Course Name: Bachelor of Science
Discipline: Mathematics
(For those who joined in June 2022 and after)
COURSE OBJECTIVES:

The syllabus for B.Sc. Mathematics degree under semester system has been designed on the basis of Choice Based Credit System, (CBCS) which will help the students to go for higher studies in any reputed institution all over India and to form a platform to prepare for any National level tests or any career development programs.

To enable the students to understand various applications of Mathematics in Real life as well as in any other allied subjects like Physics, Chemistry etc.

ELIGIBILITY FOR ADMISSION:

Candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Govt. of Tamil Nadu or any other Examinations accepted by the Syndicate as equivalent there to with Mathematics as one of the Subjects.

DURATION OF THE COURSE: Three Years

COURSE SCHEME:

Semester	Part	Subject	Hour	Credit	Int+Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of revision
I	Part I	Tamil	6	3	25+75=100		✔					✔					**U22PT11**	
	Part II	English	6	3	25+75=100				✔	✓		✓					**U22PE11**	
	Core 1	Theory of Equations and Trigonometry	5	4	25+75=100				✓	✓							**U22MAC11/** U3MAC11	No Change
	Core2	Calculus	5	4	25+75=100				✓	✓							**U22MAC12**	Revised 60%
	SBE 1	Applications of Calculus	2	2	25+75=100				✓					✓			**U22MAS11**	Revised 60%
	Allied 1	Mechanics, Properties of Matter and Sound / General Chemistry-I	4	3/3	25+75=100				✓					✓			**U22PHAX11/ U22CHAX11** U1PHA1X1/ U3CHA1X1	
	Allied 1 Lab	LAB: Physics Practical –I / Volumetric Analysis	2	-	--				✓					✓			---	
	Part IV SLC	Value Education	-	3	25+75=100							✓					**U22VE11**	
II	Part I	Tamil	6	3	25+75=100		✔					✔					**U22PT21**	
	Part II	English	6	3	25+75=100				✔	✓		✓					**U22PE21**	
	Core 3	Differential Equations	5	4	25+75=100				✓					✓			**U22MAC21**	Revised 100%
	Core4	Analytical Geometry 3D and Vector Calculus	5	4	25+75=100				✓					✓			**U22MAC22/** U3MAC22	No Change
	SBE 2	Applications of Vector Calculus	2	2	25+75=100				✓					✓			**U22MAS21**	Revised 25%
	Allied 2	Thermal Physics / General Chemistry-II	4	3/3	25+75=100				✓					✓			**U22PHAX21/ U22CHAX21**	

															U1PHA2X2/ U2CHA2X2	
Allied 2 Lab	LAB: Physics Practical –I / Volumetric Analysis	2	2	40+60=100				✓				✓			**U22PHAXP21/ U22CHAXP21/** U1PHA2PX/ U2CHA2PX1	
Part IV SLC	Environmental Studies	---	2	25+75=100								✓			**U22ES21**	

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education – Sports/YRC/RRC	3	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ **U22RR4**

Core1

Course Title:THEORY OF EQUATIONS AND TRIGONOMETRY	Total Hours: 75 Contact Hours per Week : 5
Course Code: U22MAC11/ U3MAC11	Total Credits: 4

Objectives:
- To develop skills of solving algebraic equations.
- To impart basic knowledge about hyperbolic functions and properties.

Course Outcomes
On completing this course, students can/are

Cos	CO Statements
CO1:	Capable of solving algebraic equations using the relations between the roots and coefficients.
CO2:	Get skills in transforming equations in one form into another.
CO3:	Capable of finding the solutions of numerical equations using Horner's method.
CO4:	Perform expansion of sinθ, cosθtanθ and power of sinθ and cosθ, in terms of functions of multiples of θ.
CO5:	Understand hyperbolic functions and logarithm of complex numbers.

Unit I [15 Hours]
Introduction-Remainder Theorem - Nature of roots - Relations between the roots and the coefficients of equations.
[Text Book 1 : Chapter 6 - § 1 to 11]

Unit II [15 Hours]
Symmetric function of the roots - Sum of powers of the roots of an equation - Transformations of equations : Reciprocal equations.
[Text Book 1 : Chapter 6 - § 12, 13, 15 - 15.1, 15.2, 15.3, 16 - 16.1, 16.2]

Unit III [15 Hours]
To increase or decrease the roots of a given equation by a given quantity - Division of polynomial by a binomial - Removal of terms - Horner's method.
[Text Book 1 : Chapter 6 - § 17, 18, 19, 30]

Unit IV [15 Hours]
Expansions of $\cos n\theta$ and $\sin n\theta$ - Expansion of $\tan n\theta$ in powers of $\tan \theta$ – Expansion of $\tan(A + B + C + \cdots)$ - Powers of sines and cosines of θ interms of functions of multiples of θ - Expansions of $\sin \theta \& \cos \theta$in a series of ascending powers of θ.
[Text Book 2 : Chapter III - § 1, 2, 3, 4, 5]

Unit V [15 Hours]
Hyperbolic functions : Definition - Relations between hyperbolic functions - Relation between hyperbolic functions and circular functions – Inverse hyperbolic functions – logarithms of complex quantities : Definition – Logarithm of $(x + iy)$- General value of logarithm of $(x + iy)$.
[Text Book 2 : Chapter IV - All Articles, Chapter 5 - § 5 – 5.1, 5.2]

Text Books :
1. T. K. ManicavachagamPillai, T. Natarajan& K. S. Ganapathy, Algebra - Volume 1, S. Viswanathan& Company, 2015.

2. S.Narayananand T. K. ManicavachagamPillay,Trigonometry (forB.Sc Mathematics Major), S. Viswanathan& Company, 2014.

Reference Books :
1. S. Arumugam, Algebra, Scitech Publishers, Chennai.
2. S. Arumugam, Trigonometry and Fourier Series,Scitech Publishers, Chennai.
3. S L Loney, Plane Trigonometry Part-1, Arihant Publications; Sixth edition, 2016.

Core 2

Course Title: Core2 – CALCULUS	Total Hours: 75
	Contact Hours per Week : 5
Course Code: U22MAC12	Total Credits: 4

Objectives:
- To introduce the nth derivative
- To get adequate knowledge about curvatures, evolute and envelopes.
- To enable the students to determine definite integrals.
- To derive some properties of Beta and Gamma functions

Course Outcomes:
On completing this course, students can/are

Cos	CO Statement
CO1:	Acquire knowledge about Differential Calculus, subfield of Calculus.
CO2:	Understand that the derivative of a function at a chosen input value describes the rate of change of the function near that input value.
CO3:	Learn about envelopes and evolutes and know that anevolute is the envelope of the normals to a curve.
CO4:	Find large number of industrial applications like the shape of cooking towers, mirrors used for long distance telescope.
CO5:	Get the skills of evaluating integrals by the method of substitution, integration of functions, integration of trigonometric functions, evaluation of definite integrals, reduction formula.
CO6:	Know the usage of special types of integrals namely Beta and Gamma integrals.

Unit I   Differentiation   [15 Hours]
n^{th} Derivative of some standard functions-Leibnitz's theorem.

Unit II   Applications of Differentiation   [15 Hours]
Polar curves-Pedal equation of a curve (p-r equation).

Unit III   Applications of Differentiation (Continued..)[15 Hours]
Curvature-Evolutes-Envelopes.

Unit IV   Evaluation of Integrals   [15 Hours]

Evaluation of Definite integrals-Integration by parts-Reduction formulae : $\int x^n e^{ax} dx$, $\int x^n \cos ax dx$, $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \cot^n x dx$, $\int \sec^n x dx$, $\int \cos ec^n x dx$,

$$\int \sin^m x \cos^n x\, dx \; , \; \int_{0}^{\frac{\pi}{2}} \sin^m x \cos^n x\, dx .$$

Unit V   Beta and Gamma functions   [15 Hours]

Beta and Gamma functions-Properties and results involving Beta and Gamma functions.

Text Book:

S. Arumugam& A. ThangapandiIssac, Calculus, New Gamma Publishing House, 2014.

Course contents:

Unit-I   Part-I Differential Calculus:Chapter-2 ,Sections 2.12 to 2.13

Unit-II   Part-I Differential Calculus:Chapter-3 ,Sections 3.2, 3.3

Unit-III   Part-I Differential Calculus:Chapter-3 ,Sections 3.4 to 3.6

Unit-IV   Part-II Integral Calculus:Chapter-2 ,Sections 2.6 to 2.8

Unit-V   Part-II Integral Calculus:Chapter-4 ,Section 4.1

Reference Books:

1. S. Narayanan, T.K. ManickavasagamPilay, Calculus – Volume I, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2015.
2. Khalil Ahamad, Text book of Differential Calculus ,Anamaya Publishers, New Delhi, 2004.
3. S. Narayanan, T.K. ManickavasagamPilay, Calculus – Volume II, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2004.

Course Title: SBE1-APPLICATIONS OF CALCULUS	Total Hours: 30
	Contact Hours per Week : 2
Course Code: U22MAS11	Total Credits: 2

Objectives:
The students can
- Find the maxima and minima of functions of two variables.
- Understand the concept of Jacobians
- Find the Taylor's series expansion of functions
- Evaluate double integrals
- Evaluate triple integrals

Course Outcomes:
    On completing this course, students can/are

Cos	CO Statement
CO1:	Able to apply the knowledge of differential calculus in finding the maximum/minimum values in the field of commerce, economics, science and engineering and other branches of

	arts.
CO2:	Understand the role of Jacobian in the context of integration
CO3:	Know the usefulness of series expansion in handling the functions by expanding the function in terms of series
CO4:	Much aware of how the concept of integration is very useful in getting the area and volume of the standard/random shapes which are essential in real life problems.

Unit I* [6 Hours]

Maxima and Minima of functions of two variables

Unit II [6 Hours]

Jacobians

Unit III [6 Hours]

Taylor's series expansion-Taylor's series expansion of some standard functions.

Unit IV* [6 Hours]

Double Integrals- evaluation of double integrals.

Unit V* [6 Hours]

Triple integrals – Change of variables in double and triple integrals.

NOTE: For all the units marked with *, one or more industrial visits may be organized bythe Faculty member(s). This will enable the students to understand more about the coursecontents in relation to real life.

Text Book:
S. Arumugam& A. ThangapandiIssac, Calculus, New Gamma Publishing House, 2014.
Course Contents :

Unit-I   Part-I Differential Calculus: Chapter-3,Section 3.7
Unit-II Part-I Differential Calculus:Chapter-3,Section 3.9
Unit-III Part-I Differential Calculus:Chapter-3,Section 3.13
Unit-IV Part-II Integral Calculus:Chapter-3,Sections 3.1 and 3.2
Unit-V Part-II Integral Calculus: Chapter-3,Sections 3.3 and 3.4

Reference Books:
1. S. Narayanan, T.K. ManickavasagamPilay, Calculus – Volume I, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2015
2. Khalil Ahamad, Text book of Differential Calculus, Anamaya Publishers, New Delhi, 2004.
3. S. Narayanan, T.K. ManickavasagamPilay, Calculus – Volume II, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2004.

Course Title :**Mechanics, Properties of Matter and Sound**	Total Hours : 4
Course Code : **U22PHAX11/** U1PHA1X1	Total Credits : 3

Course Outcomes

COs	CO Statement
CO1	Understanding the concepts of projectile motion
CO2	Knowing about friction and mechanics of rigid body
CO3	Understanding the concept of gravity and gravitation
CO4	Learning elastic properties of bodies
CO5	Understanding basic principles of sound

UNIT-I: **12 Hours**
        Impact of Elastic Bodies: Impulse of a force – Collision – Fundamental principles of impact – Oblique of a smooth sphere on a fixed smooth plane – Direct impact of two smooth spheres – Loss of K.E. due to direct impact of two smooth spheres – Oblique impact of two smooth spheres – Loss of K.E. due to oblique impact.
        Projectile Motion: Range on an inclined plane - Range and time of flight down an inclined plane - Two body problem and the reduced mass.

UNIT-II: **12 Hours**
        Friction: Introduction – Static, dynamic, rolling and limiting friction – Laws of static friction – Experimental method for determining coefficient of friction between two surfaces – Equilibrium of a rough inclined plane acted upon by an external force.
        Mechanics of a rigid body: Kinetic energy of a rotating body - Torque - Angular momentum – Relation between torque and angular momentum – Angular momentum of a system of particles - Conservation of angular momentum – some examples of conservation of angular momentum
        Moment of inertia – Introduction - Parallel axes theorem - Perpendicular axes theorem - Moment of inertia of a thin circular ring, circular disc, solid cylinder and solid sphere, hollow cylinder and sphere.

UNIT-III: **12 Hours**
        Gravitation: Newton's laws of Gravitation – Kepler's laws of planetary motion – Determination of G-Boy's method – Gravitational field and Gravitational strength - Variation of 'g' with latitude or rotation of the Earth - Variation of 'g' with altitude - Variation of 'g' with depth - Compound pendulum.
        Centre of Gravity: Introduction – Centre of gravity of a right solid cone **-** Centre of gravity of a solid hemisphere - Centre of gravity of a hollow hemisphere - Centre of gravity of a solid tetrahedron.

UNIT-IV: **12 Hours**
        Elasticity: Introduction - Different moduli of elasticity - Work done in twisting a wire - Torsional oscillation of a body - Rigidity modulus by torsion pendulum (Dynamic torsion method).
        Bending of beams: Definition - Expression for bending moment - Depression at the mid - point of a beam loaded at the middle - Uniform bending of a beam - Measurement of Young's modulus by bending of a beam.
        Viscosity: Introduction - Streamline and Turbulent flow - Poiseuille's formula for the flow of a liquid through a capillary tube - Corrections to Poiseuille's formula - Poiseuille's method for determining coefficient of viscosity of a liquid.

UNIT-V: **12 Hours**

Sound: Simple harmonic motion – Composition of two simple harmonic motions in a straight line - Composition of two simple harmonic motions of equal time periods at right angles – Superposition of harmonic waves of nearly the same frequency – Demonstration of beats – analytical treatment of beats – applications of the phenomenon of beats – Equation of a Plane Progressive waves – Properties of Progressive waves - Stationary waves – Properties of Stationary longitudinal waves – Melde's Experiment – AC frequency measurement using Sonometer

Book for study:
1. **Mechanics and Mathematical Physics** - R. Murugesan, S. Chand & Company Pvt. Ltd. 2016.
        Unit: I: 1.1 - 1.7, 2.1- 2.4
2. **Properties of Matter** - R. Murugesan, S. Chand & Company Pvt. Ltd. 2014.
        Unit: II: 22.1 – 22.5, 10.5 - 10.11, 7.1-7.10
        Unit: III: 6.1 - 6.4, 6.7- 6.10, 20.1 – 20.5
        Unit: IV: 1.1 - 1.2, 1.12-1.17, 1.19 – 1.21, 2.1-2.5
        Unit: V: 11.1, 12.1, 12.2, 13.1 - 13.4, 15.1, 15.2, 16.1 - 16.3, 17.1, 17.2

Books for Reference:
1. Mechanics by D.S. Mathur - S. Chand & Co. Reprint 2020.
2. Element of Properties of matter by D.S. Mathur - S. Chand & Co. Reprint 2016.
3. A Textbook of Sound by N. Subrahmanyam&Brijlal S. Chand & Co. Second Edition 2018.

Semester I – Part III – Allied Subject – GENERAL CHEMISTRY-I (for Physical Science)
(For those who joined from 2022 onwards)
Hours per week: 4   **Subject Code: U22CHAX11**/ U3CHA1X1   **Credits:** 3

Course Outcomes
    CO1 : Know the basics ideas about organic chemistry
    CO2 : Gain knowledge about the estimation of elements.
    CO3 : Able to know the details about periodic table and its periodic properties.
    CO4 : Learn the chemical equilibrium and its importance in industrial processes
    CO5 : Acquire knowledge about petroleum and petrochemical products.

Unit I: Basic concepts of organic chemistry   **12 Hours**
        Organic compounds – general properties and classification of organic compounds – functional groups – homologous series. IUPAC Nomenclature for simple acyclic compounds (Aliphatic compounds). Isomerism – types of structural isomers and stereoisomerism – R-S configuration of one asymmetric carbon and cis-trans isomerism with examples.

Unit II: Detection and estimation of elements   **12 Hours**
        Detection of nitrogen, halogens and sulphur – Estimation of carbon and hydrogen by Liebig's combustion method – estimation of nitrogen by Dumas method – estimation of halogens by Carius method.Determination of empirical and molecular formula – structural formula.Types of reactions – addition, elimination and substitution reactions.

Unit III: Periodic table, periodic properties and Hydrogen   **12 Hours**
Periodic table

Long form of the periodic table – general characteristics of groups and periods – classification of elements on the basis of electronic configuration.

Periodic properties

Atomic and ionic radii – electron affinity – ionization energy – electronegativity.

Hydrogen

Isotopes of hydrogen – preparation, properties and uses of Deuterium-ortho and para hydrogen.

Unit IV: Chemical equilibrium and Ionic equilibrium   **12 Hours**

Characteristic of Chemical equilibrium– Reversible reaction – Equilibrium law - Equilibrium constant- Equilibrium constant in terms of partial pressures- Kc and Kp relationship – Le Chatelier's principle-Synthesis of Ammonia by Haber process.

Acids, bases and salts – pH – Buffer solution – Henderson equation and its significance. Electrolyte: Classification and example – Ostwald's dilution law.

Unit V: Petroleum and fertilizers   **12 Hours**
Petroleum: Refining– composition and uses of petroleum fractions - thermal and catalytic cracking – Rating of fuels- octane number, cetane number - antiknock agents- unleaded petroleum – synthetic petrol.
Fertilizers: Role of micro and macro nutrients in plant growth - important manures – manufacture of urea - super phosphate - ammonium fertilizers, mixed fertilizers and biofertilizers.

Text Books
Unit- I & II
1. B.S.Bahl and ArunBahl, "Advanced Organic Chemistry" ,S.Chand& Co., Ltd., 2008.
Unit – III
1. B.R.Puri, L.R.Sharma and S.Pathania, "Principles of Inorganic Chemistry", Vishal publishing Co.., 33rd 2016.
Unit – IV
1. ArunBahl , B.S. Bahl and G.D.Tuli, "Essentials of Physical Chemistry", S.Chand& Co., Ltd., 2008.
Unit – V
1. Jain and Jain, "Engineering Chemistry",DhanpatRai Publishing Company, 16th Edition, 2015.
Reference books
Unit- I & II
1. M.K.Jain and S.C Sharama, "Modern Organic Chemistry", Vishal publishing Co.., 2016.
2. P.L.Soni and H.M.Chawla, "Textbook of Organic Chemistry", Sultan Chand &Sons, New Delhi, 2007.
Unit – III
1.R.D.Madanand SatyaPrakash's, "Modern Inorganic Chemistry", S.Chand& Co., Ltd., 2008.
2. P.L.Soni and Mohan Katiyal, "Textbook of Inorganic Chemistry", Sultan Chand & Sons, 2008.
Unit – IV
1. B.R.Puri, L.R.Sharma and S.Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 2004.

Unit – V

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, "A Text book of Organic Chemistry", 2nd revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.
2. B.N. Chakrabarty, "Industrial Chemistry" Oxford & IBH Oxford & IBH Publishing Company& Co, 1981.

e – Resources

1. https://www.angelo.edu/faculty/kboudrea/organic/IUPAC_Handout.pdf
2. http://kea.kar.nic.in/vikasana/bridge/chemistry/chap_18_ppt.pdf
3. https://www.vedantu.com/question-answer/liebigs-method-is-used-for-the-estimation-of-a-class-11-chemistry-cbse-5fa2fca467d44a22c23d2524
4. https://byjus.com/chemistry/types-of-organic-reactions/
5. https://www.entrancei.com/chemistry-doubts/what-are-the-characteristics-of-long-form-of-periodic-table
6. https://images.static-collegedunia.com/public/image/d83922a890f5659e7fd45217602af938.pdf
7. https://courses.lumenlearning.com/introchem/chapter/le-chateliers-principle/
8. http://www.idc-online.com/control1/Ostwalds_dilution_law.pdf
9. https://www.assignmentpoint.com/science/chemistry/bergius-process.html
10. http://www.productstewardship.eu/fileadmin/user_upload/user_upload_prodstew/documents/Booklet_nr_5_Production_of_Urea_and_Urea_Ammonium_Nitrate.pdf

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SEMESTER - II
CORE 3

Course Title: CORE 3-DIFFERENTIAL EQUATIONS	Total Hours: 75
	Contact Hours per Week : 5
Course Code: U22MAC21	Total Credits: 4

Objectives:

- To understand the basic terminologies in differential equations.
- To solve the differential equations of first order and higher degree.
- To facilitate a better understanding of some special methods of solving standard forms of partial differential equations

Course Outcomes:
On completing this course, students can/are

Cos	CO Statement
CO1:	Get skill of solving the ordinary differential equations, particularly homogeneous and non homogeneous equations.
CO2:	Able to find particular integrals of ordinary differential equations.
CO3:	Get exposure to the concepts of Charpit's method.
CO4:	Acquire the knowledge of solving partial differential equations.
CO5:	Be familiar with Lagrange's equation.

UNIT I: [15 Hours]
Introduction-Solutions of differential equations-Formation of differential equations- Equations of first order and of the first degree-Type A:Variableseparable- Type B: Homogeneous

equations- Type C: Non Homogeneous equations- Type D: Linear equations- Type E: Bernoulli's equation- Type F: Exact differential equations.

UNIT II: [15 Hours]

Equations of first order and Higher degree –Type A: Equations solvable for p- Type B: Equations solvable for x and y, Type C: Clairaut's form- Linear Equations with constant coefficients–Particular integrals for e^{ax}, sinax, cosax

UNIT III: [15 Hours]

Linear Equations with constant coefficients – Particular integrals for x^n, e^{ax}V - Linear Equations with variable Coefficients – Equations reducible to the linear Equations.

UNIT IV: [15 Hours]

Partial Differential Equations of the first order–Classification of integrals– Formation of partial differential equations–Lagrange's Method of solving the linear equations.

UNIT V: [15 Hours]

Partial Differential Equations of the first order– Special Methods–Standard forms (i) F(p,q)=0, ii) F(x,p,q)=0, F(y,p,q)=0, iii) $f_1(x,p) = f_2(y,q)$ iv) Clairaut'sform – Equations reducible to standard forms- Charpit's method.

TextBook:
S.Narayananand T.K.ManickavachagomPillay, DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS, S.Viswanathan(Printers &Publishers),Pvt.,Ltd;

Course Contents :
      Unit I: Chapter I: Sections 1,2,3. Chapter II: Sections 1,2,3,4,5,6.
      Unit II: Chapter IV: Sections 1,2,3. Chapter V: Sections 1, 2, 3, 4- 4.1,4.2 (a), (b).
      Unit III: Chapter V: Sections 4.2- (c), (d), 5 and 6.
      Unit IV: Chapter XII: Sections 1, 2, 3 and 4.
      Unit V: Chapter XII: Sections 5 and 6

Reference Book:
S. Arumugam ,ThangapandiIssac, DIFFERENTIAL EQUATIONS ANDAPPLICATIONS, New Gamma Publishing House.

Course Title: CORE 4 - ANALYTICAL GEOMETRY 3D AND VECTOR CALCULUS	Total Hours: 75 Contact Hours per Week: 5
Course Code: U22MAC22/ U3MAC22	Total Credits: 4

Objectives:
- To learn and visualize geometrical figures in three dimensional space.
- To study the differentiation of scalar valued and vector valued functions and their properties.

Course Outcomes:
On completing this course, students can/are

Cos	CO Statement
CO1:	Know various forms of equations of a plane in three dimensional space.
CO2:	Study vector differentiation and vector integration.
CO3:	Find the shortest distance between two skew lines.

CO4:	Understand the concept of Gradient, Curl and Divergene.
CO5:	Be able to evaluate line integrals and Surface integrals.

UNIT I: **[15 Hours]**
Rectangular Cartesian co-ordinates – Distance between two points - Direction cosines - The relation between direction cosines and direction ratios.

UNIT II: **[15 Hours]**
Planes – Equation of a plane – Angle between two planes – Angle bisectors of two planes.

UNIT III: **[15 Hours]**
Straight Lines – Equation of a straight line – a plane and a line – skew lines.

UNIT IV: **[15 Hours]**
Vector Differentiation: Introduction – Differentiation of vectors - Gradient.

UNIT V: **[15 Hours]**
Divergence and Curl.

Text Book :
S. Arumugam and A. Thangapandi Isaac, Analytical Geometry 3D & Vector calculus, New Gamma publishing House, 2011.

Course Contents :
        Chapter : 1 Sections : 1.1, 1.2 and 1.3.
        Chapter : 2 Sections : 2.1, 2.2, 2.3.
        Chapter :3 Sections : 3.1, 3.2.
        Chapter : 5 Sections : 5.1, 5.2, 5.3, 5.4.

Reference Books :
1. T. K. ManickavasagamPillay& T. Natarajan, A Text Book of Analytical geometry (Part II – Three dimenstions), S. Viswanathan Printers pvt. Ltd.
2. T. K. ManickavasagamPillay and others, Vector Calculus, S. Viswanathan Printers pvt. Ltd.

Course Title: SBE 2 - APPLICATIONS OF VECTOR CALCULUS	Total Hours: 30 Contact Hours per Week: 2
Course Code: U22MAS21	Total Credits: 2

Objectives:
- Tostudythe concept ofLineand Surfaceintegrals
- To know howtheyareconnectedwithdoubleand tripleintegrals usingthreefamous theorems

Course Outcomes:
On completing this course, students can/are

Cos	CO Statement
CO1:	Able to compute the double integrals much easier way by using line integrals
CO2:	Much aware of link between the double integrals and triple integrals and use a proper (easier) dimension to resolve the given problem.
CO3:	Able to apply the knowledge of line integrals or vector integrals to most of the physical problem but not limited branch of physics.

CO4:	Much flexible or well equipped in finding value of the double, triple integrals

Unit I   **[6 Hours]**
Lineintegrals–workdonebyaforce.

Unit II   **[6 Hours]**
Surface integrals.

Unit III   **[6 Hours]**
Green's Theorem in plane.

Unit IV   **[6 Hours]**
Stoke'sTheorem.

Unit V   **[6 Hours]**
GaussDivergenceTheorem.

TextBook :
       S.Arumugam   and   A.ThangapandiIsaac,Analytical   Geometry3D&Vector Calculus,New Gamma publishing House, 2011.
Course Contents :
     Chapter7 : Sections7.0,7.1, 7.2, 7.3.
ReferenceBook:
       T.K.Manickavasagam Pillay and others,Vector Calculus, S.Viswanathan Printers pvt.Ltd.

Course Title :**Thermal Physics**	Total Hours : 4
Course Code : **U22PHAX21/** U1PHA2X2	Total Credits : 3

Course Outcomes

COs	CO Statement
CO1	Learning fundamentals of heat
CO2	Knowing isothermal and adiabatic processes
CO3	Understanding the principles of conduction, convection and radiation
CO4	Getting knowledge about kinetic theory of gases
CO5	Understanding the principles of thermodynamics

UNIT: I   **12 Hours**
       Fundamentals of Heat : Concept of heat and temperature – Thermometry – Types of thermometers – Centigrade, Fahrenheit and Rankine scales – Relation between Celsius, Kelvin, Fahrenheit and Rankine scales of temperature – Liquid thermometers – Errors and correction in a mercury thermometer – Gas equation – Advantages of gas thermometer – Seeback effect – Peltier effect – Thomson effect – Thermo electric thermometer.

UNIT: II   **12 Hours**
       Isothermal and Adiabatic Process : Isothermal and adiabatic process – Gas equation during on Adiabatic process – Specific heat capacity - Dulong and Petit's law- Experiment to determine the specific heat capacity of a liquid – The two specific heat capacity of a gas – Difference between the two specific heat capacities – Joly's differential steam calorimeter for finding C_v – Regnault's method to find C_p.

UNIT: III   **12 Hours**

        Conduction, Convection and Radiation : Thermal conduction – Coefficient of thermal conductivity – Lee's disc method of determining the thermal conductivity of a bad conductor – Convection – Convection in the Atmosphere – Lapse rate – Stability of the atmosphere – Greenhouse effect - Thermal radiation – Energy distribution in black body radiation – Planck's law of radiation Wien's law – Rayleigh Jean's law – Stefan's law – Solar constant – Temperature of the sun.

UNIT: IV   **12 Hours**

        Kinetic theory of gases : Three states of mater – Concept of Ideal or perfect gas – Kinetic model – Expression for the pressure exerted by a gas – Degrees of freedom – Equipartition of energy – Atomicity of gases – Maxwell's law of distribution of molecular velocities – Experimental verification – Mean free path – Expression for the mean free path – Transport phenomena (Viscosity, Thermal conductivity and Diffusion)

UNIT: V   **12 Hours**

        Thermodynamics: Thermodynamics - Heat engine - Carnot's theorem - Derivation of efficiency - second law of thermodynamics - entropy - change of entropy in Carnot's cycle - Change of entropy in conversion of ice into steam - Joule-Kelvin effect - simple theory of Porous-plug experiment - adiabatic demagnetism - Superconductivity.

Book for study:
1. Heat Thermodynamics and Statistical Physics – Brijlal N. Subrahmanyam, P.S.Hemne
Unit-I   Chapter – 13 (**13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.9, 13.17, 13.18, 13.20, 13.23**)
Unit-IV   Chapter – 1 (**1.1, 1.2, 1.3, 1.4**)

2. Thermal Physics - R.Murugesan and Er. KiruthigaSivaprasath
Unit-II   Chapter – 13 (**13.1, 13.3, 13.4**)
                    Chapter – 1 (**1.3, 1.4, 1.9, 1.10, 1.11, 1.12, 1.13**)
Unit-III   Chapter – 4 (**4.1, 4.2, 4.4, 4.5, 4.8, 4.10, 4.11, 4.12, 4.16, 4.25, 4.29**)
                    Chapter – 11 (**11.1, 11.2, 11.3, 11.4, 11.5**)
Unit-IV   Chapter – 7 (**7.3, 7.4, 7.5, 7.6, 7.11, 7.12, 7.13, 7.14, 7.15, 7.16**)
Unit-V   Chapter – 2 (**2.1, 2.2,2.3, 2.4, 2.6, 2.11, 2.13, 2.14, 2.16**)
                    Chapter – 3 (**3.1, 3.2, 3.3, 3.11**)
       Chapter – 15 (**15.1**)
Book for Reference:
    1. Heat and Thermodynamics - Brijlal& N. Subrahmanyam, S. Chand & Co. 2004.

Part III – Allied Subject – GENERAL CHEMISTRY-II

Hours per week: 4   **Subject Code: U22CHAX21** /U2CHA2X2   **Credits:** 3
Course Outcomes:
    CO1: Understand the basics of gaseous state.
    CO2: Able to gain knowledge about colloids and its purification.
    CO3: Study the fundamental of nucleus and its application in radioactive isotope
    CO4: Adequate knowledge about reaction intermediates.
    CO5: Get the idea about the polymer and its applications.

Unit I: Gaseous state   **12 Hours**

Postulates of kinetic theory of gases – derivation of expression for pressure of an ideal gas on the basis of kinetic theory – deducing the basic gas laws. Deviation of real gases from ideal behavior – reasons for deviation. Derivation of van der Waals gas equation – explanation of behavior of real gases on the basis of van der Waals gas equation.Liquefaction of gases –Joule- Thomson effect – inversion temperature.

Unit II: Colloids   **12 Hours**

Colloidal state of matter – various types – classification.Sols – dialysis – electro osmosis- electrophorosis – stability of colloids – protective action – Hardy Schulze law – gold number. Emulsion: types of emulsion – emulsifier. Gels : Classification, preparation – application of colloids.

Unit III: Nuclear Chemistry   **12 Hours**

Composition of the nucleus – Nuclear forces – mass defect – binding energy – Nuclear stability – Soddy's displacement law – law of radioactive disintegration.Nuclear fission – fusion –theory – application – principle of atom bomb and hydrogen bomb. Application of radioactive isotopes – medicinal field – agriculture – industry – analytical field – carbon dating.

Unit IV: Basic concepts of organic chemistry   **12 Hours**

Nature of valency of carbon in organic compounds – tetrahedral arrangement of carbon – bond breaking and bond forming in organic reaction – homolytic and heterolytic cleavage –reaction intermediates – formation, stability and reactions of carbocation, carbanion and free radicals. Electrophiles and nucleophiles – definition and examples.Hybridization – definition – sp, sp^2 and sp^3 with examples.

Unit V: Polymers   **12 Hours**

Polymers – general characteristics – plastics, elastomers, and fibres – thermoplastics and thermosetting plastics - methods of polymerization – bulk, suspension and solution polymerization. Uses of polycarbonates, polyurethanes, epoxy resins and teflons.

Text Books

Unit – I & II
1. ArunBahl , B.S. Bahl and G.D.Tuli, "Essentials of Physical Chemistry", S.Chand& Co., Ltd., 2008.

Unit – III
1. B.R.Puri, L.R.Sharma and S.Pathania, "Principles of Inorganic Chemistry", Vishal publishing Co.., 33rd 2016.

Unit- IV
1. B.S.Bahl and ArunBahl, "Advanced Organic Chemistry" ,S.Chand& Co., Ltd., 2008.

Unit – V
1. Jain and Jain, "Engineering Chemistry",DhanpatRai Publishing Company, 16th Edition, 2015.

Reference Books

Unit – I & II
1. B.R.Puri, L.R.Sharma and S.Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 2004.

Unit – III
1.R.D.Madanand SatyaPrakash's, "Modern Inorganic Chemistry", S.Chand& Co., Ltd., 2008.

2. P.L.Soni and Mohan Katiyal, "Textbook of Inorganic Chemistry", Sultan Chand & Sons,
   2008.

Unit- IV
1. M.K.Jain and S.C Sharama, "Modern Organic Chemistry", Vishal publishing Co.., 2016.
2. P.L.Soni and H.M.Chawla, "Textbook of Organic Chemistry", Sultan Chand & Sons, New Delhi, 2007.

Unit – V
1. B.N. Chakrabarty, "Industrial Chemistry" Oxford & IBH Oxford & IBH Publishing Company& Co, 1981.

e – Resources
1. https://www.nios.ac.in/media/documents/313courseE/L6.pdf
2. http://fy.chalmers.se/~matic/cfsm/colloids.pdf
3. https://cyclotron.tamu.edu/reu-archive/2009projects/DukeTIPS_dibidad.pdf
4. https://byjus.com/chemistry/tetravalency-of-carbon/
5. https://www.nios.ac.in/media/documents/313courseE/L33A.pdf

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Course Title :**Lab: Physics Practical –I**	Total Hours : 2
Course Code : **U22PHAXP21/** U1PHA2PX	Total Credits : 2

Course Outcomes

COs	CO Statement
CO1	Learning to measure Young's modulus by bending methods
CO2	Verifying laws of vibration using sonometer
CO3	Determining the acceleration due to gravity using compound pendulum
CO4	Determining of Thermal conductivity of bad conductor
CO5	Learning to measure the Refractive index of glass Prism using Spectrometer

1. Determination of Young's Modulus by Uniform bending (Pin & Microscope) method.
2. Determination of Young's Modulus by Non-Uniform bending (Optic lever) method.
3. Determination of Young's Modulus by Cantilever depression method.
4. Determination of Rigidity Modulus and Moment of inertia using Torsion pendulum with loads.
5. Verification of laws of vibration using Sonometer.
6. Determination of Frequency of Tuning fork using Melde's String.
7. Determination of 'g' using Compound pendulum.
8. Determination of Thermal conductivity of bad conductor using Lee's disc method.
9. Determination of Refractive index of glass Prism using Spectrometer.
10. Determination of Resistance & Specific Resistance using Carey Foster Bridge.
11. Calibration of low range voltmeter using Potentiometer.
12. Calibration of Ammeter using Potentiometer.
13. Determination of f, R and μ using convex lens.
14. Determination of Coefficient of viscosity of a liquid using Stoke's method.

Part III– Allied Chemistry - LAB: VOLUMETRIC ANALYSIS

Hours per week: 2   **Subject Code: U22CHAXP21**/U2CHA2PX1   **Credits: 2**

(Exam to be conducted at the end of even Semester)

Course Outcome:

CO 1: Understand the solution, solute and solvent.

CO 2: Trained to prepare standard solutions.

CO 3: Know the Principles of volumetric analysis

CO 4: Determine the concentration of unknown solution.

CO 5: Able to know the applications of volumetric analysis

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of standard solution.

(a) Acidimetry and alkalimetry
  1. Titration between a strong acid and strong base.
  2. Titration between a strong acid and weak base.
  3. Titration between a weak acid and strong base.

(b) Permanganometry
  1. Titrations between potassium permanganate and oxalic acid, ferrous sulphateandferrousammoniumsulphate.

(c) Iodometry
  1. Titrations between sodium thiosulphate with potassium permanganate and potassium dichromate (demonstration only)

Course Name: Bachelor of Science

Discipline : Mathematics

Rules and regulations, Course Scheme and Scheme of Examinations

(For those who join in June 2018 and after)

Semester	Part	Subject	Hours	Credit	Int +Ext = Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of revision
III	Part I	Tamil / Hindi	6	3	25+75=100		✔					✔					U3PT3/ U1PH3	Revised/60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE3	Revised / 90%
	Core 5	Differential Equations	4	4	25+75=100				✓	✓							U3MAC3	Revised/10%
	Allied 3	Electricity & Electronics /General Chemistry - III	4	4	25+75=100				✓				✓				U2PHA3X3/ U2CHA3X3	Revised/10%/ No Change
	Allied 3 Lab	LAB: Physics Practical – II / Organic Qualitative Analysis	2	--	--				✓				✓				--	Revised/8% No Change
	Allied 4	Numerical Methods	6	4	25+75=100				✓	✓							U3MAA3	Revised/2%
	SBE 3	Applications of Differential Equations and Laplace Transforms	2	2	25+75=100				✓				✓				U3MAS3	Inter changed & Revised / 40%
IV	Part I	Tamil / Hindi	6	3	25+75=100		✔					✔					U2PT4/ U1PH4	Revised / 60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE4	Revised / 65%
	Core 6	Modern Algebra	6	4	25+75=100				✓	✓							U3MAC4	Revised/20%
	Allied 5	Optics, Spectroscopy & Modern Physics / General Chemistry - IV	4	4	25+75=100				✓				✓				U2PHA4X4/ U3CHA4X4	Revised/12%/ Revised/20%/
	Allied 5 Lab	LAB: Physics Practical – II / Organic Qualitative Analysis	2	2	40+60=100				✓				✓				U3PHA4PX/ U2CHA4PX	Revised/8%/ No Change
	Allied 6	Mechanics	4	4	25+75=100				✓				✓				U3MAA4	Inter Changed & Revised/10%
	Allied 6 Practical	LAB: Numerical Methods and Mechanics	2	**1**	40+60=100				✓				✓				U3MAA4P	Revised/50%

SEMESTER III
CORE : 5 DIFFERENTIAL EQUATIONS

Contact Hours per semester : 60   Subject Code : U3MAC3

Contact Hours per week : 4   Credit : 4

Objectives:

- To understand the basic terminologies in differential equations.
- To solve the differential equations of first order and higher degree.
- To facilitate a better understanding of some special methods of solving standard forms of partial differential equations

Unit : I (12 hours)

Introduction-Solutions of differential equations-Formation of differential equations-Equations of first order and of the first degree-Type A:Variables separables- Type B: Homogeneous equations- Type C: Non Homogeneous equations- Type D: Linear equations- Type E: Bernouilli's equation- Type F: Exact differential equations.

Unit: II (12 hours)

Equations of first order and Higher degree –Type A: Equations solvable for dy/dx - Type B: Equations solvable for x and y, Type C:Clairaut's form- Linear Equations with constant

coefficients–Particular integrals for e^{ax},sinax, cosax

Unit:III (12 hours)

Linear Equations with constant coefficients **–** Particular integrals for x^n, e^{ax}V- Linear Equations with variable Coefficients – Equations reducible to the linear Equations.

Unit :IV(12hours)

Partial Differential Equations of the first order–Classification of integrals– Formation of partial differential equations–Lagrange's Method of solving the linear equations.

Unit:V (12 hours)

Partial Differential Equations of the first order– Special Methods–Standard forms
(i)F(p,q)=0,   ii)F(x,p,q)=0,F(y,p,q)=0,   iii)f$_1$(x,p)=f$_2$(y,q)   iv)Clairaut'sform –Equations reducible to standard forms- Charpit's method

TextBook:

DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS   By S.Narayanan and
T.K.Manickavachagom Pillay, S.Viswanathan (Printers &Publishers),Pvt.,Ltd;

Unit   I: Chapter I: Sections 1,2,3. Chapter II: Sections 1,2,3,4,5,6.

Unit II: Chapter IV: Sections 1,2,3. Chapter V: Sections 1, 2, 3, 4- 4.1,4.2 (a), (b).

Unit III: Chapter V: Sections 4.2- (c), (d), 5 and 6.
Unit IV: Chapter XII: Sections 1, 2, 3 and 4.
Unit V: Chapter XII: Sections 5 and 6

Reference Book:
DIFFERENTIAL EQUATIONS ANDAPPLICATIONS By Dr. S. Arumugam , Thangapandi Issac, New Gamma Publishing House.

SEMESTER : III / V	ELECTRICITY & ELECTRONICS ALLIED PAPER	Hours : 4 Credit : 4

Subject Code : U2PHA3X3

Objectives
- To understand the fundamentals electrostatic parameters, Gauss's law and its application, Electric Potential, Capacitance and different types Capacitors.
- To learn about Kirchhoff's Laws and its applications, principle of potentiometer.
- To Study about the principle & working of galvanometer and LCR circuits.
- To Know about performance of transistor amplifiers and op-amps.
- To study the Study the principle of digital electronics and related concepts.

UNIT - I:
Electrostatics: Introduction – Coulomb's law – Electric Field – Electric Field due to a point charge – Flux of the electric field - Gauss's law – Proof – Applications: Electric field due to a uniformly charged sphere and an infinite plane sheet of charge – Field near a charged conducting cylinder – Coulomb's theorem – Electric potential: Potential difference – Potential at a point due to a point charge – Relation between electric field and electric potential – Capacitor: Introduction – Capacitance of parallel plate (with and without dielectric slab), spherical (outer sphere earthed) and cylindrical capacitors – Energy stored in a charged capacitor – Loss of energy due to sharing of charges.

UNIT - II:
Current Electricity: Kirchoff's laws – Application: Wheatstone's network – Sensitveness of bridge – Wheatstone's Network - Carey Foster's bridge – measurement of resistance and temperature coefficient of resistance – Principle of potentiometer – Calibration of ammeter and voltmeter (low range and high range) – measurement of resistance using potentiometer.

UNIT - III:
Magnetic effect of Electric current: Oersted's experiment – Force on a current carrying conductor - Torque on a current loop – Moving coil ballistic galvanometer (B.G) & Damping correction – expression for charge sensitiveness – comparison of e.m.f's and comparison of capacitors using B.G.

Alternating Current: Electromotive force generated in a coil rotating in a uniform magnetic field – R.M.S and mean value of alternating voltage and current – LCR circuit: impedances – Series and Parallel resonant circuits.

UNIT - IV:
Electronics: Formation of Junction diodes – Forward and reverse bias – Diode characteristics – Zener Diode and characteristics - LED – Bridge rectifier using junction diodes – π filter – Transistor: working (n-p-n) - characteristics (CE mode only) – Biasing – Voltage divider bias - Modulation (qualitative study) – Op-amp and its characteristics – CMRR – slew

rate - Virtual earth – Voltage amplifier (inverting and non-inverting mode) – Op-amp as adder and subtractor.

UNIT - V:

Number systems and codes: Decimal & Binary number system – binary to decimal and decimal to binary conversions – addition and subtraction of binary numbers – Logic circuits: Boolean algebra – De Morgan's theorem – OR, AND, NOT, NOR & NAND gates – NOR & NAND gates as universal building blocks – Ex-OR gate.

Text Book:

R.Murugeshan. *Electricity and Electronics*. Madurai: Annani Print Park; 2017.

Unit I	:	Chapter 1 – 1.1 – 1.19
Unit II	:	Chapter 2 – 2.1 – 2.6
Unit III	:	Chapter 3 – 3.1 – 3.3, 3.6 – 3.7, 3.9 - 3.17
Unit IV	:	Chapter 4 – 4.1 – 4.13, 4.16 - 4.25
Unit V	:	Chapter 5 – 5.1 – 5.18

Reference Books:

1. B.L.Theraja. *Solid State Electronics*. New Delhi: S. Chand Pvt Ltd; 2003.
2. Brijlal and Subramanyam. *Electricity and Magnetism* New Delhi: S. Chand Pvt Ltd; 2007.

General Chemistry - III

Hours per week: 4 Credits: 4   **Subject Code: U2CHA3X3**

Objectives:

- To know the basic requirements of chemical calculations.
- To acquire fundamental knowledge in bonding.
- To gain fundamental knowledge about adsorption, catalysis and co-ordination compounds.
- To study the principles water analysis.

Unit I – Basic chemical calculation   **(12 hours)**

Significant numbers – SI Units – Dimensions – Calculation of formula weight – understanding Avogadro number – Mole concept – Mole fraction of the solvent and solute – conversion of grams into moles and moles into grams – Stoichiometric equations. Methods of expressing concentration of the solution – Normality, molarity, molality and mole fraction – Calculations on principle of volumetric analysis.

Unit II – Theories of bonding   **(12 hours)**

Types of the chemical bonds: Ionic bond, covalent bond and coordinate bond – Valence bond theory – Valence Shell Electron Pair Repulsion theory – Shapes of CH_4, H_2O and NH_3 molecules – Molecular orbital theory – Bonding and antibonding orbital – MO theory applied to homonuclear molecules – H_2, N_2 and O_2– comparative study of VB and MO theories.

Unit III – Coordination compounds   **(12 hours)**

Introduction – nomenclature – Werner's theory – Coordination number and geometry – EAN rule – Valence Bond theory and Bonding in octahedral and tetrahedral complexes – Low spin and high spin complexes – Crystal field theory (octahedral and tetrahedral splitting only) .

Unit IV – Adsorption and catalysis   **(12 hours)**

Adsorption:

Definition of various terms (adsorption, absorption, adsorbent, adsorbate, sorption & desorption) – Difference between adsorption and absorption – Factors affecting the adsorption of

gases on solids – Physical and chemical adsorption – Adsorption isotherms (Langmuir & Freundlich basic ideas only) – Applications of adsorption.

Catalysis:

Definition – Characteristics of catalysis – Promoters and poisons – Enzyme catalysis – characteristics of enzyme catalysis (Michaelis-Menton equation only) – Acid-base catalysis and autocatalysis – Applications of catalysis.

Unit V – Water treatment   **(12 hours)**

Water quality analysis – Chemical and physical analysis of water quality parameters - Standards prescribed for water quality by WHO and Indian standards – Sea water as a source of drinking water.

Sewage treatment

Sewage –Objectives of sewage treatment – General purification reaction: aerobic and anaerobic process – Methods of sewage disposal (Bio chemical oxidation, chemical precipitation and chlorination process) – Sludge disposal (septic tank treatment and sludge digestion).

Reference Books

Unit-I
1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

Unit-II
1. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.
2. R. Gopalan Textbook of Inorganic Chemistry, Universities Press Pvt. Ltd., 2012.
3. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
4. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.

Unit-III
1. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.
2. R. Gopalan Textbook of Inorganic Chemistry, Universities Press Pvt. Ltd., 2012.
3. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
4. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.

Unit-IV
1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand & Co., 2004.
2. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

Unit-V
1. A.K.De, Environmental Chemistry (seventh edition), New Age International Publishers NewDelhi, 2010.
2. M.M.Uppal, A Text book of Engineering Chemistry, Khanna Publishers, NewDelhi1988.

ALLIED 4
NUMERICAL METHODS

Contact Hours per semester : 90   Subject Code : U3MAA3

Contact Hours per week : 6   Credit : 4

Objectives:
- Understanding the distinction between accuracy and precision.
- Learning how to quantify error.
- Understanding how to write forward, backward and centered finite- difference approximations of first and second derivatives

Unit I: (18 hours)
Numerical solution of Algebraic and Transcendental equations – Iteration method – Newton's method - Method of false positions – Solution of Simultaneous linear equations – Gauss method - Gauss' Jordan method – Iteration method – Gauss seidel iteraton method.

Unit II: (18 hours)
Finite differences – Forward difference and Backward differences – Finite differences – operators – Relations – Properties – Finding missing terms – Inverse operators – Factorial Notations.

Unit III: (18 hours)

Interpolation: Newton's forward and backward formula – Central difference formulae: Gauss formulae – Stirling formula – Bessel formula – Laplace Everrert's formula - Divided differences and properties – Newton's divided difference formula – Lagrange formula – Inverse interpolation using Lagrange formula - Simple problems

Unit IV: (18 hours)
Numerical differentiation – Finding the first and second derivatives – Maximum and minimum values of a function for a given data.

Unit V: (18 hours)
Numerical Integration – Newton-cote's formula – Trapezoidal rule – Simpson's one third rule – Simpson's three eigth rule – Weddle's rule- Romberg Method.

Text Book*:*
NUMERICAL METHODS, 2nd Editionby S.Arumugam, A.Thangapandi Isaac, A.Somasundaram, Scitech publications
Unit I: Chapter 3: Sections 3.2.3.4, 3.5; Chapter 4: Sections 4.1, 4.3, 4.4, 4.7, 4.8
Unit II: Chapter 6: Sections 6.1, 6.2
 Unit III: Chapter 7: Sections 7.1 to 7.6
Unit IV: Chapter 8: Sections 8.1 to 8.4
Unit V: Chapter 8: Section 8.5.

Reference Books:
1. Numerical methods in Science and Engineering by DR.M.K. Venkataraman
2. Numerical Methods by Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr. K. Gunavathi, 1st Edition S.Chand company.

(SBE3)
APPLICATIONS OF DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Contact Hours per semester : 30   Subject Code :U3MAS3

Contact Hours per week : 2   Credit : 2

Objectives:

- To solve the real life problems using differential equations
- To understand and apply the Laplace transform techniques in solving differential equations.

Unit I : (6 hours)

Applications of first order equations – Growth and Decay and Chemical reactions– Flow of water from an orifice- Falling bodies and other rate problems.

Unit II : (6 hours)

Applications of first order equations – The Brachistochrone – F e r m a t   a n d   B e r n o u l l i (Tautochronous property) - Simple Electric circuits.

Unit III: (6 hours)

Newton's law of Gravitation and the motion of planets - Central force - Central gravitational forces - Kepler's III law.

Unit IV: (6 hours)

The Laplace transform – Results- Laplace transform of periodic functions - some general theorems – simple problems.

Unit V : (6 hours)

Inverse transforms – Solutions of ordinary differential equations with constant coefficients – system of differential equations– simple problems.

Text Book:

DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS,

S.Narayanan and T.K.Manickavachagom Pillay,S.Viswanathan (Printers &Publishers), Pvt. Ltd.

Unit   I: Chapter III: Sections 1,2 and 3.

Unit II: Chapter III: Sections 4,5 and 6.

Unit III: Chapter V: Section 8

Unit IV: Chapter IX: Sections 1,2,3,4 and5.

Unit V: Chapter IX: Sections 6,7,8 and 9.

Reference Book:

DIFFERENTIAL EQUATIONS AND APPLICATIONS, S. Arumugam and Thangapandi Issac, New Gamma Publishing

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IV SEMESTER
CORE: 6 MODERN ALGEBRA

Contact Hours per semester : 90   Subject Code : U3MAC4

Contact Hours per week : 6   Credit : 4

Objectives:
- To know about the properties of groups, subgroups, normal subgroups.
- To know about homomorphism ,isomorphism of groups.
- To learn about rings, sub rings, characteristic of a ring and ideals.

UNIT I: (18 hours)

Subgroups – Cyclic groups – Order of an element.

UNIT II: (18 hours)

Cosets and Lagrange's Theorem – Normal subgroups and Quotient groups.

UNIT III: (18 hours)

Isomorphism – Homomorphism of groups.

UNIT IV: (18 hours)

Elementary properties of rings –Isomorphism between rings–types of Rings – Characteristic of a ring

UNIT V : (18 hours)

Subrings – Ideals – Quotient rings – Maximal and prime ideals – Homomorphism of rings.

Text Book :

Modern Algebra by Dr. S. Arumugam, A. Thanga Pandi Isaac. Publishers: Scitech publications (India) Pvt. Ltd.,

Unit I : 3.5 , 3.6 and 3.7

Unit II : 3.8 and 3.9

Unit III: 3.10 and 3.11

Unit IV: 4.2, 4.3, 4.4, 4.5

Unit V : 4.6, 4.7, 4.8, 4.9, 4.10

Reference Book:

Modern Algebra Volume I and Volume II by S. Narayanan, T. K. Manickavachagom Pillay Publishers : S. Viswanathan (Printers & Publishers), PVT., LTD.

SEMESTER : IV / VI	OPTICS, SPECTROSCOPY & MODERN PHYSICS ALLIED PAPER	Hours : 4 Credit : 4

Subject Code : U2PHA4X4

Objectives
- To understand the basics of geometrical and physical optics.
- To Study about the different technique in spectroscopy and photoelectricity.
- To Get basic knowledge about quantum physics
- To Understand the concept of relativity

UNIT - I:

Geometrical Optics: Deviation produced by thin lens – Focal length of two thin lenses in and out of contact – Definition of Cardinal points and respective planes – Prism: Refraction – Dispersion - Dispersive power – Combination of thin prisms to produce (a) deviation without dispersion and (b) dispersion without deviation – Direct vision spectroscope – Chromatic

aberration in lenses and its removal – Spherical aberration in lenses and its removal – Theory of primary and secondary rainbows.

UNIT - II:

Interference and Diffraction: Introduction - Interference in thin films – production of colours in thin films - Airwedge – Newton's rings (Reflected beam only) – Determination of wavelength – Jamin's interferometer – Principle and use.

Diffraction: Introduction - Theory of plane transmission grating– Experiment to determine wavelength (Normal incidence only).

UNIT - III:

Polarisation and Fiber Optics: Polarisation of light - Double refraction – Huygen's Theory in uniaxial crystals - Nicol prism – QWP and HWP – Optic activity – Biot's laws – Specific rotatory power – Laurent's Half shade polarimeter – Determination of specific rotatory power – Fibre optics: Introduction, Construction – Light propagation in fibres – Fibre optic communication systems.

UNIT - IV:

Spectroscopy, Quantum theory and Photoelectricity: Infrared spectroscopy – properties, sources, detectors and uses – Ultraviolet spectroscopy – properties, sources, detectors and uses – Quantum theory: Planck's quantum theory – Raman effect – discovery - experimental study (Wood's apparatus) – characteristics of Raman lines – Quantum theory of Raman effect - Applications – Photoelectricity – Introduction – Experimental investigations on Photoelectric effect - Laws of photoelectric emission – Einstein equations – Photo electric cells: Photo emissive, photo conductive and photo voltaic cells - Applications.

UNIT - V:

Wave nature of matter and Relativity: Introduction - De Broglie's theory - electron diffraction – G.P.Thomson experiment – Michelson Morley experiment – Significance of negative results – Postulates of special theory of relativity – Lorentz transformation equations (no derivation) – Length contraction – Time dilation – Variation of mass with velocity – Mass-energy relation (simple derivation).

Text Book:
1.   R.Murugeshan. *Optics, Spectroscopy and Modern Physics* Madurai: Annani Print Park; 2017.

Unit I	:	Chapter 1 – 1.1 – 1.14, 1.17 – 1.18, 1.20 - 1.24
Unit II	:	Chapter 2 – 2.1 – 2.10
Unit III	:	Chapter 3 – 3.1 – 3.15
Unit IV	:	Chapter 4 – 4.1 – 4.14
Unit V	:	Chapter 5 – 5.1 – 5.11

Reference Books:
Brijlal and N.Subramanyam. *A Text Book of Optics*. New Delhi: S.Chand Pvt Ltd; 2002.

General Chemistry - IV
Hours per week: 4   **Credits:4**   **Subject Code: U3CHA4X4**
Objectives:
   • To study the basics of chemical equilibrium.
   • To acquire basic idea about drugs.
   • To gain knowledge about the chromatographic techniques.

- To understand the role of bio-organic materials.

Unit I – Chemical Kinetics **(12 hours)**

Introduction – rate of reaction – rate law - rate constant - rate equation – order and molecularity of a reaction. Derivation of first order rate constant – Definition and Examples of Pseudounimolecular reactions (Inversion of cane sugar and hydrolysis of ester by acid). Second, third and zero order reactions – examples – half life period (no derivation required).

Unit-II- Drugs **(12 hours)**

Chemotherapy –Anaesthetics – General anaesthetics and local anasethetics (definition and example only). Sulpha drugs (Sulphonamides) - Synthesis and applications of sulpha drugs (sulphanilamide, sulphapyridine, sulphathiazole and sulphadiazine) – Mode of action of sulpha drugs. Antibiotics: Penicillin –Streptomycin- Chloramphenicol (chloromycetin) – Structure and mode of action of these drugs (synthesis not required).

Unit III – Chromatography **(12 hours)**

Basic principles of common types of chromatography – Paper chromatography – Thin layer chromatography – Column chromatography – Ion exchange chromatography. Applications of each techniques.

Unit IV – Proteins, Nucleic acids, Hormones and Vitamins **(12 hours)**

Definition – Classification of proteins – Colour reaction of proteins – Nucleic acids – nucleoside – nucleotides and general structure of DNA. Hormones – Classification – structure of some sex hormones – oestrone and progesterone. Vitamins – Classification of vitamins – Sources and deficiency diseases of vitamins A, B_1, C, D, E and K (structure not required).

Unit V – Chemistry of a few useful compounds **(12 hours)**

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2, Bleaching powder, Phenyl, Talcum powder, Shampoo, Shave lotion, Soaps and Detergents.

Reference Books
Unit-I
1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand & Co., 2004.
2. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

Unit-II
1. B.S.Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,16th edition, 2002.
2. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Textbook of Organic Chemistry, 3rdrevised edition, 2006.
3. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi,2007.

Unit-III
1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
2. B.K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House 23rd Edition, 2004.

Unit-IV
1. S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co. Ltd., 2008.

2. K.S.Tewari N.K.Vishnol and S.N. Mehrotra A Text book of Organic Chemistry, 3rd revised edition, 2006.
3. Jaya shree Ghosh, Fundamental Concept of Applied Chemistry S.Chand & Company LTD, 2008.

Unit-V

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
3. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.
4. P.K.Chattopadhyay, Modern Technology of Soaps, Detergents and Toiletries, 2nd edition, 2005.
5. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 6th edition, 1994.

SEMESTER : IV	LAB: PHYSICS PRACTICAL –II ALLIED LAB	Hours : 2 Credit : 2

Subject Code : U3PHA4PX

1. Determination of number of lines per meter of the grating (N) and wavelength of prominent lines of the mercury spectrum (λ) using Spectrometer.
2. Determination of dispersive power of a prism using Spectrometer
3. Determination of Radius of curvature of convex lens using Newton's rings.
4. Determination of Thickness of hair using Air wedge
5. Determine of Self inductance of the coil by LCR Series resonance.
6. Determine of Self inductance of the coil by LCR Parallel resonance.
7. Comparison of Capacitances of Capacitors using De Sauty's Bridge.
8. Construction of Logic gates – AND, OR, NOT using discrete components.
9. Construction of Logic gates – NAND, NOR using discrete components.
10. Design and construction of Bridge rectifier.
11. V-I Characteristics of Zener diode.
12. Static characteristics of Transistor - CE mode.
13. Verification of De Morgan's laws
14. Construction of AND, OR, NOT using NAND as universal building block.

Part III – LAB: Organic Qualitative Analysis

Hours per week: 2　　　　　　**Credits: 2**　　　　　　**Subject Code: U2CHA4PX**
Objective:
 • To gain fundamental knowledge about organic analysis
Organic analysis
　　　　Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of solid derivative / colour reaction – acids, phenols, aldehydes, ketones, esters, nitro compounds, primary amines, amides, anilides, aliphatic diamide and monosaccharides.

ALLIED 6 – MECHANICS

Contact Hours per semester : 60   Subject Code : U3MAA4

Contact Hours per week : 4   Credit : 4

Objectives:

- To know the concepts of forces and resolution of forces and its applications
- To acquire knowledge in Dynamics

Unit I: Forces Acting at a Point (12 hours)

Resultant and components – Parallelogram law of forces – Analytical expression of forces acting at a point – Triangle of forces and its converse – Lami's theorem – Resolution of forces – Theorem on resolved parts – Resultant of any number of coplanar forces – condition for equilibrium of forces.

Unit II: Parallel Forces and Moments (12 hours)

Resultant of two like and unlike parallel forces acting on a rigid body – Resultant of number of parallel forces acting on a rigid body – Conditions of equilibrium of three coplanar parallel forces –Moment of a force –Varigon's theorem -Moment of a force about an axis

Unit III: Friction (12 hours)

Friction: Statical, dynamical and limiting friction – Equilibrium of a particle on a rough inclined plane – Equilibrium of a body on a rough inclined plane under a force parallel to the plane - Equilibrium of a body on a rough inclined plane under any force – Problems on Friction (upto problem number 9)

Unit IV: Projectiles (12 hours)

Definitions – Two fundamental Principles – Path of a Projectile – Characteristics of the motion of a projectile – Horizontal projection of a particle – Two directions of projections – velocity of the projectile – Range on an inclined plane – Greatest distance of the projectile from the inclined plane-Time of flight – Maximum range on an inclined plane

Unit V: Collision of elastic bodies (12 hours)

Fundamental Laws of Impact – Newton's Experimental Law – Impact of a smooth sphere on a fixed smooth plane – Direct impact of two smooth spheres – Loss of kinetic energy due to direct impact of two smooth spheres – Oblique impact of two smooth spheres – Loss of kinetic energy due to oblique impact of two smooth spheres.

TEXT BOOKS:

1. M. K. Venkataraman, STATICS, Agasthiar Publications, 2007 (for units I to III)
2. M. K. Venkataraman, DYNAMICS, Agasthiar Publications, 2009 (for units IV to V)

       Text Book 1
       Unit   I: Chapter II : Sections 1 to 16
       Unit II: Chapter III: Sections 1 to 14
       Unit III: Chapter VII: Sections 1 to 13
       Text Book 2
       Unit IV: Chapter VI: Sections 6.1 to 6.15
       Unit V: Chapter VIII: Sections 8.1 to 8.8

REFERENCE BOOK:

P. Duraipandian, MECHANICS

ALLIED 6 PRACTICAL LAB: NUMERICAL METHODS AND MECHANICS

(Examination to be conducted at the end of 4th semester)

Contact Hours per semester : 30   Subject Code : U3MAA4P

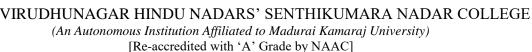Contact Hours per week : 2   Credit : 1

Objectives:

- To develop the skills of the students to solve computationally large problems using electronic tools in Numerical Methods and Mechanics

1. Algebraic and Transcendental equations
2. Simultaneous equations
3. Interpolation: Forward and Backward formulae
4. Central difference formulae
5. Interpolation for unequal intervals and inverse interpolation
6. Numerical Differentiation
7. Numerical Integration
8. Resultant and Equilibrium of forces
9. Application of Varigon's theorem on Moments
10. Equilibrium of a rigid body involving friction (sliding problems)
11. Characteristics of a projectile (Range, Maximum height, velocity, direction)
12. Direct and Oblique impact

Course Name: Bachelor of Science
Discipline   : Mathematics
(Those who join in 2018 and after)

Semester	Part	Subject	Hour	Credit	Int+Ext= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of revision 2019-2020
V	Core 7	Graph Theory and its Applications	5	4	25+75=100				✔	✔				✔			U2MAC51	No Change
	Core 8	Linear Algebra and Matrices	5	4	25+75=100				✔	✔				✔			U2MAC52	No Change
	Core 9	Real Analysis	5	4	25+75=100				✔	✔				✔			U3MAC53	Revised / 10%
	Allied 7	Sequences and Series	6	5	25+75=100				✔	✔				✔			U3MAA51	New
	Elective 1	Linear Programming	5	5	25+75=100				✔				✔	✔			U3MAE51	Interchanged / Revised / 50%
	SBE - 4	Employability Skills	2	2	25+75=100											✔	U1PS51	No Change
	NME - 1	Fundamentals of Mathematics	2	2	25+75=100				✔	✔						✔	U3MAN51	No Change
VI	Core 10	Complex analysis	6	5	25+75=100				✔	✔				✔			U2MAC61	No Change
	Core 11	Statistics	6	5	25+75=100				✔	✔				✔			U3MAC62	Interchanged / Revised / 50%
	Core 12	Operations Research	6	5	25+75=100				✔				✔	✔			U2MAC63	Revised / 10%
	Allied 8	Project	6	5	100+0=100				✔				✔			✔	U1MA6PR	New
	SBE - 5	Transformation Techniques	2	2	25+75=100				✔	✔						✔	U3MAS61	Revised / 40%
	SBE - 6	Random Process	2	2	25+75=100				✔				✔			✔	U2MAS62	No Change
	NME - 2	Statistics and Operations Research	2	2	25+75=100				✔				✔			✔	U2MAN61	Revised / 20%

Self Learning Course:

Subject	Credit	Ext =Tot	Subject Code
Advanced Programming Techniques	5	100 = 100	U1MASL51

SEMESTER V
GRAPH THEORY AND ITS APPLICATIONS

Credits: 4   **Subject Code : U2MAC51**
Contact Hours: 5/week   **Contact Hours: 75 / Semester**

OBJECTIVES:
  i) To understand the concepts of graph theory.
COURSE OUTCOMES :
  In this course the students will
  CO1: Gain the knowledge & the basic concepts of graph theory.
  CO2: Master the ways & solving real life problems using graph models.
  CO3: Develop the ability to apply various graph concepts in solving the challenging
    problems in real life.
  CO4: Possess the Knowledge & various important conjectures and established
    theorems in graph theory.

UNIT –I : Graphs
Definition and examples – Degrees- Subgraphs- Isomorphism-Independent sets and
Coverings-Matrices- Operations on graphs.   (15hrs)

UNIT – II: Connectedness, Eulerian and Hamiltonian graphs
Walks-Trails and Paths-Connectedness and Components-Connectivity-Eulerian graphs-
Hamiltonian graphs.   (15hrs)

UNIT –III : Tree
Characterisation of trees-Centre of a tree.   (15hrs)

UNIT –IV :Planarity and Matching
Matchings - Matchings in bipartite graphs- Definition and properties-Euler's formula.
                                                                   (15hrs)

UNIT – V: Colorability
Chromatic number and chromatic index-The five colour theorem -Chromatic polynomials-
Definition and basic properties.   (15hrs)

TEXT BOOKS:
S.Arumugam and S.Ramachandran, Invitation to graph theory, Scitech publications,
Chennai(2001)
    UNIT I:Sections 2.1-2.4, 2.6-2.9
    UNIT II: Sections 4.1,4.2, 4.4, 5.1, 5.2

UNIT III: Sections6.1, 6.2,
UNIT IV: Sections 7.1,7.2, 8.1
UNIT V: Sections 9.1,9.2, 9.4

REFERENCE BOOKS:
1) **S.A.Choudum,** A first course in graph theory, Macmillan India Ltd, New Delhi(1987).
2) **K.R.Parthasarathy,** Basic graph theory, Tata McGraw.Hill Publishing Co.Ltd NewDelhi (1994).

LINEAR ALGEBRA AND MATRICES
Credits: 4   **Subject code : U2MAC52**
Contact Hours: 5/week   **Contact Hours: 75 / Semester**

Objectives:
- To introduce the basic concepts of Vector spaces and linear transformations.
- To introduce the concept of Matrices and its eigen values; eigen vectors and its basic properties

COURSE OUTCOMES :
In this course the students will
CO1: Gain knowledge about the basic concepts of vector spaces and linear transformations.
CO2: Know the relationship between matrices and linear transformations.
CO3: Become familiar with the rank of the matrices.
CO4: Have thorough acquaintance with eigen values and eigen vectors.

UNIT-I :-
Introduction on vector spaces - Definitions – Subspaces - Linear Transformations – Kernel– Span of a set – linear span.   **(15 hours)**

UNIT- II: -
Basic concepts of linear independence - Theorems – Basis & Dimension – Maximal linear independent set - rank and nullity – singular linear transformations.   **(15 hours)**

UNIT – III: -
Inner Product Space – norm – orthogonality – orthogonal complements. **(15 hours)**

UNIT – IV: - (15 hours)
Theory of matrices – Algebra of matrices - Elementary transformations - rank – simultaneous linear equations – Cayley Hamilton theorems.   **(15 hours)**

UNIT – V:
Eigen values and eigen vectors.   **(15 hours)**

TEXT BOOKS:
Aumugarm. S and Issac A. T., Modern Algebra, SciTech publications (2006).
  UNIT – I: Chapter 5: 5.1 – 5.4
  UNIT – II: Chapter 5: 5.5 – 5.7
  UNIT – III: Chapter 6: 6.1 – 6.3
  UNIT – IV: Chapter 7: 7.1 – 7.6
  UNIT – V: Chapter 7: 7.7 – 7.8

REFERENCE BOOKS:
Grossman, Introduction to Linear Algebra, Saunders College Pub. – 1994.

Core: 9 - REAL ANALYSIS

Credits: 4   Subject Code : U3MAC53
Contact Hours: 5/week   Contact Hours: 75 / Semester
Objectives:
  To introduce the concept of metric spaces and its importance.
  To learn the concept of open sets, closed sets, compact sets and connected sets in metric spaces.
  To learn the essence of completeness of a metric space and to introduce the concept of continuity between metric spaces.
  To introduce the notion of homeomorphism between metric spaces.
Course Outcome
On successful completion of this course, a student will be

CO1:	Able to identify the important properties of a non-empty subset of a metric space.
CO2:	Able to apply the concept of continuity in real life problems.
CO3:	Able to figure out similarities (in the sense of homeomorphism) among the metric spaces
CO4:	Able to apply the theory to identify the complete metric spaces and make use of these spaces directly or indirectly to the real life problems.

Unit I: Preliminaries : Countable sets – Uncountable sets.
Metric Spaces : Definition and Examples - Bounded sets in a metric space – Open ball in metric space - open sets - subspaces – Interior of a set . (15 hours)

Unit II Metric Spaces : Closed sets – closure of a set – limit Point – Dense sets.
Complete Metric Spaces : Completeness – Baire's Category Theorem. (15 hours)

Unit III: Continuity – Homeomorphism – Uniform continuity. (15 hours)

Unit IV: Connectedness : Definition and Examples - connected subsets of R – Connectedness and continuity. (15 hours)
 Unit V: Compactness : Compact metric spaces – Compact subsets of R - Compactness and Continuity. (15 hours)
 Text Book:
Modern Analysis – By Dr.S. Arumugam and Mr.A. Thanga Pandi Isaac. New Gamma Publishing House, Palayamkottai, 2017
 Unit I: Chapter 1 – 1.2, 1.3 (Solved Problems Excluded)

Chapter 2 – 2.1 to 2.6 (Solved Problems in 2.4 Excluded)
Unit II: Chapter 2 – 2.7 to 2.10 (Solved Problems Excluded)
        Chapter 3 – 3.0 to 3.2 (Solved Problems Excluded)
Unit III: Chapter 4 – 4.1 to 4.3
Unit IV: Chapter 5 – 5.1 to 5.3
Unit V: Chapter 6 – 6.1, 6.2 and 6.4 (6.3 not included)

Reference Books:
1. D.Soma Sundram & B.Choudhary, A First course in Mathematical Analysis , Narosa
Publishing House, Chennai
 2. Richard R. Gold berg, Methods of Real Analysis, Oxford & IBH Publishing Company, New
Delhi.

ALLIED : 7 SEQUENCES AND SERIES

Credit : 5   Subject Code : U3MAA51
Contact Hours per week : 6   Contact Hours per semester : 90

Objectives:
- This syllabus aims to introduce the concept of order relation on real numbers.
- To learn about the relation between Arithmetic mean, Geometric mean and Harmonic
  mean.
- To introduce the notion of convergent sequences, monotonic sequences and its behaviors,
  Cauchy sequences, bounded sequences, oscillating sequences and divergent sequences.
- To learn in detail about the series of positive terms and various tests of convergence of
  series.

Course Outcome
Upon the successful completion of this course, a student will be

CO1:	Able to apply the important properties of order relation on $\mathbb{R}$.
CO2:	Capable of Solving problems pertaining to AM, GM and HM.
CO3:	Able to apply their skills in getting better approximation through the theory of sequences
CO4:	Much aware about the concept of infinite series of numbers and their applications.
CO5:	Able to apply various tests of convergence of series to conclude the nature of series of positive terms.

Unit I: (18 hours)
Inequalities – Triangle inequalities – The arithmetic, geometric and harmonic means – Cauchy –
Schwarz inequality.

Unit II: (18 hours)
Sequences – Bounded sequences – Monotonic sequences – Convergent sequences – Divergent
and oscillating sequences – The algebra of limits.

Unit III: (18 hours)
Behaviour of Monotonic sequences – Some theorems on limits – Cauchy sequences.

Unit IV: (18 hours)
Series of positive terms – Infinite series – Comparison test.

Unit V: (18 hours)

Kummer's test – D'Alembert's ratio test - Raabe's test – De Morgan and Bertrand's test – Gauss test – Root test and Condensation test.

Text Book:

Sequences and Series by Dr.S.Arumugam and Prof. A. Thangapandi Isaac, New Gamma Publishing House, Edition : November 2017.

Unit I   : Chapter 2: Sections 2.1, 2.2, 2.3, 2.4.
Unit II : Chapter 3: Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6.
Unit III : Chapter 3: Sections : 3.7, 3.8, 3.11.
Unit IV : Chapter 4: Sections : 4.1, 4.2.
Unit V   : Chapter 4: Sections : 4.3, 4.4.

Reference Book :

Algebra , Volume I by T. K. Manicavasagam Pillay, T. Natarajan, K. S. Ganapathy.

Semester V
Elective 1-LINEAR PROGRAMMING

Credits: 5   **Subject Code : U3MAE51**
Contact Hours: 5/week   **Contact Hours: 75 / Semester**

Course Outcome

For a student who learned this course will be

CO1:   Getting the ability of converting the real life problems in to a LPP and apply the techniques of LPP to solve the problems.

CO2:   Able to apply the methods of optimization, viz., simplex method, Big-m method to solve the real life problems.

CO3:   Getting the idea of transporting the goods from source to destination at minimum cost.

CO4:   Able to assign the jobs optimally to more suitable persons/machines so as to reduce the total working hours which in turn yields a maximum profit.

CO5:   Realize the mathematical background of each and every industry as a part of the industrial visit.

Objectives:

- To enable the students to formulate real world problems in to suitable LPP
- To understand the types of solution of LPP and techniques of solving an LPP
- To get clear understanding of transportation problem and its optimal solution
- To use assignment problem to the real life problems for finding optimal assignments.

Unit-I*: Linear Programming Problem-Mathematical Formulation: Introduction-Linear programming problem-Mathematical formulation of the problem-Illustrations on mathematical formulation on LPPs.   (15 hours)

Unit-II: Linear Programming Problem-Graphical Solution and Extension: Introduction-Graphical solution method-Some Exceptional cases-General linear programming problem-Canonical and standard forms of L.P.P. **Linear Programming Problem-Simplex Method:** Introduction - The computational procedure (The simplex algorithm and problems)   (15 hours)

Unit-III: Linear Programming Problem-Simplex Method (contd..): - Use of artificial variables: Big-M method only-Solution of simultaneous linear equations – Inverting a matrix using simplex method.   (15 hours)

Unit-IV*: Transportation Problem: Introduction-LP formulation of the transportation problem-Existence of solution in T.P-The transportation table-Loops in transportation tables-Finding an IBFS-Test for optimality-Degeneracy in transportation problem-Transportation algorithm (MODI method) – Stepping stone solution method.   (15 hours)

Unit-V*: Assignment Problem: Introduction-Mathematical Formulation of the assignment problem-Solution methods of assignment problem-Special cases in assignment problem-A typical assignment problem.   (15 hours)

NOTE: For all the units marked with *, one or more industrial visits may be organized by the Faculty member(s). This will enable the students to understand more about the course contents in relation to real life.

Text Book :
Kanti swarup, P.K. Gupta , Man Mohan, Operations Research, 19th Edition (Reprint 2018), Sultan Chand and Sons Educational Publishers, New Delhi.

Unit –I: Chapter 2 - Sections 2.1 to 2.4.
Unit-II: Chapter 3 - Sections 3.1 to 3.5 and Chapter 4: Section 4.1 and 4.3.
Unit-III: Chapter 4 - Sections 4.4 (Big-M method only), 4.6, 4.7.
Unit-IV: Chapter 10 – Sections 10.1, 10.2, 10.3, 10.5, 10.6, 10.9, 10.10, 10.12, 10.13, 10.14.
Unit-V: Chapter 11 – Sections 11.1, 11.2, 11.3, 11.4, 11.5.

Reference Books :
1. **V.Sundaresan, K.S.Ganapathy,** Resource Management Techniques
2. **Subramanian, K.Ganesan**, Operations Research, A.R.Publications
3. **S.Arumugam,** Operations Research**,** New Gamma Publications

SBE- EMPLOYABILITY SKILLS

Contact Hours per week: 2   **Subject Code: U1PS51**
Contact Hours per Semester: 30   **Credits: 2**
Objectives:
        To enrich the Employability Skills by imparting Reasoning skills, Aptitude skills and General Knowledge.
Unit I : Quantitative Aptitude – Averages, Percentage, Profit & Loss, Ratio & Proportion, Time & Work, Time & Distance, Clock.   **(6-hours)**

Unit II : Quantitative Aptitude –Problems on Ages, Boat & Stream, Simple Interest, Compound Interest, Area, Partnerships.   **(6-hours)**

Unit III: Reasoning   **(6-hours)**
Verbal Reasoning - Analogy, Classification, Series, Coding & Decoding, Blood Relations, Direction Sense Test.

Unit IV: Reasoning (6-hours)

Verbal Reasoning - Number Test, Ranking & Time sequence Test, Alphabet Test, Logical Venn Diagrams.

Unit V: (6-hours)

General Knowledge: Abbreviations, Acronyms, Famous Personalities, Important Days, Capital Cities, Currencies, Books and Authors, Inventions.

Reference Books:

1. Verbal & Non Verbal Reasoning   -   R.S.Aggarwal
2. Quantitative Aptitude   -   R.S.Aggarwal
3. Subjective & Objective Quantitative Aptitude   -   R.S.Aggarwal
4. Malayala Manorama Year Book, 2014

Fundamentals of Mathematics

Credits: 2   **Subject code : U3MAN51**
Contact Hours: 2/week   **Contact Hours: 30 / Semester**

Objectives:

♦ To lay the foundation in the basic principles of Mathematics

COURSE OUTCOMES :

In this course the students will
CO1: Classify different types of equations and solve them.
CO2: Be able to define sequence of numbers and understand progression as sequence.
CO3: Study different types of progressions and thereby study Arithmetic and Geometric means.
CO4: Understand the notion of set and describe different types of sets.
CO5: Possess the knowledge of Matrix and write down different types of matrices.
CO6: Perform algebra of Matrices.

Unit: I
Equation (6 hours)

Equations- Linear equations- Simultaneous Equations- Quadratic Equations-Simultaneous Equations-Linear and Quadratic (Example only).

Unit: II
Progression (6 hours)

Sequence of Numbers- Arithmetic Progression- Geometric Progression- Arithmetic and Geometric Means. (Examples only)

Unit: III
Theory of Sets (6 hours)

Sets-Representation of Sets- Finite and Infinite Sets-Sub-sets- Properties of subsets-Universal Sets-Venn Diagrams- Set Operation- Properties of set Union and Intersection. (Example only).

Unit: IV

Matrix (6 hours)

Introduction-Matrices-Types of Matrices- Algebra of Matrices. (Example only).

Unit: V

Differential Calculus (6 hours)

Derivatives-Differential Coefficients-u $\pm$ v form, uv form, u/v form (Example only).

Text Book:

G.K Ranganth, C.S. Sampangiram, Y. Rajaram, Business Mathematics, Himalaya Publishing House-2006.

Unit: I chapter 4 section 4.1 to 4.5
Unit: II chapter 6 section 6.1to 6.4
Unit: III chapter 7 section 7.1 to 7.10
Unit: IV chapter 8 section 8.1 to 8.4
Unit: V chapter 11 section 11.9 and 11.10

Reference Book:

Dr. M. Manoharan, Dr. C. Elango, Prof. K. L. Eswaran, Business Mathematics, Palani Paramount Publications-2007.

SEMESTER VI
COMPLEX ANALYSIS

Credits: 5 **Subject code : U2MAC61**
Contact Hours: 6/week **Contact Hours: 90 / Semester**

Objectives:

To enable the students to understand that the study of complex Analysis is an essential background for Mathematicians, Physicists and other Scientists and to acquire a good knowledge of Analytic Functions in terms of Power series approach, differentiability approach and the Geometric approach and Perceive them all as unified.

COURSE OUTCOMES :

In this course the students will

CO1: Demonstrate the idea of the Complex number system and work with arithmetic of complex numbers.

CO2: Acquire a good knowledge of analytic functions in terms of power series approach, differentiability approach and the geometrical approach.

CO3: Identify many important applications of line integrals and curve integrals by recalling Green's theorem, Stoke's theorem and Gauss Divergence theorem from vector calculus.

CO4: Know the importance of improper integrals and the application of "Contour integration".

CO5: Understand main ideas behind the elementary transformations like translation, rotation, homothetic transformation and inversion in transforming regions in the complex plane.

Unit I:
(The Extended Complex plane – Limits – Continuous Function – Differentiability- Definitions only)– The Cauchy – Riemann equations – Analytic function – Harmonic functions.   (18 hours)

Unit II:
Bilinear Transformations – Cross ratio – Fixed points of Bilinear transformations – Some Special Bilinear Transformations: The real axis onto itself- The unit circle onto itself-The real axis onto the unit circle.   (18 hours)

Unit III: (18 hours)
Definite Integral – Cauchy's Theorem – Cauchy's Integral Formula – Higher Derivatives – **(General form of Cauchy theorem excluded)**.   (18 hours)

Unit IV: (18 hours)
Taylor's Series – Laurent's Series – Zeros of an Analytic function – Singularities.
Unit V: (18 hours)
Residues – Cauchy's Residue theorem – (**Argument theorem , Rouche's Theorem , Fundamental Theorem of Algebra are excluded**) – Evaluation of Definite Integrals (First three types only).
Text Book:
      S.Arumugam, T.ThangaPandi Isaac and A.SomaSundram, Complex Analysis, Scitech Publications (India) Pvt. Ltd., Chennai – (June 2004)
Reference Books:
1. **T.K.Manicavachagam Pillai & Others,**Complex Analysis, S.Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.
2. **P.DuraiPandian and Others,** Complex Analysis, Emerald Publishers, Chennai.

Core 11 -STATISTICS

Credits: 5   Subject Code : U3MAC62
Contact Hours: 6/week   Contact Hours: 90 / Semester
Objectives:
- Introduce the theoretical background for the theory of probability.
- Introduce various special types of probability distributions and sampling techniques
- Enable the concept of averages and tests of significance based on the hypotheses.

Course Outcome
A successful completion of this course the student

CO1:	Is capable of analyzing statistical data using measures of central tendency and dispersion.
CO2:	Could use the concept of the law of large numbers to define a random variable and the corresponding probabilities for a particular industrial or any real life problem.

CO3:	Is able to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
CO4:	Is able to translate real-world problems into probabilistic models and critically evaluate the underlying assumptions of analysis tools.
CO5:	Can understand and discuss the issues/significance in the framed hypothesis based on the samples.

Unit I Measures of dispersion: Range- Quartile deviation - Mean deviation - Standard deviation -Coefficient of variation. **Correlation:** Karl Pearson's Coefficient of Correlation - Rank Correlation.

Unit II Probability: Random Experiments – Trial - Event -Probability Set Function- Mutually disjoint - Exhaustive. **Conditional Probability**: Multiplication theorem for probabilities - Pairwise independent - Mutually independent - Properties of independent events.

Unit III Random variables: Random variables- Discrete Random Variable - Continuous Random Variable - Mathematical Expectations – Moment Generating Function.

Unit IV Some Special Distributions: Binomial Distribution – Poisson distribution – Normal distribution.

Unit V Tests of Significance: Sampling- Sampling distribution –Testing of hypothesis - Test of significance (small samples): Test of significance based on t–Distribution -Test of significance based on F–Distribution.

Text Book :

Statistics by S.Arumugam and Isaac., New Gamma Publishing house.

    Unit I: Chapter III Section 3.1 & Chapter VI Sections 6.1 & 6.2

    Unit II : Chapter XI Section 11.1

    Unit III: Chapter XII Sections 12.1 – 12.5

    Unit IV: Chapter XIII Sections 13.1 – 13.3

    Unit V :Chapter XIV Sections 14.1-14.3& Chapter XV Sections 15.1 & 15.2

Reference Book(s):

    1.S.P Gupta, Statistical Methods, Sultan Chand & Sons(37th Revised Edition, 2008)

    2. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

Core 12- OPERATIONS RESEARCH

Credits: 5   **Subject Code : U2MAC63**

Contact Hours: 6/week   **Contact Hours: 90 / Semester**

Objectives

- To impart the knowledge of formulation of practical problems using the linear programming method
- Impart comprehensive knowledge and understanding of sequencing, replacement, game theory and network problems
- This course aims in providing the students with a rigorous framework with which to model and analyze queuing systems.
- The course is aims to provide deep understanding of the theory and concepts of various scheduling problems in the area of operations research

Course Outcome

Students completing this course will be able to:

CO1:	Identify and develop operations research models from the verbal description of the real system
CO2:	Understand the mathematical tools that are needed to solve optimization problems

CO3:	Apply the knowledge of game theory concepts to articulate real-world decision situations for identifying, analyzing, and practicing strategic decisions to counter the consequences
CO4:	Demonstrate solution methods including graphs and linear programming to analyze and solve the Two-person, zero-sum games
CO5:	Know the fundamental concepts of Operations Research.
CO6:	Develop mathematical models associated with network problems and find critical path analysis for an optimum solution

Unit -I: Sequencing: Problem of sequencing-basic terms used in sequencing-processing n jobs through 2 machines- processing n jobs through k machines- processing 2 jobs through k machines. **(18 hours)**

Unit-II: Games and strategies: Introduction-Two person zero-sum games-some basic terms-the maximin-minimax principle - games without saddle points-mixed strategies-graphic solutions of $2 \times n$ & $m \times 2$ games dominance property-arithmetic method for $n \times n$ games-general solution of $m \times n$ rectangular games. **(18 hours)**

Unit-III: Replacement problem: Replacement of equipment/asset that deteriorates gradually-replacement of equipment that fails suddenly. **(18 hours)**

Unit-IV: Queuing theory: Introduction-queuing system-elements of queuing system-operating characteristics of a queuing system-Deterministic queueing system-probability distributions in queuing systems-classification of queuing models definition of transient and steady states-Poisson queuing systems (Model I to Model IV only). **(18 hours)**

Unit-V: Network scheduling by PERT/CPM: Introduction-Network and basic components-logical sequencing- rules for network constructions-concurrent activities-critical path analysis. **(18 hours)**

Text Book :

Kanti swarup, P.K. Gupta , Man Mohan, Operations Research, 19th Edition (Reprint 2018), Sultan Chand and Sons Educational Publishers, New Delhi.
Unit –I: Chapter 12 - Sections 12.1 to 12.6 .
Unit-II: Chapter 17 - Sections 17.1 to 17.9.
Unit-III: Chapter 18 - Sections 18.1 to 18.3.
Unit-IV: Chapter 21 – Sections 21.1 to 21.8 and 21.9 (Models I to Model IV).
Unit-V: Chapter 25 – Sections 25.1 to 25.6.
Reference Books :
1. **V.Sundaresan, K.S.Ganapathy,** Resource Management Techniques
2. **Subramanian, K.Ganesan**, Operations Research, A.R.Publications
3. **S.Arumugam,** Operations Research**,** New Gamma Publications

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Project work

Credits: 5   **Subject Code : U1MA6PR**
Contact Hours: 6/week   **Contact Hours: 90 / Semester**

Course Outcomes:

Upon successful completion of this project work the student:

- Will get a little exposure to the field of research in mathematics.

- Able to convert a real life problem into a mathematical model and solve it by mathematical skills.
- Able to frame the hypothesis, derivations and conclusions of their mathematical model.
- Will familiarize about various applications of mathematics.

Guidelines:
- The maximum marks for the project work shall be 100.
- There shall be single internal valuation only.
- Students are encouraged to work on the topic of their own interest or shall do a project in the field of Differential equations, Statistics, Numerical methods, graph theory, fuzzy mathematics, image processing, mathematical analysis, etc., under the supervision of a faculty member.
  The report of the project shall be in about 35-40 pages with works cited properly.

SBE – 5 TRANSFORMATION TECHNIQUES

Credits: 2   **Subject Code : U3MAS61**
Contact Hours: 2/week   **Contact Hours: / Semester**
Objectives
- This course aims to introduce the concept of transforms and transform techniques to solve the difference as well as differential equations.
- Introduce the concept of Fourier series to represent and hence to handle complicated functions which arouse naturally in terms of known sine and cosine functions
- Enable the students to know more on applications of integral transform and Fourier series.

Course Outcome

CO1:	Understand and apply Z Transforms techniques.
CO2:	Solve the finite difference problems using Z transforms.
CO3:	Write the Fourier series of functions which arouse naturally in real world problems.
CO4:	Apply the techniques of Fourier transform to solve the differential equations.

Unit – I
        Z Transforms – Definition – Proprieties – Z Transforms of some basic functions – Problems.

Unit – II
        Inverse Z Transforms – Methods to find the inverse Z Transform – Use of Z – Transforms to solve finite Difference Equations – problems.

Unit – III
        Fourier Series – Definition – even and odd functions.

Unit – IV
        Half range Fourier Series – problems – Change   of interval- (Harmonic analysis not included)

Unit – V

Fourier Transforms – Properties of Fourier Transform –– Fourier sine and cosine Transforms – properties – Parsevals Identity - Problems – Convolution theorem(Worked out examples only)
.

Text Books:
1. Engineering Mathematics 3rd Edition by T.Veerarajan, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Calculus Volume III by S.Narayanan and T.K.ManicavachagomPillay, S.Viswanathan (Printers & Publishers) Pvt. Ltd., 2014.

Unit I	Text Book 1: Chapter 7 sections 7.1 to 7.23
Unit II	Text Book 1: Chapter 7 sections 7.26 to 7.40
Unit III	Text Book 2: Chapter 6 sections 1 to 3
Unit IV	Text Book 2: Chapter 6 sections 4 to 7
Unit V	Text Book 2: Chapter 6 sections 9 to 12

Book for Reference:
1. Transforms and Partial Differential Equations by Dr.A.Singaravelu, Meenakshi Agency, Chennai

RANDOM PROCESSES
Credits: 2   **Subject Code: U2MAS62**
Contact Hours: 2/week   **Contact Hours: 30 / Semester**

Objectives:
- To introduce the fundamental concepts of random processes, particularly continuous-time Markov chains, and related structures.
- Introduce the concept of Poisson process and Markov chain and its limiting behavior.
- Learn about the stationarity and wide sense stationarity of the random behavior of a system with respect to the time or the surrounding behaviors

COURSE OUTCOMES :

Upon successful completion of this course, students are able to
CO1: Demonstrate about mathematical basis of continuous-time Markov chains.
CO2: To formulate continuous-time Markov chain models for relevant practical systems.
CO3: To apply the theory developed to specific problems in signal communications.
CO4: Develop the attitude of the analyzing the role of random processes in system modeling.

Unit-I : Random Process
Classification of random process-methods of description of a random process-special classes of random process-average value of random process-stationary-examples of a SSS process (examples 1 to 9) page 290 – 300.   **(6 hours)**

Unit-II : Autocorrelation function

Autocorrelation function and its properties-cross- Autocorrelation function and its properties-ergodicity- mean ergodic process- mean ergodic theorem-correlation ergodic process. (examples 1,2,3,5 and 6 only) page no 311-316 and 319 -320

(6 hours)

Unit-III :Power spectral density function

Power spectral density function- properties - power spectral density function- Wiener-Khinechine theorem not included, examples 1,2,3,4 and 5, pages 324-329, 334 – 337

(6 hours)

Unit-IV :Poisson process

Poisson process-properties of Poisson process - examples 1 to 6, pages 386- 393

(6 hours)

Unit-V: Markov process

Markov process-definition of Markov chain-Chapman-Kolmogorov theorem-classification of states of a Markov chain. Examples: 1,2,3, 5 and 8, Pages 397-404 and 407-410.

(6 hours)

Text Book:

T.Veerarajan, Probability, statistics and random process**,** 3rd edition, Tata Mcgraw-hill publishing company limited, New Delhi

Reference Books :

Kandasamy , Probability and Queuing
Medhi, Stochastic process

NME 2 - STATISTICS AND OPERATIONS RESEARCH

Credits: 2   **Subject code : U2MAN61**
Contact Hours: 2/week   **Contact Hours: 30 / Semester**
Course Outcome

Upon completion of this course, students are

CO1:	Able to apply mean, median and mode concepts in real life problems.
CO2:	Getting the ability of analyzing the economic problems using index numbers.
CO3:	Able to apply the optimization techniques in real life situations.
CO4:	Getting the ability of converting the real life problems in to a LPP and apply the techniques of LPP to solve the problems.
CO5:	Getting the idea of transporting the goods from source to destination at minimum

Objectives:

- To develop the ability of understanding statistical concepts.
- To apply the Linear Programming techniques to solve practical problems

Unit I: Mean—Median—Mode (6 hours)

Unit II: Index numbers— simple aggregate method --Weighted index numbers—Laspeyre's ,Paasche's, Fisher's ideal Index numbers, Marshall-Edgeworth and Kelly's method. (6 hours)

Unit III: Operations Research : Introduction—definition—modeling in OR—General solution methods for OR models—scientific method in OR—Applications of OR. (6 hours)

Unit IV: Mathematical formulations of LPP –Graphical solutions of LPP—General LPP—Canonical and standard forms of LPP. (6 hours)

Unit V: LP formulations of Transportation Problem – Existence of solution in TP – Initial Basic Feasible Solution of Transportation problem using North West Corner Rule, Matrix minima method, Vogels Approximation methods (6 hours)

Text Books:

1. R.S.N.Pillai, Bagavathi, Statistics S.Chand& company Ltd., edition 2008 [For Units I, II]
2. Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research, Sultan chandand sons, 12th revised edition. [For Units III, IV and V]

Reference Books:

1. S.P.Gupta, Statistical Methods,Sultan Chand & Sons (37th Revised Edition , 2008)
2. V. K. Kapoor, Operations Research, Sultan Chand & Sons.

Course Name: Bachelor of Science
Discipline   : Mathematics
(Those who join in 2015 and after)
Self-Learning Course:

Subject	Credit	Ext =Tot	Subject Code
Advanced Programming Techniques	5	100 = 100	U1MASL51

SELF LEARNING
ADVANCED PROGRAMMING TECHNIQUES

Credit: 5   Subject code: U1MASL51
TOTAL MARKS: 100

Objectives:
        To know various techniques of programming

Unit I:Dynamic programming: Introduction – The recursive equation approach – Characteristics of dynamic programming – Dynamic programming algorithm – Solution of discrete dynamic programming.
        (Chapter 13)

Unit II: Integer Programming: Introduction – Gomory's all –I.P.P method – Construction of Gomory's constraints – Fractional cut methods - Branch and Bound method
        (Chapter 7)

Unit III: Advanced Linear Programming: Introduction – Revised simplex method
        (Chapter 9)

Unit IV: Non Linear Programming: Introduction – Formulating a non-linear programming – General NLPP – Constrained optimization with equality constraints
        (Chapter 24)

Unit V: Non Linear Programming methods: Graphical solutions – Kuhn-Tucker conditions with non-negative constraints
        (Chapter 25)

Text Book
   1. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan and Sons, Reprint 2006
Reference Book(s)
   1. P.K. Gupta and Man Mohan, Problems in quantitative techniques, Sultan and Sons.
   2. Hamdy A. Taha, Operations Research, 8th edition, prentice Hall, New Delhi, 2008

Course Name: Bachelor of Science
Discipline   : Mathematics
VALUE ADDED COURSES

Course Name	Internal Mark = Total Mark	Subject Code
Maths for Competitive Exam	100=100	V1MA1
Fundamentals of Logic & Reasoning skills	100=100	V1MA2
MS Office and Latex	100=100	V1MA3
Problem Solving Techniques: Mathematical Analysis	100=100	V1MA4
Problem Solving Techniques: Complex Analysis	100=100	V1MA5
Problem Solving Techniques: Linear Algebra	100=100	V1MA6
Problem Solving Techniques: Algebra	100=100	V1MA7
Problem Solving Techniques: Differential Equations (Ordinary and Partial)	100=100	V1MA8
Problem Solving Techniques: Numerical Analysis	100=100	V1MA9

Maths for Competitive Exam
(For all UG and PG Students of any Discipline)

Contact Hours: 30   **Subject code: V1MA1**
Course Outcomes
On successful completion of this course, the students

- are able to solve problems like finding the missing number, identifying the pattern of sequence, finding n^{th}-term of a series or a sequence etc,.
- are able to quickly solve the problems pertaining percentage, age, profit and loss, time and work, and average.
- able to qualify in any competitive examination of Government of Tamilnadu.

Unit - I   **6 Hours**
     Numbers - Problem on number
Unit - II   **6 Hours**
     Simplification – Average
Unit - III   **6 Hours**
     Problems on Ages – Percentage
Unit - IV   **6 Hours**
     Profit & Loss – Partnership
Unit - V   **6 Hours**
     Time & Work – Time & Distance
Text Book :
     Quantitative Aptitude for competitive examinations as per new examination pattern–
R.S. Agarwal , seventh revised edition. S.Chand & company private Ltd.,
Unit - I (chapter-1&7)
Unit - II (chapter - 4&6)
Unit - III (Chapter – 8&10)
Unit - IV (Chapter – 11&13)
Unit - V (chapter – 15&17)
Reference Book :
1.Quantitative Aptitude for competitive examinations by Abhijit guha ,5 th Edition, Mc Graw hill education.

2.Teach yourself Quantitative aptitude useful for all competitive examinations by Arun sharma, Mc Graw hill education.

Fundamentals of Logic & Reasoning skills
(For all UG and PG Students of any Discipline)

Contact Hours: 30   **Subject code: V1MA2**

Course Outcomes
On successful completion of this course, the students

- are able to identify and quickly solve the problems pertaining blood relation, throwing dice, number analogy, coding and decoding, number series.
- able to understand given tabular values, pie chart, line graph and Venn diagram and analyze them to get conclusions corresponding to the given question(s).
- able to qualify in any competitive examination of Government of Tamilnadu

Unit - I   **6 Hours**
    Number Analogy – Problems On Dice
Unit - II   **6 Hours**
    Blood Relation – Coding & Decoding
Unit - III   **6 Hours**
    Number Series – Venn Diagram & Sets
Unit - IV   **6 Hours**

    Tabulation – Bar Graphs
Unit - V   **6 Hours**
    Pie chart – Line graphs

TEXT BOOK :
    1) UGC-NET (paper – I) – D.Shyam Anand
    2)Quantitative Aptitude for competitive examinations as per new examination pattern–
R.S. Agarwal , seventh revised edition. S.Chand & company private Ltd.,
Unit - I Text Book I (P.NO: 232-243) (P.NO.244-247)
Unit - II Text Book I (P.NO:247-255) (P.NO:255-267)
Unit - III Text Book I (P.NO:276-291) (P.NO:292 – 301)
Unit - IV Text Book II (Chapter 36 & 37)
Unit - V Text Book II (Chapter 38 & 39)

Reference Book :
1. A Modern approach to Verbal and Non verbal Reasoning by R.S. Agarwal, seventh revised edition. S.Chand & company private Ltd.,
2. Teach yourself Quantitative aptitude useful for all competitive examinations by Arun sharma, Mc Graw hill education.

MS Office and Latex
(For all UG and PG Students of any Discipline)

Contact Hours: 30   **Subject code: V1MA3**
Course Outcomes
On successful completion of this course, the students

- Able to install as well as uninstall a programme, manage their personal files and various components of their operating system.

- Able to apply their learning skills to make any official communication or documents, power point presentation etc,.
- Able to manipulate the cells in spread sheet and implement various predefined math functions for various statistical computations.
- Able to create their own documents for presentation, mathematical symbols and type documents in accordance with journals by using Latex.

Operating system-MS-Windows

Operating system- Basics components of Windows-Running applications, exploring computer, managing files and folders, copying and moving files and folders- Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance.

MS Word and MS Power point

Introduction to MS–Word - Working with documents, using tables, pictures, and charts, mail merge , creating form letters and labels, Modifying a report- Creating presentation, Modifying a presentation, Delivering a presentation and designing a template.

Spread Sheet and MS Excel

Application/usage of Electronic Spread Sheet, Opening of Spread Sheet, menu bar, Creation of cells and addressing of cells, Cell inputting - Manipulation of cells - Mathematical, statistical and financial function -Charts - Spread sheets for Small accountings

Latex

Introduction to Latex and types of softwares - Document structure-Essentials, Troubleshooting, creating a Title, Sections, Table of Contents- Type setting Text- Creating Tables- Inserting figures, Equations.

Insertion in Latex

 Inserting References, Bibliography, Citing references, Foot notes, Margin Par and end notes. Document templates- Beamer template, Article template, Book template, tug boat template.

Reference books :

1. Fundamentals of Computer V.Rajaram – Prentice – Hall of India
2. Study Material on Latex

Problem Solving Techniques: Mathematical Analysis
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA4**

Course Outcomes:

On successful completion of this course, students

- are able to think critically about various simpler/harder problems in mathematical analysis and come out with correct answer(s).
- are able to analyze effectively and accurately to solve problems and reach sound conclusions about them.
- may implement their learned skills to solve problems pertaining to compactness, connectedness, convergence, continuity, uniform continuity, continuous functions in relation to compactness/connectedness etc,.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, conducted by the Government of Tamilnadu/India.

Unit I: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum,

Unit II: Sequences and series, convergence, limsup, liminf, Bolzano Weierstrass theorem, Heine Borel theorem.

Unit III: Continuity, uniform continuity, differentiability, mean value theorem.

Unit IV: Sequences and series of functions, uniform convergence, Riemann sums and Riemann integral, Improper Integrals.

Unit V: Metric spaces, compactness, connectedness, completeness, normed spaces.

Reference Books:
1. **Walter Rudin,** Principles of Mathematical Analysis, Third Edition, McGraw-Hill Book company, Singapore, 1976.
2. **D.SomaSundram & B.Choudhary,** A First course in Mathematical Analysis , Narosa Publishing House, Chennai
3. **Richard R. Gold berg,** Methods of Real Analysis, Oxford & IBH Publishing Company, New Delhi.
4. **S. C. Malik, Savita Arora,** Mathematical Analysis, Second Edition, New Age International Publishers, New Delhi, 2005.

Problem Solving Techniques: Complex Analysis
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA5**
Course Outcomes:
On successful completion of this course, students
- are able to think critically about various simpler/harder problems in complex analysis and come out with correct answer(s).
- are able to analyze effectively and accurately to solve problems and reach sound conclusions about problems belonging to analytic functions, contour integration and conformal mappings.
- will implement their learned skills to solve problems (more specifically in the complex domain) pertaining to compactness, connectedness, convergence, continuity, uniform continuity, continuous functions in relation to compactness/connectedness, series representation of functions etc,.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, conducted by the Government of Tamilnadu/India.

Unit I: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.

Unit II: Conformal mappings, Mobius transformations, Analytic functions, Cauchy-Riemann equations.

Unit III: Line integral, Contour integral, Cauchy's theorem, Cauchy's integral formula,

Unit IV: Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.

Unit V: Taylor series, Laurent series, calculus of residues, Principle of analytic continuation

Reference Book(s):
1. Lars V. Ahlfors - Complex Analysis - Third Edition - McGraw- Hill International Company, Singapore.
2. John B.Conway, Functions of one complex variable, Second Edition, Springer 1978.
3. V.Karunakaran, Complex Analysis, Second Edition, Alpha science International Limited, U.K.
4. S. Ponnusamy, Foundations of Complex Analysis, Second Edition, Alphascience International, 2002.
5. R.Roopkumar, Complex Analysis, First Edition, Published by Pearson, Delhi.

Problem Solving Techniques: Linear Algebra
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA6**
Course Outcomes:
On successful completion of this course, students
- are able to think critically about various simpler/harder problems in Linear algebra and come out with correct answer(s).
- are able to analyze effectively and accurately to solve related problems and got sound conclusions about them.
- may implement their learned skills to solve problems pertaining to eigen values and eigen vectors, more specifically diagonalization of matrices etc,.
- able to apply various techniques and approaches in solving problems involving Linearly independent set, basis, rank nullity theorem, linear transformations and associated matrices, orthogonalization etc,.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, conducted by the Government of Tamilnadu/India.

Unit I: Vector spaces, subspaces, linear dependence, basis, dimension.

Unit II: Algebra of linear transformations, Algebra of matrices, rank and determinant of matrices, linear equations, Eigenvalues and eigenvectors.

Unit III: Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis.

Unit IV: Canonical forms, diagonal forms, triangular forms, Jordan forms Inner product spaces, orthonormal basis.

Unit V: Quadratic forms, reduction and classification of quadratic forms.

Reference Books:
1. **I.N.Herstein**, Topics in Algebra, Second Edition, John Wiley & Sons, New York, 1975.
2. **Joseph A Gallian,** Contemporary Abstract Algebra, 9th Edition, Cengage Learning India Pvt. Ltd, 2017.
3. **David B. Damiano and John B. Little**, A course in Linear Algebra, Dover Publications, 2011.
4. **Vijay K Khanna and S.K. Bhambri,** A course in Abstract Algebra 5th Edition, Vikas Publishing, 2017.

5. **Seymour Lipschutz,** Schaum's Outline of Linear Algebra, McGraw-Hill Education, 1996.
6. **Kenneth M Hoffman,** Linear Algebra, 2nd edition Prentice Hall India Learning Private Limited, 2015.

Problem Solving Techniques: Algebra
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA7**

Course Outcomes:

On successful completion of this course, students

- able to think critically about various simpler/harder problems in abstract algebra and come out with correct answer(s).
- are able to analyze effectively and accurately to solve problems and reach sound conclusions about them.
- may implement their learned skills to solve problems pertaining to the number of subgroups of a group, p-Sylow subgroups, normal subgroups.
- are able to apply various techniques and approaches in solving problems in permutation and combinations, permutation groups, quotient groups etc,.
- are able to find the roots of a given polynomial over a given filed and analyze the irreducibility of a polynomial.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, conducted by the Government of Tamilnadu/India.

Unit I: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements.

Unit II: Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's φ-function, primitive roots.

Unit III: Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups,

Unit IV: Permutation groups, Cayley's theorem, class equations, Sylow theorems.

Unit V: Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria.

Reference Books:

1. **I.N.Herstein**, Topics in Algebra, Second Edition, John Wiley & Sons, New York, 1975.
2. **Joseph A Gallian,** Contemporary Abstract Algebra, 9th Edition, Cengage Learning India Pvt. Ltd, 2017.
3. **David B. Damiano and John B. Little**, A course in Linear Algebra, Dover Publications, 2011.
4. **Vijay K Khanna and S.K. Bhambri,** A course in Abstract Algebra 5th Edition, Vikas Publishing, 2017.
5. **Seymour Lipschutz,** Schaum's Outline of Linear Algebra, McGraw-Hill Education, 1996.
6. **Kenneth M Hoffman,** Linear Algebra, 2nd edition Prentice Hall India Learning Private Limited, 2015.

Problem Solving Techniques: Differential Equations (Ordinary and Partial)
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA8**

Course Outcomes:

On successful completion of this course, students

- are able to think critically about various simpler/harder problems in Differential equations (ordinary as well as partial) and come out with correct answer(s).
- are able to analyze effectively and accurately to solve Sturm-Liouville problem, first order differential equations with constant/variable coefficients and reach sound conclusions about the general/particular solution of the respective problems.
- may implement their learned skills to solve first order PDE using Lagrange and Charpit methods.
- are able to apply various techniques and approaches to classify the given PDE accordingly able to write the general solution of the given PDE as well as for higher order PDE.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, conducted by the Government of Tamilnadu/India.

Unit I: Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

Unit II: General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function

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

Unit IV: Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Unit V: Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema, Variational methods for boundary value problems in ordinary and partial differential equations.

Reference Books:

1. M.D.RAISINGHANIA, Ordinary & Partial Differential Equations, Sultan and Chand, India
2. George F. Simmons, Differential equations With applications and Historical notes Third edition, CRC Press.

Problem Solving Techniques: Numerical Analysis
(Only for PG Mathematics Students*)

Contact Hours: 36   **Subject Code: V1MA9**

Course Outcomes:

On successful completion of this course, students

- able to think critically about various simpler/harder problems in Numerical analysis and come out with correct answer(s).
- are able to analyze effectively the given algebraic/transcendental equations and write an approximate solution by using proper method.

- able to solve the given differential equation, compute the integral value and finding the derivative of a given function numerically using more suitable numerical methods.
- able to identify and write the largest eigen value of a given matrix or given system of linear equations approximately.
- will qualify in any one of the exams like the SET/ UGC-CSIR-NET /NBHM/ GATE etc, examinations conducted by the Government of Tamilnadu/India.

Unit I: Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence.

Unit II: Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation,

Unit III: Numerical differentiation– Newton's method, Gauss's method and integration: Simpson's rules, Picard's method, Euler's methods.

Unit IV: Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Unit V: Approximations: Eigen value and Eigen vectors.

Reference Books:
1. Richard W. Hamming, Numerical Methods for Scientists and Engineers, Dover Publications Inc, 1987.
2. S. Arumugam, A. Thangapandi and A. Somasundaram, Numerical Methods, 2nd Edition, Scitech, India.
3. M. K. Jain, S. R. K. Iyengar & R. K. Jain, Numerical Methods, New Age International Publishers, New Delhi.