edu/~nieh/teaching/e6118_s00/
2. www.clarkson.edu/~jnm/cs644
3. pages.cs.wisc.edu/~remzi/Classes/736/Fall2002/

Semester – IV

19MMU404 COST AND MANAGEMENT ACCOUNTING 8H – 6C

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The area of cost and management accounting
- The major differences and similarities between financial and management accounting
- The role of management accountant in an organization, and the importance of upholding ethical standards
- Methods and techniques needed by managers for performing functions such as costing, cost allocations.
- The concepts preparation of flexible budgets and variance analysis.
- The Financial Statement Analysis.

Course Outcomes (COs)

On successful completion of this course, the student will be able to:

1. Asses the significance and role of cost accounting
2. Import the knowledge on the nature of elements of cost and cost sheet preparation
3. Enrich the knowledge on the preparation of various budgets
4. Analyze the Financial Statement Analysis
5. Prepare budget and budgetary control
6. Acquire knowledge of Profit analysis.

UNIT I

Meaning – Definition – Scope – Objectives – Function-Merits and demerits of cost and management accounting – Distribution between cost, management and financial accounting – Elements of cost – Cost concepts and costs classification.

UNIT II

Preparation of cost sheet – stores control – EOQ – maximum, minimum, reordering levels, – Pricing of materials issues – FIFO, LIFO, Average cost, Standard price. Methods of labour cost – remuneration and incentives.

UNIT III

Financial Statement Analysis – Preparation of comparative and common size statements – analysis and interpretation – Trend Analysis. Ratio analysis– classification of ratios – liquidity, profitability, solvency ratios – inter firm comparison.

UNIT IV

Fund flow analysis and cash flow analysis (problems only)

UNIT V

Standard costing – Variance Analysis – Material and Labour – variances. Marginal costing – Cost Volume Profit analysis. Budget and Budgetary Control –Preparation of various budgets.

SUGGESTED READINGS

1. Jain S.P.,andNarang,K.L. (2014). Cost Accounting. Kalyani Publishers,Ludhiana.
2. Reddy.T.S. & Dr. A. Moorthy,(2016), Cost Accounting Margham Publications, Chennai.
3. Saxena V.K., Vashist C.D.(2015), Advanced Cost And Management Accounting,Sultan Chand & Sons, New Delhi.

Semester – IV

19MMU411 **NUMERICAL METHODS - PRACTICAL** **4H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Exercise user defined functions to solve real time problems.
- Illustrate flowchart and algorithm to the given problem.
- The basic structure of the programme, declaration and usage of variables.
- The basic MATLAB (matrix laboratory) programme.
- The usage of Matlab in order to facilitate understanding and visualization of mathematical problems
- Practical approach to apply the acquired knowledge and skills in professional and specialist courses.

Course outcomes (COs)

On successful completion of this course, the student will be able to

1. Acquire the basic knowledge of MATLAB and explore the structure of the numerical methods.
2. Use different memory allocation methods.
3. Deal with different input/output methods.
4. Use different data structures.
5. Express their ideas in terms of the syntax of the computer package MATLAB.
6. Apply the MATLAB programme in the real world situation involving numerical problems.

List of Practical (using MATLAB/Mathematica/ SCILAB)

(Any 10 Programs)

1. Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection Method.
5. Newton Raphson Method.
6. Secant Method.
7. RegulaiFalsi Method.

8. LU decomposition Method.
9. Gauss-Jacobi Method.
10. Gauss-Seidel Method.
11. Lagrange Interpolation or Newton Interpolation.
12. Simpson's rule.

19MMU501A **MULTIVARIATE CALCULUS** **Semester – V** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100** **End Semester Exam:** 3 Hours

Course Objectives

This course enables the students to learn

- The basics concept of functions of several variables.
- Mastery in the skills of limit and continuity functions of two variables.
- Definition and compute partial derivatives, directional derivatives and differentials.
- Find local extreme values of functions of several variables, test for saddle points, examine the conditions for the existence of absolute extreme values.
- Differential, integral and double integral calculus for functions of more than one variable.
- The mathematical tools and methods are used extensively in the physical sciences, engineering and economics.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the functions of several variables.
2. Know about the Extrema of functions of two variables.
3. Use double, triple and its applications.
4. Know about the change of variables in double integrals and triple integrals
5. Synthesize the key concepts of line integrals and its applications.
6. Ability to apply the knowledge of Green's theorem and Stoke's theorem

UNIT I

FUNCTIONS OF SEVERAL VARIABLES

Limit and continuity of functions of two variables - Partial differentiation - Total differentiability and differentiability - Sufficient condition for differentiability. Chain rule for one and two independent parameters - Directional derivatives - The gradient - Maximal and normal property of the gradient - Tangent planes.

UNIT II

EXTREMA OF FUNCTIONS OF TWO VARIABLES

Method of Lagrange multipliers - Constrained optimization problems - Definition of vector field - Divergence and curl.

UNIT III

DOUBLE INTEGRATION OVER RECTANGULAR REGION

Double integration over non-rectangular region - Double integrals in polar co-ordinates - Triple integrals - Triple integral over a parallelepiped and solid regions. Volume by triple integrals - Cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals

UNIT IV

LINE INTEGRALS

Applications of line integrals - Mass and Work. Fundamental theorem for line integrals - Conservative vector fields - Independence of path.

UNITV

GREEN'S THEOREM

Surface integrals - Integrals over parametrically defined surfaces. Stoke'stheorem - The Divergence theorem.

SUGGESTED READINGS

1. Strauss M.J., Bradley G.L. and Smith K. J., (2007). Calculus, Third Edition, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education), Delhi.
2. Thomas G.B., and Finney R.L., (2005).Calculus, Ninth Edition, Pearson Education, Delhi.
3. Marsden E., Tromba A.J. and Weinstein A., (2005). Basic Multivariable Calculus, Springer (SIE), Indian reprint, New Delhi.
4. James Stewart., (2001). Multivariable Calculus, Concepts and Contexts, Second Edition, Brooks Cole, Thomson Learning, USA.

Semester – V

19MMU501B **THEORY OF REAL FUNCTIONS** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The solution of Reciprocal and Binomial Equations and properties of the derived functions.
- About the relations between the roots and coefficients**.**
- The concept of continuous functions and limits of functions.
- The Applications of mean value theorem to inequalities and approximation of polynomials.
- Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions.
- The transformations of equations.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Learn about the Limits of functions and continuous functions.
2. Understand uniform continuity, non-uniform continuity criteria, uniform continuity theorem.
3. Know about the, algebra of differentiable functions.
4. Familiarize about the Mean value theorem and its applications.
5. Know about the Cauchy's mean value theorem.
6. Understand the Taylor's theorem with Cauchy's form of remainder.

UNIT I
LIMITS
Limits of Functions-Limit theorems-some Extensions of the Limit concept.

UNIT II
CONTINUOUS FUNCTIONS

Continuous Functions-Combinations of Continuous Functions-Continuous functions on Intervals-Uniform Continuity-Continuity and Gauges-Monotone and Inverse Functions.

UNIT III
DIFFERENTIATION

The Derivative-The Mean Value theorem-L'Hospital rules-Taylor's theorem.

UNIT IV
SEQUENCES OF FUNCTIONS
Pointwise and Uniform Convergence-Interchange of Limits-The Exponential and logarithmic Functions- The trigonometric functions.

UNIT V
INFINITE SERIES
Absolute Convergence - Tests for Absolute Convergence - Tests for Non-absolute Convergence - Series of functions.

SUGGESTED READINGS

1. Bartle R., and Sherbert D.R.,(2003). Introduction to Real Analysis, John Wiley and Sons.
2. Mattuck A., (2013). Introduction to Analysis, Prentice Hall.
3. Ghorpade S. R. andLimaye B.V., (2006). A Course in Calculus and Real Analysis, Springer.New York.
4. Ross K.A., (2004). Elementary Analysis: The Theory of Calculus, Springer. New York.

Semester – V

19MMU502A **RING THEORY AND LINEAR ALGEBRA I** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Linear transformations, homomorphism, isomorphism and its properties.
- The basic definitions of Rings, subrings, vector spaces, subspaces, algebra of subspaces, isomorphism and its properties.
- The concept of ideals and maximal ideals
- Fundamental characteristics of vector spaces.
- Concepts of linear transformations and their role in modern mathematics.
- The concept of ring homomorphisms, properties of ring homomorphisms.

Course Outcomes (COs)

On successful completion of this course, the student will be able to:

1. Understand the concept of rings, subrings, vector spaces, subspaces, algebra of subspaces, isomorphism and its properties.
2. Understand the concept of ring homomorphisms, properties of ring homomorphisms.
3. Know about the Vector spaces and dimension.
4. Analyze Linear transformations and matrix representation of a linear transformation.
5. Study change of coordinate matrix and its properties.
6. Understand Isomorphism theorems I, II and III, field of quotients.

UNIT I
RINGS
Definition and examples of rings - Properties of rings - Subrings - Integral domains and fields - Characteristic of a ring. Ideal - Ideal generated by a subset of a ring - Factor rings - Operations onideals - Prime and maximal ideals.

UNIT II
RING HOMOMORPHISMS
Ring homomorphisms - Properties of ring homomorphisms - Isomorphism theorems I, II and III - Field of quotients.

UNIT III
VECTOR SPACES

Vector spaces - Subspaces - Algebra of subspaces - Quotient spaces - Linear combination of vectors - Linear span - Linear independence - Basis and dimension - Dimension of subspaces.

UNIT IV

LINEAR TRANSFORMATIONS

Linear transformations - Null space - Range - Rank and nullity of a linear transformation –Matrix representation of a linear transformation - Algebra of linear transformations.

UNIT V

ISOMORPHISM

Isomorphism theorems -Invertability and isomorphisms - change of coordinate matrix.

SUGGESTED READINGS

1. Fraleigh.J.B., (2004). A First Course in Abstract Algebra , Seventh Edition , Pearson Education Ltd, Singapore.

2.Joseph A. Gallian., (2013). Contemporary Abstract Algebra, Fourth Edition, Narosa Publishing House, New Delhi.

3. Kumaresan S., (2000). Linear Algebra- A Geometric Approach, Prentice Hall of India, New Delhi

Semester – V

19MMU502B **INDUSTRIAL MATHEMATICS** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic facts about mathematics.
- Display the knowledge of conventions such annotations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- A relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved with mathematical reasoning.
- Translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- Application of Fourier and inverse Fourier transforms.
- The concepts of Medical Imaging and Inverse Problems.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Get adequate exposure to global and local concerns so as to explore many aspects of Mathematical Sciences.
2. Apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
3. Know about the X-ray: Introduction, X-ray behavior and Beers Law.
4. Aware of history of mathematics and hence of its past, present and future role as part of our culture.
5. Know the concept of Radon Transform.
6. Use the application of Fourier and inverse Fourier transforms.

UNIT I

MEDICAL IMAGING AND INVERSE PROBLEMS

The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, elementary differential equations, complex numbers and matrices.

UNIT II

INVERSE PROBLEMS

Introduction - Illustration of Inverse problems through problems taught in Pre-Calculus - Calculus - Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

UNIT III

X-RAY

Introduction, X-ray behavior and Beers Law (The fundament question of image construction) Lines in the place.

UNIT IV

RADON TRANSFORM

Definition and Examples – Linearity - Phantom (Shepp - Logan Phantom - Mathematical phantoms). Back Projection: Definition - Properties and examples.

UNIT V

CT SCAN

Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction. Algorithms of CT scan machine. Algebraic reconstruction techniques abbreviated as ART with application to CT scan.

SUGGESTED READINGS

1. Timothy G. Feeman.,(2010). The Mathematics of Medical Imaging, A Beginners Guide, Springer Under graduate Text in Mathematics and Technology, Springer.
2. Andreas Kirsch., (2011). An Introduction to the Mathematical Theory of Inverse Problems, 2nd Ed., Springer.
3. Groetsch C.W., (1999). Inverse Problems, Activities for Undergraduates, The Mathematical Association of America.

Semester – V

19MMU503A **PROBABILITY AND STATISTICS** **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objective:

This course enables the students to learn

- Basic concepts in probability theory and statistical measures.
- Commonly used probability distributions (both discrete and continuous).
- Central Limit theorem and their applications in various disciplines.
- The nature of uncertainty and randomness and set up data collection methods that are free of bias.
- Appropriate methods to draw conclusions based on sample data by constructing and/or evaluating tables, graphs, and numerical measures of characteristics of data.
- The foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the basic concepts of Measures of central tendency.
2. Know about the Probability Concepts and its properties.
3. Know about the Discrete distributions and its types.
4. Study the Continuous distributions and its types.
5. Understand the Basic Theory of Chebyshev's inequality.
6. Chapman-Kolmogorov equations, classification of states.

UNIT I
BASICS OF STATISTICS

Meaning and definition of statistics - Frequency Distribution Measures of central tendency:Arithmetic Mean, Median, Mode. Measures of dispersion – Range, Coefficient of range - Quartile deviation - Coefficient of Quartile deviation - Standard deviation and Coefficient of variation.

UNIT II
PROBABILITY CONCEPTS

Trial, event -Sample space - Mutually exclusive event - Exclusive and exhaustive events - Dependent and independent events - Simple and compound events - Mathematical properties - Permutation and combination -Probability axioms - Addition and multiplication theorem - Real

random variables (discrete and continuous) - Cumulative distribution function - Probability density functions - Mathematical expectation - Moments - Moment generating function - Characteristic function.

UNIT III

DISCRETE DISTRIBUTIONS

Binomial distribution - Poisson distributionand its properties - Joint probability density functions - Marginal and conditional distributions - Expectation of function of two random variables - Conditional expectations - Independent random variables.

UNIT IV

CONTINUOUS DISTRIBUTIONS

Uniform distribution - Normal distribution - Standard normal distribution - Exponential distribution. Joint cumulative distribution function and its properties - Joint probability density functions (No derivations) and simple problems. Bivariate distribution - Correlation coefficient - Joint moment generating function (jmgf) and calculation of covariance (from jmgf) - Linear regression for two variables.

UNIT V

LIMIT THEOREMS AND MARKOV CHAINS

Chebyshev's inequality - Statement and interpretation of (weak) law of large numbers and strong law of large numbers - Central Limit theorem for independent and identically distributed random variables with finite variance -Markov Chains – Chapman-Kolmogorov equations - Classification of states.

SUGGESTED READINGS

1. Gupta S.P., (2001). Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Robert V. Hogg, Joseph W. McKean and Allen T. Craig., (2007). Introduction to MathematicalStatistics, Pearson Education, Asia.
3. Irwin Miller and Marylees Miller, John E. Freund, (2006). Mathematical Statistics with Application, Seventh Edition, Pearson Education, Asia.
4. Sheldon Ross., (2007). Introduction to Probability Model, Ninth Edition, Academic Press, Indian Reprint.
5. Pillai R.S.N., and Bagavathi V., (2002). Statistics , S. Chand & Company Ltd, New Delhi.
6. Srivastava T.N., and ShailajaRego., (2012). 2e, Statistics for Management, McGraw Hill Education, New Delhi.
7. Dr.P.N.Arora, (2002). A foundation course statistics, S.Chand& Company Ltd, New Delhi.

Semester – V

19MMU503B BOOLEAN ALGEBRA AND AUTOMATA THEORY 8H – 6C

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Lattice and algebraic system, Basic properties of algebraic systems
- Finite Automata and regular languages
- The foundations of computability theory
- A strong background in reasoning about finite state automata and formal languages.
- Mathematical arguments using logical connectives and quantifiers.
- The various categories of languages and grammars in the Chomsky hierarchy.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand how lattices and Boolean algebra are used as tools and mathematical models in the study of networks.
2. Define various categories of automata.
3. Context free grammars and pushdown automata.
4. Understand Turing machine as a model of computation.
5. Define the various categories of Undecidability.
6. Knowledge about Post Correspondence Problem.

UNIT I
LATTICES AND BOOLEAN ALGEBRAS

Definition of ordered set with examples and basic properties of ordered sets - Maps between ordered sets - Duality principle - Lattices as ordered sets- Lattices as algebraic structures - sublattices - Products and homomorphisms - Modular and distributive lattices.
Boolean algebras: Boolean polynomials - Minimal forms of Boolean polynomials - Quinn-McCluskey method -Karnaugh diagrams - Switching circuits and applications of switching circuits.

UNIT II
THE CENTRAL CONCEPT OF AUTOMATA

Alphabets - String and languages. Finite Automata and Regular Languages: Deterministic and non-deterministic finite automata - Regular expressions - Regular languages and their relationship with finite automata - Pumping lemma and closure properties of regular languages.

UNIT III

CONTEXT FREE GRAMMARS AND PUSHDOWN AUTOMATA

Context free grammars (CFG) - Parse trees -ambiguities in grammars and languages - Pushdown automaton (PDA) and the language accepted by PDA - Deterministic PDA - Non- deterministic PDA - Properties of context free languages -Normal forms - Pumping lemma - Closure properties - Decision properties.

UNIT IV

TURING MACHINES

Turing machine as a model of computation - Programming with a TuringMachine - Variants of Turing machine and their equivalence.

UNIT V

UNDECIDABILITY

Recursively enumerable and recursive languages - Undecidable problems about
Turing machines: halting problem - Post Correspondence Problem and undecidability problems About CFGs.

SUGGESTED READINGS

1. Davey B A., and Priestley H. A., (2002).Introduction to Lattices and Order, Cambridge University Press, Cambridge.
2. Hopcroft J. E., Motwani R., and Ullman J.D., (2001). Introduction to Automata Theory, Languages, and Computation, Second Edition, Addison-Wesley.
3. Edgar G. Goodaire and Michael M. Parmenter, (2003).Discrete Mathematics with Graph Theory, Second Edition, Pearson Education P.Ltd., Singapore.
4. Rudolf Lidl and Günter Pilz, (2004).Applied Abstract Algebra, Second Edition , Undergraduate Texts in Mathematics, Springer (SIE).
5. Lewis H.R., Papadimitriou C.H.,and Papadimitriou C.,(2005). Elements of the Theory of Computation, Second Edition ,Prentice-Hall. New Delhi**.**
6. Anderson J.A., (2006). Automata Theory with Modern Applications, Cambridge University Press, Cambridge.

		Semester – V
19MMU504A	**NUMBER THEORY**	**6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Numbers, functions and its properties.
- Beauty and clarity of number theoretic functions.
- The challenging problems in number theory.
- How number theory is related to and used in cryptography.
- The concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization.
- The Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the Linear Diophantine equation,
2. Know about the Fermat's Little theorem.
3. Mastery in the Mobius Inversion formula.
4. Familiar with the concepts of primitive roots
5. Acquire knowledge of the Legendre symbol and its properties.
6. Acquire concepts of Public key encryption, RSA encryption and decryption

UNIT I
DIVISIBILITY, PRIMES AND CONGRUENCES
Linear Diophantine equation - Prime counting function - Statement of prime number theorem - Goldbach conjecture - Linear congruences - Complete set of residues - Chinese Remainder theorem.

UNIT II
FERMAT'S LITTLE THEOREM
Fermat's little theorem - Wilson's theorem. Number theoretic functions - Sum and number of divisors Totally multiplicative functions - Definition and properties of the Dirichlet product.

UNIT III

NUMBER THEORETIC FUNCTIONS

The Mobius Inversion formula - The greatest integer function - Euler's phi- function - Euler's theorem reduced set of residues- Some properties of Euler's phi-function.

UNIT IV

PRIMITIVE ROOTS AND INDICES

Order of an integer modulo n, primitive roots for primes- Composite numbers having primitive roots- Euler's criterion - The Legendre symbol and its properties.

UNIT V

THE QUADRATIC RECIPROCITY LAW

Quadratic reciprocity- Quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption -The equation $x^2 + y^2 = z^2$ - Fermat's Last theorem.

SUGGESTED READINGS

1. David M. Burton, (2007). Elementary Number Theory, Sixth Edition, Tata McGraw- Hill, Delhi.
2. Neville Robinns, (2007). Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi.
3. Neal Koblitz., (2006).A course in Number theory and cryptography,Second Edition, Hindustan Book Agency, New Delhi.

Semester – V

19MMU504B **PORTFOLIO OPTIMIZATION** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The changing domestic and global investment scenario in general and Indian capital market in particular with reference to availability of various financial products and operations of stock exchanges.
- The theory and practice of portfolio management.
- Important theories, techniques, regulations and certain advancements in theory of investment will be covered with an aim of helping the participants make sound investment decisions in the context of portfolio investment.
- The Risk-free assets and one fund theorem, efficient frontier.
- The various strategies followed by investment practitioners.
- The measure and the relationship between risk and return.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the various alternatives available for investment.
2. Learn to measure risk and return.
3. Find the relationship between risk and return.
4. Value the equities and bonds.
5. Gain knowledge of the various strategies followed by investment practitioners.
6. Study Index tracking optimization models.

UNIT I

Financial markets -Investment objectives - Measures of return and risk -Types of risks- Risk free Assets- Mutual funds -Portfolio of assets.

UNIT II

Expected risk and return of portfolio -Diversification -Mean-variance portfolio optimization- The Markowitz model and the two-fund theorem.

UNIT III

Risk-free assets and one fund theorem - Efficient frontier.Portfolios with short sales.

UNIT IV

Capital market theory. Capital assets pricing model - The capital market line – Beta of an asset- Beta of a portfolio -Securitymarket line.

UNIT V

Index tracking optimization models - Portfolio performance evaluation measures.

SUGGESTED READINGS

1. Reilly . F. K., Keith C. Brown., (2011). Investment Analysis and Portfolio Management, Tenth Edition, South-Western Publishers.
2. Markowitz H.M., (2000). Mean-Variance Analysis in Portfolio Choice and Capital Markets, Blackwell, New York.
3. M.J. Best., (2010). Portfolio Optimization, Chapman and Hall, CRC Press.
4. Luenberger. D.G., (2013).Investment Science, Second Edition., Oxford University Press.

Semester – VI

19MMU601A METRIC SPACES AND COMPLEX ANALYSIS 8H – 6C

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The theory of functions of a complex variable with examples.
- Metric spaces, Continuous mappings and Convergence of sequences and series.
- Techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication)
- Subsets of a metric space are open, closed, connected, bounded, totally bounded and/or compact.
- Function on a Complex number, and differentiability on complex functions.
- The Cauchy's Theorem, Cauchy's integral formula, Liouville's Theorem and Laurent's expansion.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the various properties of metric spaces
2. Definite continuous mappings - sequential criterion.
3. Understand the basic concepts of Riemann equations, sufficient conditions for differentiability.
4. Explore various properties of Analytic functions.
5. Understand the Contour integrals and its examples.
6. Apply the concept Liouville's theorem and the fundamental theorem of algebra.

UNIT I
METRIC SPACES

Definition and examples - Sequences in metric spaces - Cauchy sequences.
Complete Metric Spaces - Open and closed balls – neighbourhood - open set - interior of a set. Limit point of a set - closed set - Diameter of a set - Cantor's theorem – Subspaces - dense sets – separable spaces.

UNIT II
CONTINUOUS MAPPINGS

Continuous mappings - sequential criterion and other characterizations of continuity – Uniform Continuity – Homeomorphism - Contraction mappings - Banach Fixed point Theorem - Connectedness - connected subsets of R.

UNIT III

LIMITS

Limits - Limits involving the point at infinity - continuity. Properties of complex numbers – regions in the complex plane - functions of complex variable - mappings. Derivatives, differentiation formulas - Cauchy-Riemann equations, sufficient conditions for differentiability.

UNIT IV

ANALYTIC FUNCTIONS

Analytic functions - Examples of analytic functions - Exponential function - Logarithmic function - Trigonometric function - Derivatives of functions - Definite integrals of functions.

Contours: Contour integrals and its examples - Upper bounds for moduli of contour integrals - Cauchy- Goursat theorem - Cauchy integral formula.

UNIT V

CONVERGENCE

Liouville's theorem and the fundamental theorem of algebra.Convergence of sequences and series- Taylor series and its examples - Laurent series and its examples, absolute and uniform convergence of power series.

SUGGESTED READINGS

1. Kumaresan S., (2011). Topology of Metric Spaces, Second Edition.,Narosa Publishing House, New Delhi.
2. Simmons G.F., (2004).Introduction to Topology and Modern Analysis, McGraw-Hill, New Delhi.
3. James Ward Brown., and Ruel V. Churchill., (2009). Complex Variables and Applications, Eighth Edition., McGraw – Hill International Edition, New Delhi.
4. Joseph Bak., and Donald J. Newman., (2010). Complex Analysis, Second Edition., Undergraduate Texts in Mathematics, Springer-Verlag New York.

Semester – VI

19MMU601B RIEMANN INTEGRATION AND SERIES OF FUNCTIONS 8H – 6C

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The Riemann integration, Point wise and uniform convergence of sequence of functions and Series of functions.
- The concept of continuous functions and their bounded variation property.
- Difference between Riemann Integration and Riemann Stieltjes Integration of functions.
- Fundamental theorems of Calculus and Improper integrals.
- The concept of cauchy criterion for uniform convergence and Weierstrass M-Test.
- About pointwise and uniform convergence of sequence of functions.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Understand Riemann sum and definition of Riemann integral.
2. Convergence of Beta and Gamma functions
3. Know about Pointwise and uniform convergence of sequence of functions
4. Theorems on the continuity and derivability of the sum function of a series of functions.
5. Understand Cauchy criterion for uniform convergence and Weierstrass M-Test.
6. Limit superior and Limit inferior and integration of power series.

UNIT I

RIEMANN INTEGRATION

Riemann integration - inequalities of upper and lower sums - Riemann conditions of integrability - Riemann sum and definition of Riemann integral through Riemann sums - equivalence of two definitions- Riemann integrability of monotone and continuous functions, Properties of the Riemann integral.

UNIT II

CONTINUOUS FUNCTIONS

Definition and integrability of piecewise continuous and monotone functions - Intermediate Value theorem for Integrals - Fundamental theorems of Calculus - Improper integrals - Convergence of Beta and Gamma functions.

UNIT III

CONVERGENCE

Pointwise and uniform convergence of sequence of functions - Theorems on continuity - derivability and integrability of the limit function of a sequence of functions.

UNIT IV

SERIES OF FUNCTIONS

Series of functions - Theorems on the continuity and derivability of the sum function of a series of functions - Cauchy criterion for uniform convergence and Weierstrass M-Test.

UNIT V

LIMITS

Limit superior and Limit inferior - Power series - radius of convergence - Cauchy HadamardTheorem - Differentiation and integration of power series - Abel's Theorem - Weierstrass Approximation Theorem.

SUGGESTED READINGS

1. Ross K.A., (2004). Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint,
2. Bartle R.G ., Sherbert D.R., (2002). Introduction to Real Analysis, Third Edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore,
3. Charles G. Denlinger, (2011). Elements of Real Analysis, Jones & Bartlett (Student Edition)

Semester – VI

19MMU602A RING THEORY AND LINEAR ALGEBRA II **8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The behavior of polynomials and operators.
- The Rings and basic properties of rings and ideals.
- The concepts of unique factorization domains, Euclidean domains.
- The transpose of a linear transformation and its matrix in the dual basis.
- The Inner product spaces and norms, Gram-Schmidt orthogonalisation process.
- Least Squares Approximation and Spectral theorem.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Polynomial rings over commutative rings, dual spaces, dual basis, double dual, minimal solutions to systems of linear equations, normal and self-adjoint operators.
2. Understand the Divisibility in integral domains.
3. Study the transpose of a linear transformation and its matrix in the dual basis.
4. Know about the Inner product spaces and norms.
5. Study Least Squares Approximation, minimal solutions to systems of linear equations.
6. Know about the Orthogonal projections and Spectral theorem.

UNIT I

RINGS

Polynomial rings over commutative rings - Division algorithm and consequences - Principal ideal domains - Factorization of polynomials - Reducibility tests - Irreducibility tests - Eisenstein criterion - Unique factorization in Z[x]**.**

UNIT II

INTEGRAL DOMAINS

Divisibility in integral domains- Irreducibles – Primes - Unique factorization domains - Euclidean domains.

UNIT III

VECTOR SPACES

Dual spaces - Dual basis - Double dual - Transpose of a linear transformation and its matrix in the

dual basis - Annihilators - Eigen spaces of a linear operator - Diagonalizability - Invariant subspacesandCayley-Hamilton theorem - The minimal polynomial for a linear operator.

UNIT IV

INNER PRODUCT SPACES

Inner product spaces and norms - Gram-Schmidt orthogonalisation process - Orthogonal complements - Bessel's inequality - The adjoint of a linear operator.

UNIT V

OPERATORS

Least Squares Approximation - Minimal solutions to systems of linear equations - Normal and self - Adjoint operators - Orthogonal projections and Spectral theorem.

SUGGESTED READINGS

1. Fraleigh.J.B., (2004). A First Course in Abstract Algebra , Seventh Edition , Pearson Education Ltd, Singapore.
2. Stephen H. Friedberg., Arnold J. Insel., Lawrence E. Spence, (2004) .Linear Algebra, Fourth Edition., Prentice- Hall of India Pvt. Ltd., New Delhi.
3. S. Lang, (2005). Introduction to Linear Algebra, Second Edition., Springer.

Semester – VI

19MMU602B	**LINEAR PROGRAMMING**	**8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Fundamental concepts of duality, economic interpretation of dual constraints and game theory.
- The simplex method to solve small linear programming models by hand, given a basic feasible point.
- Formulation of a given simplified description of a suitable real-world problem as a linear programming model.
- Revised Simplex Method, Parametric Linear Programming, Integer Linear Programming: Branch and Bound Method, Cutting Plane Method.
- Mathematical Formulation of LPP, Solution of LPP: Graphical Method with special cases, Simplex Method, Big-M Method, Two Phase method. Special cases in simplex method, Duality theory, Dual Simplex algorithm.
- Solution of Transportation problem and Assignment Problems.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Formulate a LPP and solve it by simplex and graphical method. Also do post optimal analysis of the formulated problem or other application areas.
2. Understand the concepts of Duality, Primal Dual relationship.
3. Solve a Transportation and its types.
4. Analysis Assignment problem and its models.
5. Know the concept of game theory.
6. Study the games with mixed strategies, graphical solution procedure, linear programming solution of games.

UNIT I

LINEAR PROGRAMMING

Introduction to Linear Programming Problem – Graphical Linear Programming Solution- Theory of Simplex Method-Optimality and unboundedness-the Simplex algorithm –Simplex method in

tableau format- Introduction to artificial variables – two –phase method – Big –M method and their comparison.

UNIT II

PRIMAL DUAL PROBLEMS

Duality – Definition of the dual Problems-Formulation of the dual Problem-Primal Dual relationship: Review of simplex matrix Operations –Simplex tableau Layout-Optimal Dual Solution-Simplex Tableau computations. Economic interpretation of the dual: Economic Interpretation of Dual Variables-Economic Interpretation of Dual Constraints.

UNIT III

TRANSPORTATION METHOD

Definition of the Transportation model – Nontraditional Transportation model – The Transportation Algorithm: Determination of the Starting Solution-Northwest –corner method, Least – corner method, Vogel approximation method- Iterative Computations of the Transportation Algorithm.

UNIT IV

THE ASSIGNMENT MODEL

Introduction to Assignment model- Mathematical Formulation of Assignment model- Hungarian method for solving assignment problem –Simplex Explanation of the Hungarian method.

UNIT V

GAME THEORY

Formulation of two person zero games – Solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

SUGGESTED READINGS

1. Handy .A. Taha., (2007). Operations Research, Seventh edition, Prentice Hall of India Pvt Ltd, New Delhi .
2. Hillier F.S., and Lieberman G.J., (2009). Introduction to Operations Research, Ninth Edition, Tata McGraw Hill, Singapore.
3. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D.Sherali, (2004). Linear Programming and NetworkFlows, Second Edition, John Wiley and Sons, India.
4. Hadley G.,(2002). Linear Programming, Narosa Publishing House, New Delhi.

Semester – VI

19MMU603A **MATHEMATICAL MODELING** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basics concepts of mathematics modelling.
- Mathematical models of real-world systems, analyze them and make predictions about behavior of these systems.
- Modeling with a Differential Equations.
- Simulation Modeling and Discrete-Evvnt Simulation, Continuous Simulation, MonteCarlo simulation.
- Analytic methods of model fitting.
- How to construct a mathematical model of a given physical system and analyze it.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Know about the Modeling Change with Difference Equations.
2. Understand the basic concepts of Mathematical Models
3. Knowledge the Fitting Models to Data Graphically and experimental models.
4. Study the basic concepts of simulation models.
5. Study the Probabilistic Modeling with Discrete Systems
6. Understand the concepts of Sensitivity Analysis.

UNIT I

MODELING CHANGE

Modeling Change with Difference Equations-Approximating Change with Difference Equations-Solutions to Dynamical-Systems of Difference Equations.

UNIT II

THE MODELING PROCESS, PROPORTIONALITY, AND GEOMETRIC SIMILARITY

The Modeling Process, Proportionality, and Geometric Similarity: Mathematical Models-Modeling Using Proportionality- Modeling Using Geometric Similarity- Automobile Gasoline Mileage- Body Weight and Height, Strength and Agility.

UNIT III

MODEL FITTING

Fitting Models to Data Graphically- Analytic Methods of Model Fitting- Applying the Least-Squares Criterion- Choosing a Best Model.

Experimental Modeling: Harvesting in the Chesapeake Bay and Other One-Term Models- Smoothing: Low-Order Polynomial Models- Cubic Spline Models.

UNIT IV

SIMULATION MODELING

Simulating Deterministic Behavior-Area Under a Curve - Generating Random Numbers - Simulating Probabilistic Behavior - Inventory Model: Gasoline and Consumer Demand -Queuing Models.

UNIT V

DISCRETE PROBABILISTIC MODELING

Probabilistic Modeling with Discrete Systems- Modeling Component and System Reliability- Linear Regression- An Overview of Optimization Modeling- Linear Programming I: Geometric Solutions- Linear Programming II: Algebraic Solutions- Linear Programming III: The Simplex Method- Linear Programming IV: Sensitivity Analysis.

SUGGESTED READINGS

1. Shepley L. Ross, (2004). Differential Equations, Fourth Edition, John Wiley and Sons , New York**.(For Unit-I,II & III)**
2. Sneddon I., (2006). Elements of Partial Differential Equations, McGraw-Hill, International Edition, New York**..(For Unit-IV & V)**
3. TynMyint-U and LokenathDebnath, (2006).Linear Partial Differential Equation for Scientists and Engineers, Springer.
4. Frank R. Giordano, Maurice D. Weir and William P. Fox, (2003).A First Course in Mathematical Modeling, Thomson Learning, London and New York.

Semester – VI

19MMU603B **DIFFERENTIAL GEOMETRY** **6H – 4C**

Instruction Hours / week: L: 4 T: 2 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objective:

This course enables the students to learn

- To get introduced to the concept of a regular parameterized curve in n
- To Understand the concept of curvature of a space curve and signed curvature of a plane curve.
- To be able to understand the fundamental theorem for plane curves.
- To get introduced to the notion of Serret-Frenet frame for space curves and the
- Involutes and evolutes of space curves with the help of examples. To be able to compute the curvature and torsion of space curves.
- The Parallel propagation of vectors, Covariant and intrinsic derivatives

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the theory of space curves with examples.
2. Study the concept of parametric curves on surfaces.
3. Know about the torsion of a geodesic and geodesic curvature.
4. Study the Tensors of different type, Algebra of tensors and contraction.
5. Know about the Parallel propagation of vectors.
6. Understand Laplacian operators in tensor form.

UNIT I
THEORY OF SPACE CURVES

Space curves - Planer curves, Curvature, torsion and Serret-Frenet formulae - Osculating circles, Osculating circles and spheres - Existence of space curves - Evolutes and involutes of curves.

UNIT II
THEORY OF SURFACES

Parametric curves on surfaces - Direction coefficients -First and second Fundamental forms - Principal and Gaussian curvatures - Lines of curvature - Euler's theorem -
Rodrigue's formula - Conjugate and Asymptotic lines.

UNIT III

DEVELOPABLES

Developable associated with space curves and curves on surfaces – Minimal surfaces.

Geodesics: Canonical geodesic equations - Nature of geodesics on a surface of revolution - Clairaut's theorem. -Normal property of geodesics -Torsion of a geodesic - Geodesic curvature - Gauss-Bonnet theorem - Surfaces of constant curvature -Conformal mapping.Geodesic mapping- Tissot's theorem.

UNIT IV

TENSORS ALGEBRA

Summation convention and indicial notation - Coordinate transformation and Jacobian,

Contra-variant and Covariant vectors - Tensors of different type - Algebra of tensors and contraction - Metric tensor and 3-index Christoffel symbols.

UNIT V

TENSORS CALCULUS

Parallel propagation of vectors,Covariant and intrinsic derivatives - Curvature tensor and its properties - Curl, Divergence andLaplacian operators in tensor form - Physical components.

SUGGESTED READINGS

1.Willmore T.J., (2012). An Introduction to Differential Geometry, Dover Publications, New York.

2. B. O'Neill., (2006). Elementary Differential Geometry, 2nd Ed., Academic Press,New Delhi.

3. Weatherburn C.E., (2003). Differential Geometry of Three Dimensions, Cambridge University Press, Cambridge.

4. Struik D.J., (2012). Lectures on Classical Differential Geometry, 2nd Edition, Dover Publications, New York.

5. Lang S., (2001). Fundamentals of Differential Geometry, Springer, New York.

6. Spain B., (2003).Tensor Calculus: A Concise Course, Dover Publications, New York.

19MMU691	**PROJECT**	**Semester – VI** **8H – 6C**

Instruction Hours / week: L: 8 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours