ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

CUDDALORE-1

PG & RESEARCH DEPARTMENT OF MATHEMATICS

B.Sc. MATHEMATICS

SYLLABUS (2017-2018)

B. Sc .MATHEMATICS

Year/ Sem	Subject	SUB CODE	Paper	Title of the paper	Hrs	Credits
I YEAR/ I SEM	Language	LT101T	I	**TAMIL/HINDI/FRENCH – I**	4	3
	English	LE101T	I	**FUNCTIONAL ENGLISH – I**	4	3
	Core	MT101S	I	**ALGEBRA AND TRIGNOMETRY**	5	4
	Core	MT102P	II	**TWO DIMENSIONAL & THREE DIMENSIONAL GEOMETRY**	6	4
	Allied	ASMT101P	I	**MATHEMATICAL STATISTICS I**	8	4
	Foundation courses	VE101T	I	**VALUE EDUCATION**	3	2
I YEAR/ II SEM	Language	LT202T	II	**TAMIL /HINDI/FRENCH – II**	4	3
	English	LE202T	II	**FUNCTIONAL ENGLISH – II**	4	3
	Core	MT203S	III	**CALCULUS**	6	4
	Core	MT204S	IV	**NUMERICAL METHODS**	5	4
	Allied	ASMT202T & ASMP201Q	II	**MATHEMATICAL STATISTICS II**	8	4
				MATHEMATICAL STASTICS –II (PRACTICAL)		2
	Foundation courses	EPD201T	II	**DYNAMICS OF PERSONALITY**	3	2
II YEAR/ III SEM	Language	LT303T	III	**TAMIL /HINDI/FRENCH – III**	4	3
	English	LE303T	III	**FUNCTIONAL ENGLISH – III**	4	3
	Core	MT305S	V	**DIFFERENTIAL EQUATIONS**	5	4
	Core	MT306S	VI	**VECTOR AND FOURIER ANALYSIS**	6	4
	Allied (Optional)	ACMT301Q	III	**ACCOUNTING FOR BUSINESS**	8	5
	Foundation courses	EVS301S / A0FA301	III	**FIRST AID / ENVIRONMENTAL SCIENCE**	3	4
II YEAR/ IV SEM	Language	LT404T	IV	**TAMIL /HINDI/FRENCH – IV**	4	3
	English	LE404	IV	**FUNCTIONAL ENGLISH – IV**	4	3
	Core	MT407S	VIII	**FUZZY SETS AND APPLICATIONS**	6	4
	Core	MT408	IX	**GRAPH THEORY**	5	4
	Allied(Optional)	APH401T & APHP401	IV	**ALLIED PHYSICS**	8	4
				ALLIED PHYSICS (PRACTICAL)		2
	Foundation courses	EVE401S/ A0FA401	III	**FIRST AID / ENVIRONMENTAL SCIENCE**	3	2

IIIYEAR/ V SEM	Core	MT509	X	**ABSTRACT ALGEBRA**	6	5
	Core	MT510	XI	**REAL ANALYSIS –I**	6	5
	Core	MT511	XII	**COMPLEX ANALYSIS – I**	6	5
	Core	17EMT512 / EMT512A	XIII	**MECHANICS / SPECIAL FUNCTIONS**	6	5
	Elective-I	EMT513S & EMT513A	XIV	**MATLAB / THEORY OF FUZZY NUMBER SYSTEM**	6	5
IIIYEAR/ VI SEM	Core	MT614	XV	**LINEAR ALGEBRA**	6	5
	Core	MT615	XVI	**REAL ANALYSIS-II**	6	5
	Core	MT616	XVII	**COMPLEX ANALYSIS- II**	6	5
	Elective-II	EMT617S	XVIII	**PROGRAMMING IN C LANGUAGE / MATHEMATICAL MODELING**	6	4
		MTP601		**PROGRAMMING IN C LANGUAGE – PRACTICAL**		2
	Elective-III	EMT618S & EMT618A	XIX	**OPERATIONS RESEARCH / ASTRONOMY**	6	5

TOTAL CREDITS = 138+ 2(EXTENSION)=140

I-B.Sc(MATHS)	ALGEBRA AND TRIGONOMETRY	MT101S
SEMESTER-I	For the students admitted from the year 2014	HRS/WK – 5
CORE-I		CREDIT – 4

OBJECTIVES

The course aim is to introduce the concepts of Theory of Equations, Summation of Series, Matrices and Elementary Number theory.

UNIT - I: THEORY OF EQUATIONS

Polynomial Equations - Imaginary and Irrational roots – Symmetric Functions of roots in terms of Coefficients –Reciprocal Equations – Transformation of Equations-Descartes Rule of Signs – Approximate Solutions of Polynomials by Horner's method – Newton Raphson method of Solution of a cubic polynomial.

UNIT -II: SUMMATION OF SERIES

Binomial - Exponential and Logarithmic series [Theorems without proofs]

UNIT -III: MATRICES

Symmetric and Skew symmetric – Hermitian and Skew Hermitian – Orthogonal and Unitary Matrices – rank of Matrix – Consistency and solutions of Linear Systems – Cayley Hamilton Theorem[without proof] – Eigen Values – Eigen Vectors – Similar Matrices – Diagonalisation of Matrix.

UNIT - IV: ELEMENTARY NUMBER THEORY

Prime Number – Composite Number – Decomposition of a Composite Number as a Product of Primes uniquely [without proof] – Divisors of a Positive Integer – Congruence Modulo n – Euler Function [without proof] – Highest Power of a Prime Number p contained in n! – Fermat's and Wilson's Theorems (without proof)

UNIT-V : TRIGONOMETRY

Expansion of cosnθ, sinnθ- Expansion of tannθ in terms of tanθ- Expansion of tan[A+B+C+…] -solution of trigonometric equations. Powers of sines and cosines of θ in terms of functions of multiples of θ - Expansions of sinθ, cosθ and tanθ in a series of ascending powers of θ - Hyperbolic and Inverse Hyperbolic functions: Real and Imaginary parts - Inverse Hyperbolic functions.

TEXT BOOKS:

1. T.K.ManicavachagomPillay, T.Natarajan and K.S.Ganapathy[2004],"Algebra",Volume I & II S.Viswanathans Printers Pvt. Ltd. Chennai.
2. P. Kandasamy, K.Thilagavathy [2004], "Mathematics for B.Sc" ,Volume- I, II, III & IV, S.Chand& Company Ltd., New Delhi-55.

REFERENCE BOOKS:

1. S.Arumugam [2003], "Algebra", New Gamma Publishing House, Palayamkottai.
2. A.Singaravelu [2003], "Algebra and Trigonometry", Volume – I &II Meenakshi Agency, Chennai.
3. S.Sudha [1998], "Algebra and Trigonometry", Emerald Publishes, Chennai.

I – B.Sc (Maths)	TWO DIMENSIONAL & THREE DIMENSIONAL GEOMETRY For the students admitted from the year 2014	MT102Q
SEMESTER – I		HRS/WK – 6
CORE – 2		CREDIT – 4

OBJECTIVES:

The course aims to introduce the concepts of Parabola, Ellipse, Hyperbola & Rectangular Hyperbola, Planes and Straight lines, Sphere, Cone and Cylinder.

UNIT - I: PLANES

General equation –passing through three points – angle between the planes - line of intersection – length of the perpendicular – plane bisecting the angle between the Plane.

UNIT - II: STRAIGHT LINES

Symmetrical form – passing through two points – plane and straight line – Angel between the Plane and the Line.

Unit-III: STRAIGHT LINE (Contd..)

coplanar lines – shortest distance between two lines – Intersection of three Planes.

UNIT - IV: THE SPHERE

Equation of a sphere- length of tangent to the sphere- plane section of spheres- intersection of two spheres- Tangent plane to the sphere

UNIT - V: CONE AND CYLINDER

Equation of a cone– Intersection of a straight line and a quadric cone – tangent plane and normal – Cylinder – Right circular cylinder – Equation of an Enveloping cylinder.

TEXT BOOK:

1. T.K.ManicavachagomPillay& T. Natrajan (2011), "Analytical Geometry, part II-Three Dimensions", S.Viswanathan Printers & Publishers Pvt.Ltd. Chennai.

Unit-I: Chapter: 2.1 – 2.11,
Unit-II: Chapter: 3.1 - 3.6
Unit-III: Chapter:3.7-3.8
Unit-IV: Chapter: 4.1 – 4.8,
Unit-V: Chapter: 5.2,5.2.1,5.3,5.4,5.5,5.6& 8,8.1,8.2,8.3.

REFERENCE BOOKS:

1. Duraipandian and LaxmiDuraipandian(1965), "Analytical Geometry – 3D", Emerald Publishers, Chennai.
2. S.Santha&T.Pathinathan(2005), "3D Analytical Geometry &Propability", Vijay Nicole Imprints Pvt.Ltd.,Chennai.
3. P.R.Vittal [2003], "Coordinate Geometry", Margham Publication, Chennai.
4. P.Kandasamy, K.Thilagavathy (2004), "Mathematics for B.Sc" Vol-I, II, III & IV, S.Chand& Company Ltd, New Delhi-55.

I – B.Sc (Maths)	CALCULUS For the students admitted from the year2014	MT203S
SEMESTER – II		HRS/WK – 6
CORE – 3		CREDIT – 4

OBJECTIVES

The course aims to introduce the concepts of Differential Calculus, Curvature, Asymptotes, and Reduction formulae, Beta and Gamma Functions and Double Integrals.

UNIT - I:DIFFERENTIAL CALCULUS

Jacobians – Total differential – maxima and minima functions of 2 and 3 independent variable, Lagrange's method [without proof].

UNIT - II:DIFFERENTIAL CALCULUS[Contd]

Curvature, Radius of Curvature in Cartesian and Polar coordinates , p-r equation.

UNIT – III: DIFFERENTIAL CALCULUS[Contd]

Evolutes, Envelope, Asymptotes: Methods [without proof] of finding asymptotes of rational algebraic curves with special cases.

UNIT –IV:INTEGRAL CALCULUS

Reduction formulae, Beta , Gamma Functions and their Properties .

UNIT –V: INTEGRAL CALCULUS[Contd]

Change of order of Integration – Applications to Area, Surface Area and Volume.

TEXT BOOKS:

1. S.Narayanan and T.K.ManicavachagomPillay [2006], "Calculus" Volume-I & II, S.Viswanathan Printers & Publishers Pvt.Ltd. Chennai.
Volume-I: Unit-II- Chapter: X (Sec:2.1-2.4,2.6-2.8),
Volume-II: Unit-IV- Chapter:1 (Sec:13.1-13.10) & Chapter:7 (Sec:2.1-6),
Unit-V- Chapter:5 (Sec:5.1-5.7).
2. P.Kandasamy, K.Thilagavathy [2004], "Mathematics for B.Sc", Vol-I &II ,S.Chand& Company Ltd., New Delhi-55.
Volume-I: Unit-I- Pages:(199-209 , 215 – 241),
Volume-II: Unit-III- Chapter: 3 (Pgs:345 - 361) & Chapter:4 (Pgs:380 - 396).

REFERENCE BOOKS:

1. Shanti Narayan [2001], "Differential Calculus",Shyamlal Charitable Trust, New Delhi.
2. Shanti Narayan [2001], "Integral Calculus", S.Chand& Co. New Delhi.
3. S.Sudha [1998], "Calculus", Emerald publishers, Chennai.
4. G.B.Thomas and R.L.Finney[1998], "Calculus and Analytic Geometry", Addison Wesley [9th Ed], Mass.[Indian Print].
5. P.R.Vittal [2004], "Calculus", Margham Publication, Chennai.

I – B.Sc (Maths)	NUMERICAL METHODS For the students admitted from the year 2014	MT204S
SEMESTER – II		HRS/WK – 5
CORE – 4		CREDIT – 4

OBJECTIVES

The course aims to introduce the concepts of Finite differences, Central differences, Interpolation for unequal intervals, Inverse interpolation and Solutions of simultaneous linear equations.

UNIT- I: FINITE DIFFERENCES

First and higher order differences-forward differences and Backward differences-Operators, Relation between ∇, Δ and E – Interpolation –Gregory- Newton's forward & backward formulae for interpolation-Factorial polynomial.

UNIT-II: CENTRAL DIFFERENCES

Central difference Operators – Central differences formulae- Gauss Forward and Backward formulae – Stirling's formula – Bessel's formula.

UNIT–III:INTERPOLATING FOR UNEQUAL INTERVALS AND INVERSE INTERPOLATION

Divided differences – Newton's divided differences formula and Lagrange's interpolation formula – Estimating the Missing terms [with one or more missing values] –Inverse Lagrange's method.

UNIT – IV: LINEAR ALGEBRAIC EQUATIONS

Gauss elimination method – Gauss Jordan Method- Gauss Seidal method – Crout's method [Three unknowns only]- inverse of a matrix-Gaussian method.

UNIT – V: NUMERICAL DIFFERENTIAL AND INTEGRAL EQUATION

Euler's method-Improved Euler's method- Modified Euler's method- The RungeKutta Method-Adam's method-Trapezoidal rule-Simpson's 1/3rd rule-Simpson's 3/8 th rule.

TEXT BOOKS:

1. A.Singaravelu [2004], "Numerical Methods", Meenakshi Agency, Chennai
2.M.K.Venkataraman(1992), "Numerical Methods for Science and Engineering", National Publishing Company, Chennai.

REFERENCE BOOKS:

1. S.Arumugham[2003], "Numerical Methods", New Gamma Publishing, Palayamkottai.
2. H.C.Saxena[1991], "Finite Differences and Numerical Analysis" ,S.Chand& Co. Delhi.
3. B.D.Gupta(2001), "Numerical Analysis", Konark Pub. Ltd., Delhi.
4. P.Kandasamy, K.Thilagavathy [2003], "Calculus of Finite difference & Numerical Analysis", S.Chand& Company Ltd., New Delhi-55.

II – B.Sc (Maths)	**DIFFERENTIAL EQUATIONS** **For the students admitted from the year 2014**	**MT305S**
SEMESTER – III		**HRS/WK - 5**
CORE – 5		**CREDIT - 4**

OBJECTIVES

The course aims to introduce the concepts of Equations of the First Order and Higher Degree, Euler's homogeneous linear equations, Legendre's Linear Equations, Simultaneous Equations, Laplace Transform and Formation of PDF.

UNIT-I: ORDINARY LINEAR DIFFERENTIAL EQUATIONS:

Equations of the First Order and Higher Degree- Equations Solvable for p- Equations Solvable for x - Equations Solvable for y – Clairaut's Equation- Equations of second and higher order with constant coefficients.

UNIT – II: ORDINARY LINEAR DIFFERENTIAL EQUATIONS [Contd]:

Euler's homogeneous linear equations – Legendre's Linear Equations- Method of Variation of Parameters- Method of undetermined Coefficients.

UNIT III:TOTAL DIFFERENTIAL EQUATIONS

Total Differential Equations – Different Methods of solving $Pdx+Qdy+Rdz = 0$.

UNIT – IV: PARTIAL DIFFERENTIAL EQUATIONS:

Formation of PDE – Complete Integral – Particular Integral – Singular Integral – Equation's Solvable by direct Integration – Solving equations of the types: $f(p, q) = 0$, $f(x, p, q) = 0$, $f(y, p, q) = 0$, $f(z, p, q) = 0$, $f(x, p) = f(y, p)$, $Z = p x + q y + f(p, q)$ - Lagrange's equations.

UNIT – V: LAPLACE TRANSFORM:

Transform – Inverse Transform – Application of Laplace Transform to solution of first and second order linear Differential equations [with constant coefficients] and simultaneous Linear Differential Equations.

TEXT BOOK:

1. P.Kandasamy, K.Thilagavathy [2004], "Mathematics for B.Sc" Vol-,III, S.Chand& Company Ltd., New Delhi-55.

Unit-I: Chapters:1,2,3 (pgs: 1 - 41) ,Unit-II:Chapters:4,5 (pgs: 48 -87),
Unit-III: Chapter:6 (pgs:92-116) , Unit-IV:Chapters:1,2 (pgs:117-185),
Unit-V: Chapter:1 (pgs:164-185).

REFERENCE BOOKS:

1.M.D.Raisighanian, [2001], "Ordinary and Partial Differential Equations", S.Chand and Co., New Delhi

2. S.Sudha [1998], "Differential Equations and Integral Transforms", Emerald publishers, Chennai.

3. P.R.Vittal [2004], "Differential Equations and Laplace Transform", Margham Publication, Chennai.

4. M.K.Venkataraman(1992)," Higher Engineering Mathematics: III-B", National Publishing Company, Chennai.

II – B.Sc (Maths)		**MT306S**
SEMESTER – III	**VECTOR AND FOURIER ANALYSIS**	**HRS/WK – 6**
CORE – 6	**For the students admitted from the year 2014**	**CREDIT – 4**

OBJECTIVES

The course aims to introduce the concepts of Differentiation of a Vector, Vector Differential Operator, Solenoidal and Irrotational, The Line Integral, Divergence Theorem and Green's Theorem, Stoke's Theorem, Fourier Expansion and Parseval's Identity for Fourier Transforms.

UNIT – I: DIFFERENTIAL VECTOR CALCULUS

Differentiation of a Vector – Geometrical Interpretation of the Derivative – Differentiation Formulae – Differentiation of dot and Cross Products – Partial Derivatives of Vectors – Differentials of Vectors.

UNIT – II: GRADIENT, DIVERGENCE AND CURL

Vector Differential Operator Del – Gradient of a Scalar Function – Directional Derivative – Geometric Interpretation – Gradient of the sum of Functions; of the product of functions and of a function of function – Operations involving Del – Divergence of a Vector and its Physical Interpretation – Curl of a Vector and its Physical Interpretation – Expansion Formulae for Operators involving Del – Solenoidal and Irrotational.

UNIT – III: VECTOR INTEGRATION

The Line Integral – Surface Integral –Volume Integral – Theorem of Gauss Divergence, Stoke's Theorem and Green's Theorem [Without proof].

UNIT – IV: FOURIER SERIES

Conditions for Fourier Expansion – Functions having Discontinuity – Change of Interval – Odd and Even Functions – Expansions of Odd or Even periodic Functions – Half range series.

UNIT – V: FOURIER TRANSFORM

Definition – Fourier Integrals – Fourier Sine and Cosine Integral – Complex Form of Fourier Integral – Fourier Transform: Fourier Sine and Cosine Transforms – Finite Fourier Sine and Cosine Transforms [with out proof] – Properties of Fourier Transforms – Convolution Theorem for Fourier Transforms – Parseval's Identity for Fourier Transforms – [with out derivation].

TEXT BOOKS:

1. P.R.Vittal [2004], "Vector Analysis,Analytical Solid Geometry & Sequences & Series", Margham Publication, Chennai.

Unit-I & II: Chapter-1, Unit-III: Chapter-2.

2. P.R.Vittal [2002], "Differential equations, Fourier &LaplaceTransformsand Probability". Margham Publication, Chennai.

Unit-IV & V: Chapter- 6 & 8.

REFERENCE BOOKS:

1. B.S.Grewal, "Higher Engineering Mathematics" [2002], Khanna Publishers, New Delhi.

2. M.K.Venkataraman(1992), "Higher Engineering Mathematics", III-B, National Publishing Company, Chennai.

II – B.Sc (Maths)	**FUZZY SETS AND APPLICATION**	**MT407S**
SEMESTER – IV		**HRS/WK – 6**
CORE – 7	**For the students admitted from the year 2017**	**CREDIT – 4**

OBJECTIVES:

To get formalized with fuzzy principles and appreciate its nuances by constricting with crisp set and principles

.

UNIT I - FUZZY SET THEORY

Fuzzy sets – Fuzzy set : definition – Different types of fuzzy sets – General definitions and properties of fuzzy sets – Other important operations – General properties : Fuzzy vs Crisp.
(Sec: 1.16 – 1.21)

UNIT II – OPERATIONS ON FUZZY SETS

Introduction – Some important theorems – fuzzy compliments – Further operations on fuzzy sets – t-norms and t-conorms – Intersection and union of fuzzy sets.
(Sec: 2.1, 2.2, 2.4 – 2.9)

UNIT III – FUZZY NUMBERS AND ARITHMETIC

Introduction – fuzzy numbers – algebraic operations with fuzzy numbers – binary operation of two fuzzy numbers – Some special extended operations – Interval analysis in arithmetic – Lattice of fuzzy numbers.
(Sec: 3.1 – 3.5 and 3.11, 3.12)

UNIT IV – FUZZY RELATIONS AND FUZZY GRAPHS.

Introduction – Composition – Properties of Min-max composition – binary relations on a single set – compatibility relation – fuzzy ordering relation.
(Sec: 4.1 and 4.3 -4.7)

UNIT V – FUZZY LOGIC

Fuzzy logic – Fuzzy connectives – fuzzy inference – fuzzy propositions – fuzzy quatifiers – linguistic hedges.
(Sec: 7.13 – 7.18)

TEXT BOOK :

Dr.SudhirK.Pundir and Dr.RimplePundir, Fuzzy sets and their applications.

REFERENCE BOOK:

A.Kaufmann “Introduction to the Theory of fuzzy

II – B.Sc (Maths)	GRAPH THEORY For the students admitted from the year 2008	MT408
SEMESTER – IV		HRS/WK - 5
CORE – 8		CREDIT - 4

OBJECTIVES

The course aims to introduce the concepts of Graphs, Sub graphs, Adjacency and incidence of matrices, Connectedness and components, Eulerian graphs and Hamiltonian graphs, Characterizations of planar graph and chromatic number and index.

UNIT – I:

Graphs- Sub graphs- Degree of a vertex- Isomorphism of graph- independent sets and coverings- intersection graphs.

UNIT –II:

Adjacency and incidence of matrices- Operations on graphs- degree sequences- graphic sequences- Walks- trails- paths.

UNIT –III:

Connectedness and components- cut point- bridge- block- Connectivity theorems.

UNIT – IV:

Eulerian graphs and Hamiltonian graphs- Trees.

UNIT – V:

Planarity- Characterizations of planar graph- Colourability- chromatic number and index.

TEXT BOOK:

1. S. Arumugam and S. Ramachandran, "Invitation to Graph Theory", Sitech Publications India Pvt Ltd, 7/3C, Madley Road, T. Nagar, Chennai – 17.

Unit-I: Chapters: 2(2.0 - 2.7),
Unit-II: Chapters: 2,3,4(Sec:2.8 - 2.9,3.0-3.2,4.0-4.1),
Unit-III: Chapters: 4(4.2,4.3,4.3,4.4),
Unit-IV: Chapters: 5,6(Sec:5.0 - 5.2,6.0-6.2),
Unit-V: Chapters: 8,9(Sec: 8.0 - 8.2, 9.0-9.1).

REFERENCE BOOKS:

1. S. Kumaravelu, SusheelaKumaravelu, "Graph Theory", Publishers, 182, Chidambara Nagar, Nagercoil-629 002.
2. S. A. Choudham, "A First Course In Graph Theory", Macmillan India Ltd.
3. Robin J. Wilson, "Introduction to Graph Theory", Longman Group Ltd.
4. J.A. Bondy and U. S. R. Murthy, "Graph Theory with Applications", Macmillan, London.

YEAR – III		MT509
SEMESTER –V	ABSTRACT ALGEBRA	Hrs / Week: 6
CORE –IX	For the students admitted from the year 2008	Credit: 5

OBJECTIVE:

The Course aim is to introduce the concept of groups and rings and study the notion related theorems

UNIT – I: GROUPS

Definition of a Group - Examples – Subgroups

UNIT – II: GROUP [CONTD]

Counting Principle – Normal Subgroups – Homomorphism.

UNIT – III: GROUP [CONTD]

Automorphisms – Cayley's Theorem – Permutation Groups.

UNIT – IV: RINGS

Definition and Examples - Integral Domain – Homomorphism of Rings – Ideals and Quotient Rings.

UNIT – V : RINGS [CONTD]

Prime Ideal and Maximal Ideal – The field of quotients of an Integral domain – Euclidean rings.

TEXT BOOK:

1. I.N.Herstein.[1989], "Topics in Algebra",[2nd ed] Wiley Eastern Ltd. New Delhi.
   Chapter:2 (Sec: 2.1 – 2.10 [Omit Applications 1 and 2 of 2.7]),
   Chapter : 3 (Sec: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7)

REFERENCE BOOKS:

1. S.Arumugam[2004], "Modern Algebra", SciTech Publications, Chennai.
2. J.B.Fraleigh [1987], "A First Course in Algebra", [3rd edition] Addison Wesley, Mass. [Indian Print]
3. Lloyd R.Jaisingh and Frank Ayres,Jr. [2005], "Abstract Algebra", [2nd edition], Tat McGraw Hill, New Delhi.
4. M.L.Santiago[2002], "Modern Algebra", Tat McGraw Hill, New Delhi
5. SurjeetSingh and QaziZameeruddin[1982], "Modern algebra", Vikas Publishing House Pvt.Ltd. New Delhi.

YEAR – III	REAL ANALYSIS- I For the students admitted from the year 2008	MT510
SEMESTER –V		Hrs / Week: 6
CORE –X		Credit: 5

OBJECTIVES

To expose the students to the basics of real analysis and studying the notion of continuous functions and related theorems

UNIT – I:

Functions – Real valued functions – Equivalence – Countability and Real numbers- Least Upper Bound.

UNIT – II: SEQUENCES

Definition – Subsequences – Limit of sequence – Convergent Sequence – Divergent Sequence – Bounded Sequence – Mono tone Sequence.

UNIT – III: SEQUENCES [CONTD]

Operations on Convergent Sequence Operation on Divergent Sequence – Limit Superior and Limit Inferior – Cauchy sequence.Series: Convergence and Divergence – Series with non-Negative terms – Alternating series – Conditional Convergence and Absolute Convergence.

UNIT –IV: SERIES [CONTD]

Rearrangement of Series – Tests for Absolute Convergence – Series whose terms form a non decreasing Sequence – Summation of Parts.Limits and Metric spaces: Limit of an Function of the Real Line – Metric Spaces – Limits in Metric Spaces.

UNIT – V: CONTINUOUS FUNCTIONS ON METRIC SPACES

Functions Continuous at a point on the real line – Reformulation – Functions Continuous on a Metric Spaces – Open sets – Closed Sets.

TEXT BOOK:

1.R.Goldberg[2000], "Methods of Real Analysis", Oxford & IBH Publishing Co., New Delhi.
Unit-I: Chapter:1(1.4 - 1.7),
Unit-II: Chapter:2 (2.1-2.6),
Unit-III: Chapter:2,3(2.7-2.10,3.1-3.4),
Unit-IV: Chapter:3,4 (3.5 -3.8,4.1-4.3),
Unit-V: Chapter:5(5.1 -5.5).

REFERENCE BOOKS:

1.Tom M. Apostol [1974]. Mathematical Analysis, 2nd Edition, Addison – Wesley, New York.
2.Bartle,R.G. and Shebert [1976], "Real Analysis", John Willy & Sons Inc., New York.
3.Malik, S.C and SavithaArora [1991], "Mathematical Analysis", Willy Eastern Ltd, New Delhi.

YEAR – III	COMPLEX ANALYSIS-I For the students admitted from the year 2008	MT511
SEMESTER –V		Hrs / Week: 6
CORE –XI		Credit: 5

OBJECTIVES:

The course aims to introduce the concepts of complex numbers, functions of complex variables, limits and continuity, Cauchy Riemann equations and analytic functions, elementary functions, Definite integrals of functions

UNIT- I:

Complex numbers: Sums and products – Basic algebraic properties – Further properties – Vectors and Moduli – Complex conjugates – Exponential form – Products and powers in exponential form – Arguments of products and quotients – Roots of complex numbers – Examples – Regions in the complex plane.

UNIT- II:

Functions of a Complex variable – Mappings - Mapping by exponential functions – Limits – Theorems on Limits – Limits involving the point at infinity – Continuity – Derivatives – Differentiation formulas

UNIT- III:

Cauchy-Riemann Equations-Sufficient Conditions For Differentiability-Polar Coordinates-Analytic Functions-Examples-Harmonic Functions-Uniquely Determined Analytic Functions-Reflection Principle.

UNIT- IV:

The Exponential Function-The Logarithmic Function-Branches And Derivatives Of Logarithms-Trignometric Functions-Hyperbolic Function.

UNIT- V:

Derivatives of Functions (t)- Definite Integrals of Functions (t)- Contours- Contour Integrals-Some Examples-Upper Bounds For Moduli of Contour Integrals- Antiderivatives-Proof of The Theorem-Cauchy-Goursat Theorem- Proof of The Theorem(omit proof of the lemma).

TEXT BOOK:

"Complex Variables and Applications", James Ward Brown, Ruel V. Churchill, McGraw – Hill International Edition(2009).

Unit-I: Chapter-1 (sec: 1 - 11), Unit-II: Chapter-2 (Sec: 12 - 20),Unit-III: Chapter-2 (Sec: 21-28), Unit-IV:Chapter-3 (Sec: 29-31 ,34-35), Unit-V:Chapter-4 (Sec: 37-41,43-47).

REFERENCE BOOKS:

1."Functions of a Complex Variable", J.K.Goyal , K.P. Gupta(18^{th} Revised), Enlarged Edition 2004, PragathiPrakashan Publishers, Meerut, UP.

2. P. Duraipandian and LaxmiDuraipandian(1976), "Complex Analysis", Emerald Publishers, Chennai.

3. S.Ponnusamy(2000), "Foundations of Complex Analysis", Narosa Publishing House, New Delhi.

4. Murray R. Spiegel(2005), "Theory and Problems of Complex Variable", Tata-McGraw Hill Edition, New Delhi.

YEAR – III	MECHANICS For the students admitted from the year 2017	17EMT512
SEMESTER –V		Hrs / Week: 6
CORE-XII		Credit: 5

OBJECTIVES:

The course aims to introduce the concept of type of forces, magnitude and direction, kinematics, projectiles, central orbital, momentum of interia.

UNIT-I FORCE:

Types of Force- Magnitude and direction of the resultant of the force acting on a particle – Triangle of Force –Lamie's Theorem.

UNIT-II KINEMATICS:

Kinematics of a particle- Velocity-Accelaration-RelativeVelocity-Relative Accealration-Angular Veloacity-Accelaration Components in Co-planer motion along
[a] Two fixed perpendicular direction ,
[b] Tangential and Normal Direction
[c] Radial and Transverse direction .
Work, Power, Energy , Principal of Work and Energy. Rectlinear motion with uniform acceleration.Simple Harmonic Motion.

UNIT-III PROJECTILES

Motion of the Projectile , Nature of Trajectory, Result Pertaining to the motion of the projectile, range on an inclined plane.

UNIT-IV CENTRAL ORBIT

Central Forces and Central Orbit , Equation of Central orbit, Finding Law of Force and Speed of a given orbit , finding the orbit given the Law of Force .

UNIT-V MOMENTUM OF INERTIA

Momentum of Inertia of Simple Body, Theorems of Parallel anf Perpendicular Aixs , Momentum of Inertia Triangular Lamina, Circular Lamina, Circular Ring , Right Circuklar Cone, Sphere.(Solid and Hollow)

TEXT BOOK:

P.Duraipandian, Lakshmi Duraipandian and MuthamizhJayapragasam [2012], "Mechanics", Revised Edition, S.Chand& Co, New Delhi.
Unit-I: Chapter-2 & 3 (sec: 2.1-2.2), and 3.2-3.4
Unit-II: Chapter-1 (Sec: 1.2,2.2,2.3,1.3,4.1,4.2,4.3,),Chapter 11(sec 11.1-11.3)
chapter -1(1.3.1,1.3.2), Chapter- 12(12.1-12.1.2)
Unit-III: Chapter-13 (Sec: 13.1,13.1-13.1.3,4-6,13.2,13.2.1),
Unit-IV:Chapter-16 (Sec:16.1,16.2,16.2.1,16.2.2,16.2.3,16.3),
Unit-V:Chapter-17 (Sec:17.1-17.1.1).

REFERENCE BOOKS:

1.A.V.Dharmapadam [1991], “Mechanics” ,S.Viswanathan and Co. Chennai.
2.S.L.Loney [1982], “Elements of Dynamics”, Macmillan India, Delhi.
3.M.K.Venkataraman [1990], “Dynamics”, Agasthier Book Depot, Trichy- 1.
4.P.N.Chatterjee[1992], “Dynamics”, A Rajhans Publication, (19^{th} Ed) .
5.JosephF.Shelley [2005], “Vector Mechanics for Engineers Vol-I: Dynamics”, Tata McGraw Hill Edition, New Delhi.

YEAR – III	**SPECIAL FUNCTIONS** **For the students admitted from the year 2017**	EMT512A
SEMESTER –V		**Hrs / Week: 6**
ELECTIVE –I		**Credit: 5**

OBJECTIVES:

To develop computational skill in certain special functions which are frequently occurring in higher mathematics and mathematical physics.

UNIT-I:

Properties of Linear Operators - Simultaneous Linear Differential Equations - Special Solvable Types of Nonlinear Equations.

UNIT-II:

Numerical Solutions Using Taylor Series - Adams and Modified Adams Method - Extrapolation with Differences

UNIT-III:

Properties of Power Series - Examples - Singular Points of Linear Second Order Differential Equations - Method of Frobenius.

UNIT-IV:

Bessel Functions - Properties - Legendre Functions.

UNIT-V:

Term by Term Differentiation of Fourier Series, Legendre Series - Fourier Integral.

TEXT BOOK:

1. F.B.Hildebrand. (1977) Advanced Calculus for Applications. Prentice Hall. New Jersey. B.Sc. Mathematics : Syllabus (CBCS)

REFERENCE BOOKS:

1. J.N.Sharma and R.K.Gupta (1998) Special Functions, Krishna Prakashan Mandir, Meerut.
2. Satya Prakash. (2004)Mathematical Physics.Sultan & Sons. New Delhi.
3. B.D.Gupta (1978) Mathematical Physics, Vikas Publishing House.

YEAR – III	MATLAB For the students admitted from the year 2014	EMT513S
SEMESTER –V		Hrs / Week: 6
ELECTIVE-I		Credit: 5

OBJECTIVE:

To expose the students to the basics of Matlab windows, Operations in Matlab, Loops and Polynomials and ordinary differential equation using Matlab.

UNIT – I STARTING WITH MATLAB, CREATING ARRAYS

Starting with MATLAB, MATLAB Windows – Working in the Command windows – Arithmetic Operations with Scalars – Display formats – Elementary Math Bult in functions – Defining Scalar Variable – Creating one dimensional arrays and Creating two dimensional arrays.

Chapter 1: 1.1 – 1.6 **Chapter 2:** 2.1 – 2.2

UNIT – II MATHEMATICAL OPERATIONS WITH ARRAYS

Addition and Subtraction – Array Multiplication – Array Division – Element by Element Operation – Using Arrays in MATLAB – Bult in Math Function – Bult in Functions for Analyzing Arrays.

Chapter 3: 3.1 – 3.6

UNIT – III PROGRAMMING IN MATLAB

Relational operator and Logical operator – Conditional Statement – The Switch Statement – Loops – Nested Loop and Nested Conditional Statement – The Break and Continue Commands.

Chapter 7 : 7.1 – 7.6

UNIT – IV POLYNOMIALS, CURVE FITTING AND INTERPOLATION

Polynomials – Curve fitting – Interpolation – The Basic fitting Interface.

Chapter 8: 8.1 – 8.4

UNIT – V APPLICATION IN NUMERICAL ANALYSIS

Solving an Equation with one variable – Finding a Maximum or a Minimum of a function – Numerical Integration – Ordinary Differential Equation.

Chapter 10: 10.1 – 10.4

TEXT BOOK :

MATLAB An Introduction with ApplicationsAMOS GILAT – John wiley& sons, INC

YEAR-**III**	**Theory of Fuzzy number System** **For the students admitted from the year 2017**	EMT513A
SEMESTER – V		**HRS/WK - 6**
ELECTIVE-I (OPTIONAL)		**CREDIT – 5**

OBJECTIVES:

To get formalized with fuzzy principles and appreciate its nuances by constricting with crisp set and principles

UNIT I - FUZZY SET THEORY

Fuzzy sets – Fuzzy set : definition – Different types of fuzzy sets – General definitions and properties of fuzzy sets – Other important operations – General properties : Fuzzy vs Crisp.
(Sec: 1.16 – 1.21)

UNIT II – OPERATIONS ON FUZZY SETS

Introduction – Some important theorems – fuzzy compliments – Further operations on fuzzy sets – t-norms and t-conorms – Intersection and union of fuzzy sets.
(Sec: 2.1, 2.2, 2.4 – 2.9)

UNIT III – FUZZY NUMBERS AND ARITHMETIC

Introduction – fuzzy numbers – algebraic operations with fuzzy numbers – binary operation of two fuzzy numbers – Some special extended operations – Interval analysis in arithmetic – Lattice of fuzzy numbers.
(Sec: 3.1 – 3.5 and 3.11, 3.12)

UNIT IV – FUZZY RELATIONS AND FUZZY GRAPHS.

Introduction – Composition – Properties of Min-max composition – binary relations on a single set – compatibility relation – fuzzy ordering relation.
(Sec: 4.1 and 4.3 -4.7)

UNIT V – FUZZY LOGIC

Fuzzy logic – Fuzzy connectives – fuzzy inference – fuzzy propositions – fuzzy quatifiers – linguistic hedges.
(Sec: 7.13 – 7.18)

TEXT BOOK :

Dr.SudhirK.Pundir and Dr.RimplePundir, Fuzzy sets and their applications.

REFERENCE BOOK:

A.Kaufmann "Introduction to the Theory of fuzzy

YEAR– III	LINEAR ALGEBRA For the students admitted from the year 2008	MT614
SEMESTER –VI		Hrs / Week: 6
CORE-XIV		Credit: 5

OBJECTIVES:

Continuations of Abstract Algebra, we study about Vector Spaces and its linear equations.

UNIT - I : VECTOR SPACES

Linear dependence and independence- Definition and examples.

UNIT – II: VECTOR SPACES [CONTD]

Dual space – inner product spaces.

UNIT – III:LINEAR TRANSFORMATIONS

Algebra of linear transformations – characteristics roots;

UNIT – IV: LINEAR TRANSFORMATIONS [CONTD]

Matrices, canonical forms: triangular forms.

UNIT – V: LINEAR TRANSFORMATIONS [CONTD]

Trace and Transpose, Determinants

TEXT BOOK:

I.N.Herstein [1989], "Topics in Algebra", Wiley Eastern Ltd. New Delhi.
Chapters – 4 & 6(Sec: 4.1, 4.2, 4.3, 4.4 & 6.1, 6.2, 6.3, 6.4, 6.8, 6.9).

REFERENCE BOOKS:

1. S.Arumugam.[2004], "Modern Algebra", Scitech Publications, Chennai.
2.J.B.Fraleigh [1987], "A First Course in Algebra", [3rd edition] Addison Wesley, Mass. [Indian Print]
3.LloydR.Jaisingh and Frank Ayres,Jr. [2005], "Abstract Algebra", [2nd edition], Tata McGraw Hill, New Delhi.
4.M.L.Santiago[2002], "Modern Algebra", Tata McGraw Hill, New Delhi
5.Surjeet Singh and QaziZameeruddin[1982], "Modern algebra", Vikas Publishing House Pvt.Ltd. New Delhi.

YEAR – III	REAL ANALYSIS-II For the students admitted from the year 2008	MT615
SEMESTER –V		Hrs / Week: 6
CORE-XV		Credit: 5

OBJECTIVE:

To develop the understanding of complete, compactness of sequence and series of functions, integration process of Riemann and to enhance the mathematical maturity and to work comfortably with concepts

UNIT – I: CONNECTEDNESS

More about Open Sets – Connected Sets –Bounded Sets and Totally Bounded Sets

UNIT –II: COMPLETENESS, COMPACTNESS

Complete Metric Spaces – Compact Metric Space – Continuous Functions on Compact Metric Spaces – Continuity of Inverse Functions

UNIT – III: RIEMANN INTEGRATION

Definition of the Riemann Integral – Properties of the Riemann Integral – Derivatives – Rolle's Theorem

UNIT – IV: IMPROPER RIEMANN INTEGRATION

The Law of the Mean – Fundamental Theorem of Calculus – Improper Integrals – Cauchy's Principle Value.

UNIT –V: TAYLOR'S THEOREM

Taylor's Theorem: Taylor's Formula with Different Forms of Remainder – The Binomial Theorem - L' Hospital Rule

TEXT BOOK:

R.Goldberg. [2000] Methods of Real Analysis. Oxford & IBH Publishing Co., New Delhi.
Unit:I Chap:6(Sec:6.1-6.4), Unit-II: Chap:6 (Sec:6.4-6.7)
Unit-III: Chap:7(Sec: 7.2-7.6(omit 7.3)),Unit-IV: Chap:7(Sec:7.7-7.10),
Unit-V: Chap: 8(Sec:8.5-8.7)

REFERENCE BOOKS:

1.Tom M. Apostol [1974]. Mathematical Analysis, 2nd Edition, Addison – Wesley, New York.
2.Bartle,R.G. and Shebert [1976] Real Analysis, John Willy & Sons Inc., New York.
3.Malik, S.C and SavithaArora [1991] Mathematical Analysis Willy Eastern Ltd, New Delhi.

YEAR – III	COMPLEX ANALYSIS-II For the students admitted from the year 2008	MT616
SEMESTER –VI		Hrs / Week: 6
CORE-XVI		Credit: 5

OBJECTIVES:

The course aims to introduce the concepts of connected domains Liouville's theorem, convergence sequence and series along with Taylor's and Laurent's series, Cauchy, improper and definite integrals, linear transformations and conformal mapping.

UNIT- I:

Simply connected domains – Multiply connected domains – Cauchy integral's formula – An extension of Cauchy integral's formula – Some consequences of the extension – Liouville's theorem and the fundamental theorem of Algebra – Maximum modulus principle.

UNIT- II:

Convergence of sequences – Convergence of series – Taylors Series – Proof of Taylor's theorem – Examples – Laurent Series – Proof of Laurent's Theorem – Examples – Uniqueness of Series representations.

UNIT -III:

Isolated singular points – Residues – Cauchy's Residue Theorem – Residue at infinity – The three types of isolated singular points – Residues at poles – Examples – Zeros of an analytic function – Zeros and poles.

UNIT -IV:

Evaluation of improper integrals – Examples – Improper integrals from Fourier Analysis – Jordan' s lemma – Definite integrals involving sines and cosines – Argument principle – Rouche's Theorem.

UNIT V:

Linear transformations – The transformation w = 1/z - Linear fractional transformations – implicit form – Mappings of the upper half plane(Omit examples) Conformal mapping: Preservation of angles

TEXT BOOK:

1."Complex Variables and Applications", James Ward Brown, Ruel V. Churchill, McGraw – Hill International Edition(2009).

Unit-I: Chap:4 (Sec:4.48-4.45)

Unit-II: Chap:5(Sec: 5.55-5.62,5.66), Unit-III:Chap:6(Sec:6.68-6.76)

Unit-IV:Chap:7(Sec:7.78-7.81,7.85-7.87)

Unit-V: Chap:8(Sec:8.90-8.95), Chap:9(Sec:9.101)

REFERENCE BOOKS:

1. Functions of a complex variable, J.K.Goyal , K.P. Gupta(18^{th} Revised), Enlarged Edition 2004, PragathiPrakashan Publishers, Meerut, UP.
2. P. Duraipandian and LaxmiDuraipandian(1976), Complex Analysis, Emerald Publishers, Chennai.
3. S.Ponnusamy(2000)Foundations of Complex Analysis, Narosa Publishing House, New Delhi.
4. Murray R. Spiegel(2005), Theory and Problems of Complex Variable, Tata-McGraw Hill Edition, New Delhi.

YEAR – III	THEORY: PROGRAMMING IN C LANGUAGE For the students admitted from the year 2014	EMT617S
SEMESTER –VI		Hrs / Week: 4
ELECTIVE-II		Credit: 3

OBJECTIVE:

To make the students abreast with the programming concepts and to master them in C Language.

UNIT –I: OVERVIEW OF C

Basic Structure of C Programs- Programming style- Executing a 'C' Programs –'c' Tokens-Keywords and Identifiers.

UNIT – II: CONSTANTS, VARIABLES & DATA TYPE

Constants-Variables-Data Types- Declaration of Variables- Declaration of Storage Class-Assigning values to variables.

UNIT – III: OPERATORS AND EXPRESSION

Arithmetic Operators-Relational operators- Logical operators-Assignment operators-Increment and decrement operators-Conditional operators-Bitwise operators-Evaluation of Expressions-Precedence of Arithmetic operators.

UNIT –IV:FORMATTED INPUT,OUTPUT& DECISION MAKING AND BRANCHING

Formatted input- Formatted output- Decision making with 'IF' statement- Simple IF statement-The IF….ELSE statement-Nesting of IF…ELSE statement-The ELSE IF ladder-The switch statement – The ?: Operators- The GOTO statement.

UNIT – V: DECISION MAKING AND LOOPING & ARRAYS

The WHILE statement-The DO statement-The FOR statement- Jumps in LOOPS-One dimensional array-Declaration of one dimensional arrays-Initialization of one dimensional arrays-Two dimensional arrays-Multi dimensional arrays.

TEXT BOOK:

1. E. Balagurusamy [1996], "Programming in ANSI C" .Tata McGraw Hill.

Unit:I Chap:1(1.8-1.10),Chap:2 (2.3,2.4)
Unit:II Chap:2 (2.5-2.10),
Unit:III Chap: 3 (3.2-3.12),
Unit-IV Chap:4 (4.4,4.5),Chap:5 (5.2-5.9),
Unit:V Chap:6 (6.2-6.5),Chap:7(7.2-7.7)s

REFERENCE BOOKS:

1.V.Rajaraman [1995], "Computer Programming In C", Prentice Hall. New Delhi.
2.H.Schildt, Obsborne (1994), "Teach Yourself C", McGraw Hill, New York ,Mullish Cooper.
3. "The Spirit of C – An Introduction to Modern Programming",Jaico Publishing House. Delhi. 1998.
4.YashavantKanetkar, "Let Us C", 6th edition BPB publication

YEAR – III	**PRACTICAL: COMPUTER PRACTICAL IN C LANGUAGE** **For the students admitted from the year 2014**	**MTP601**
SEMESTER –VI		**Hrs / Week: 2**
MAIN		**Credit: 2**

The following exercise shall be performed as minimum mandatory requirements [for eligibility to take the practical examination] and a RECORD of the code-listing and outputs shall be maintained by each student.

1. Assigning the ASCII value.
2. Square of numbers: Using For loop, While loop
3. Square of numbers: Do- while loop, Go to statement.
4. Characters between two given characters.
5. Number of Vowels and consonants.
6. Three – dimensional matrix
7. Prime numbers between two give numbers
8. Fibonacci series
9. Factorial numbers
10. Power of a value
11. Interchange sort
12. Shell sort
13. Student record.

REFERENCE BOOKS:

1."The spirit if C", Mullish Cooper, Indian edition by jaicopubishers, 1987.

2. "Teach yourself C", Herbert Schildt, ObsbomeMegrawhill, 2nd edition 1994 Programming in C- Schaum series.

YEAR – III	**MATHEMATICAL MODELING** **For the students admitted from the year 2017**	EMT617A
SEMESTER –VI		**Hrs / Week: 6**
ELECTIVE-II (OPTIONAL)		**Credit: 5**

OBJECTIVE:

To achieve a broad understanding of the objectives of mathematical modelling within the physical sciences

UNIT I

Mathematical Modelling through Ordinary Differential Equations of First order : Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

UNIT II

Mathematical Modelling through Systems of Ordinary Differential Equations of First Order : Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III

Mathematical Modelling through Ordinary Differential Equations of Second Order : Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

UNIT IV

Mathematical Modelling through Difference Equations : Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT V

Mathematical Modelling through Graphs : Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

TEXT BOOK:

1. J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, New Delhi, 1988.

REFERENCE BOOK:

1. J.N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi, 1985.

YEAR – III	OPERATIONS RESEARCH For the students admitted from the year 2014	EMT618S
SEMESTER –VI		Hrs / Week: 6
ELECTIVE-III		Credit: 5

OBJECTIVES

The course aim is to introduce linear programming, transportation methods, assignment models, sequencing problem, game theory and network analysis in project planning

UNIT - I : LINEAR PROGRAMMING

Definitions of OR - formulations of Linear programming problem - Graphical methods of solution - The simplex method - Artificial variables techniques - The Big-M method - The two-phase method.

UNIT - II : TRANSPORTATION METHODS

Definitions of the transportation model - Formulation and solution of transportation models - North-west corner rule - Least cost method - Vogel's approximation method - Solution of transportation - MODI method.

UNIT - III : ASSIGNMENT MODELS

Definition of Assignment models - Mathematical representation of assignment models - Comparison with the transportation models - Solution of the assignment model - The hungarian methods for solution of the assignment models - variation of the assignment problem.

SEQUENCING PROBLEM

Sequencing problems - processing 'n' jobs through two machines - processing 'n' jobs through three machines - processing two jobs through 'm' machines - processing n jobs through 'm' machines.

UNIT - IV : GAME THEORY

Definitions - Rules for game theory - Rule 1 look for a pure strategy - Rule 2 reduce game by dominance - Rule 3 Solve for mixed strategy - Mixed strategies (2x2 games) - Mixed strategies (2xn games & mx2 games) - mixed strategies (3x3 or higher games).

UNIT - V : NETWORK ANALYSIS IN PROJECT PLANNING

Basic tools and techniques of project managements - Network logic - Numbering the events - Activity on node diagram - Critical path method - Programme evaluation and review technique [PERT].

TEXT BOOK:

1. Prem Kumar Gupta, D.S. Hira[2008], “Operation Research”s.

Chapters: 1 – 5 , 9 &14 (Sec:1.2 &2.6,2.9,2.16-2.17,2.17.1-2.17.2 &3.3,3.5 &4.1- 4.5,4.7 &5.1,5.4,5.5,5.6,5.7 & 9.13 – 9.20 & 14.6,14.8 – 14.10,14.12,14.13).

YEAR – III	ASTRONOMY (Optional Paper) For the students admitted in the year 2017	EMT618A
SEMESTER –VI		Hrs / Week: 6
ELECTIVE-III (OPTIONAL)		Credit: 5

OBJECTIVE:

To expose the students to the basics of Spherical Trigonometry basics, Astronomical Refraction and Laws to know the Planets.

UNIT-I : SPHERICAL TRIGONOMETRY

Celestial Sphere – Dinural motion – Simple Problems.

UNIT-II : THE EARTH

Zones of Earth – Terrestial Latitudes and Longitudes – Rotation of Earth – Dip of the horizon – Twilight – Simple problems.

UNIT-III

Astronomical Refraction – Geocentric Parallax – Simple problems.

UNIT-IV

Kepler's Laws – simple problems, Equation of Time – Seasons – Calendar – Conversion of Time

UNIT-V

Moon : Different phases of moon – full moon – new moon – necessary and sufficient condition .

TEXT BOOK:

S. Kumaravelu and SusheelaKumaravelu (2004), "Astronomy", SKV Publishers,Nagarkoil.
Unit-I: (Sec: 1 – 86),Unit-II: (Sec: 87-91,105-109),Unit-III: (Sec: 117-133,135-144).

REFERENCE BOOKS:

1. L.W.Frederick and R.H.Baker (1976), "Astronomy" (10th Ed.) Vas Nostrand,New York.
2. R.Jastrow and M.H. Thompson (1984), "Astronomy : Fundamentals and Frontiers", (4th Ed) John Wiley & Sons, New York.
3. H. Karttunenet. Al. (2003), "Fundamental Astronomy", (4th Ed) SpringerVerlag, Berlin.
4. L. Motz and A. Duveen(1977), "Essentials of Astronomy", (2nd Ed)Columbia University Press, New York.
5. G.V. Ramachandran(1965), "A Text Book of Astronomy", (5thEdn)Published by Mrs. RukmaniRamachandran, Tiruchirappalli.
6. M.Zeilik(2002), "Astronomy: The Evolving Universe", (9thEdn) CambridgeUniversity Press, Cambridge.

YEAR – I	ALLIED MATHEMATICS – I For the students admitted from the year 2017	AMCS101T
SEMESTER – I		HRS/WK – 8
ALLIED – 1		CREDIT –5

(For B.Sc Computer Science)

OBJECTIVES

This subject covers the topics Theory of equations, matrices, differential calculus, Integral calculus and vector analysis, to explore the fundamental concepts of Mathematics.

UNIT-I: THEORY OF EQUATIONS

Polynomial Equations with real Coefficients – Irrational roots – Complex roots – Symmetric functions of roots.

UNIT-II: THEORY OF EQUATIONS(CONTD)

Transformation of equation by increasing or decreasing roots by a constant – Reciprocal equations – Newton's method to find a root approximately (without proof).

UNIT-III:MATRICES

Rank of a matrix – Consistency of equations – Eigen roots and Eigen vectors – Cayley – Hamilton's theorem [without proof] – Verification and computation of inverse matrix.

UNIT-IV: TRIGONOMETRY

Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ – Expansions of $\sin\theta$, $\cos\theta$, $\tan\theta$ in terms of θ – Hyperbolic and inverse hyperbolic functions – Logarithms of complex numbers.

UNIT-V: DIFFERENTIAL CALCULUS

n-th derivatives – Leibnitz theorem [without proof] and its applications – Jacobians – Concepts of polar co-ordinates – Curvature and radius curvature in Cartesian co-ordinates.

TEXT BOOK:

1.P. Duraipandian and S. Udayabaskaran. 2005, " Allied Mathematics", Vol I & II. Chennai: Muhil Publishers.

Unit-I: Chap:3(3.1,3.1.1,3.1.2,3.2,3.2.1)
Unit-II: Chap:3(3.2.2,3.3,3.4.1), Unit-III: Chap:4(4.4,4.5,4.5.2,4.5.3),
Unit-IV: Chap:6 (6.1,6.1.1-6.1.3,6.2,6.2.1-6.2.3,6.3,6.4),
Unit-V: Chap:1(1.1.1,1.1.2,1.2,1.4.3,1.4).

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian. 1997, " Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan 2005, "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal(2003), "Allied Mathematics", Chennai: Marghan Publications.
4. P.Kandhasamy, K. Thilagavathy(2003), "Allied Mathematics", Vol I & II. New Delhi: S. Chand & Co Ltd.

I – BCA		**AMTCA101**
SEMESTER - I	**MATHEMATICAL FOUNDATIONS**	**HRS/WK – 5**
ALLIED – 1	**For the students admitted from the year 2008**	**CREDIT – 5**

(For B.C.A. I – Year)

OBJECTIVE:

To learn how to apply fundamental mathematical tools and techniques used in most fields of science and mathematics

UNIT –I:LOGICAL OPERATORS

Conjunction, disjunction, negation, conditional and bi-conditional operators.Converse, inverse, contra-positive, logically equivalent, tautology and contradiction, arguments and validity of arguments.

UNIT-II:SET THEORY

Set theory, Relations and Functions.

UNIT –III:PERMUTATION& COMBINATION

Binary operations, Permutations and Combinations, Mathematical induction.

UNIT –IV:MATRICES

Types of matrices, operations on matrices, simple problems, singular and non-singular matrices, adjoint of a matrix, inverse of a matrix,symmetric and skew-symmetric, Hermitian and skew-Hermitian, orthogonal and unitary matrices, rank of a matrix.

Consistency of a system of linear equations by

1. Cramer's rule
2. Matrix inversion method.
3. Rank method.

UNIT –V:MATRIX (CONTD)

Characteristic roots and characteristic vectors, and problems on Cayley-Hamilton theorem.

APPLICATION OF MATRICES: Matrix of linear transformation: Reflection about x -axis, y axis, the line y = x, and the line y = -x, rotation about the origin through an angleθ, expression and compression, shears, translation, successive transformation.

TEXT BOOKS:

1. "Mathematical Foundations", P.R.Vittal, Margham Publications, Chennai.
   Unit-I: Chapter 1(Pages : 1.1 -1.50),
   Unit-II: Chapter:2&3&4 (Pages: 2.1- 2.38 &3.1 -3.25 & 4.1-4.35),
   Unit-III:Chapter:6& 7(Pages:6.1 -6.10 & 7.1-7.53),
Unit-IV:Chapter 8(Pages:8.1 to 8.97),
   Unit-V: Chapter:8&9 (Pages:8.97-8.140 & 9.1-9.7).

REFERENCE BOOKS:

1."Discrete Mathematics", Second edition, Seymour Lipschutz& Marc Lipson, Schaum's outlines, Tata McGraw-Hill.

2. Discrete Mathematics, B.S. Vatssa, WishwaPrakashan.

YEAR – I	ALLIED MATHEMATICS – I For the students admitted from the year 2017	AMT101Q
SEMESTER – I		HRS/WK –8
ALLIED- 1		CREDIT - 5

(For B.Sc. Physics & Chemistry)

OBJECTIVES:

To acquire knowledge on finding roots of the complex equation.And to improve their ability on applications of matrices and calculus.

UNIT-I: THEORY OF EQUATIONS

Polynomial Equations with real Coefficients – Irrational roots – Complex roots – Symmetric functions of roots.

UNIT-II: THEORY OF EQUATIONS(CONTD)

Transformation of equation by increasing or decreasing roots by a constant – Reciprocal equations – Newton's method to find a root approximately (without proof) .

UNIT-III:MATRICES

Characteristic equation of a square matrix– Eigen roots and eigen vectors – Cayley – Hamilton theorem [without proof] – Verification and computation of inverse matrix-

UNIT-IV: DIFFERENTIAL CALCULUS

n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians– Curvature and radius of curvature in Cartesian co-ordinates and polar co-ordinates.

UNIT-V: APPLICATION OF INTEGRATION

Evaluation of double, triple integrals – Simple applications to area, volume and centroid.

TEXT BOOK:

P. Duraipandian and Dr. S. Udayabaskaran. 1997, "Allied Mathematics" ,Vol I & II. Chennai: Muhil Publishers.

Unit-I: Sec(3.1,3.1.1,3.1.2,3.2,3.2.1),
Unit-II:Sec(3.2.2,3.3,3,3.4),
Unit-III:Sec(1.1.1,1.1.2,1.2,1.4.3),
Unit-IV:Sec(2.7,4.1,4.1.1,4.2),
Unit-V: Chap:3(3.4,3.4.1,3.5,3.5.1,3.5.2,3.6),

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal (2003), "Allied Mathematics",Chennai: Marghan Publications.

P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II. New

YEAR – I	ALLIED MATHEMATICS – II For the students admitted from the year 2017	AMCS202T
SEMESTER – II		HRS/WK –8
ALLIED – 2		CREDIT - 5

(For B.Sc Computer Science)

OBJECTIVES

This subject covers the topics Laplace Transform, Vector differentiation & Integration, Finite Differences, to explore the fundamental concepts of Mathematics.

UNIT-I: LAPLACE TRANSFORMS

Laplace Transformations of standard functions and properties – Inverse Laplace transforms.

UNIT-II:LAPLACE TRANSFORM(CONTD)

Applications to solutions of linear differential equations of order 1 and 2.

UNIT-III:VECTOR DIFFERENTIATION

Scalar point functions-Vector point functions-Gradient-Divergence-Curl-Directional Derivatives-Unit to normal to a surface.

UNIT-IV: VECTOR INTEGRATION

Gauss, Stoke's and Green's theorems [without proofs].

UNIT-V: FINITE DIFFERENCES

Operator E, Relation between Δ, ∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation-Lagrange's interpolation formula for unequal intervals(without proof) .

TEXT BOOK:

1.P. Duraipandian and S. Udayabaskaran(1997), "Allied Mathematics", Vol I & II. Chennai.Muhil Publishers.

Unit-I: Sec(7.1.1-7.1.4,7.2,7.2.1,7.2.2,7.2.3),
Unit-II:Sec(7.3), Unit-III:Sec(8.1,8.1.1,8.2,8.3,8.3.1,8.3.2,8.4,8.4.1,8.4.2,8.4.3,8.4.4),
Unit-IV:Sec(8.6.1, - 8.6.3),
Unit-V:Sec(…).

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian.1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal (2003), "Allied Mathematics",Chennai: Marghan Publications.
4. P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II. New Delhi: S. Chand & Co Ltd.

YEAR – I	ALLIED MATHEMATICS – II For the students admitted from the year 2017	AMT202T
SEMESTER – II		HRS/WK – 8
ALLIED- 1I		CREDIT - 5

(For B.Sc Physics & Chemistry)

OBJECTIVES:

To expand trigonometric functions and also to find partial differential equations and to learn about vector differentiations and integrations and too familiar with physical interpretation of divergence and curl of a vector

UNIT-I:TRIGONOMETRY

Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ – Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ – Hyperbolic and inverse hyperbolic functions – Logarithms of complex numbers.

UNIT-III:PARTIAL DIFFERENTIAL EQUATIONS

Formation-complete integrals and general integrals-Four standard types-Lagranges equation.

UNIT-III: VECTOR DIFFRENTIATION

Gradient- Directional derivatives –Unit vector normal to a surface – angle between the surfaces-divergence, curl.

UNIT-IV: VECTOR INTEGRATION

Gauss, Stoke's and Green's theorems [without proofs].

UNIT-V: FINITE DIFFERENCES

Operator E, Relation between Δ, ∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation-Lagrange's interpolation formula for unequal intervals(without proof) .

TEXT BOOK:

P. Duraipandian and S. Udayabaskaran(1997), "Allied Mathematics", Vol I & II. Chennai: Muhil Publishers.

Unit-I: Chap: 6 (6.1,6.1.1-6.1.3,6.2,6.2.1-6.2.3,6.3,6.4),
Unit-II: Chap:6 (6.1,6.1.1,6.2,6.3,6.4),
Unit-IIISec(8.1,8.1.1,8.2,8.3,8.3.1,8.3.2,8.4,8.4.1,8.4.2,8.4.3,8.4.4),
Unit-IV:Sec(8.6.1, - 8.6.3),
Unit-V:Sec(5.1,5.2).

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal (2003), "Allied Mathematics",Chennai: Marghan Publications.
4. P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II. New

II – BCA	**NUMERICAL METHODS** **For the students admitted in the year 2008**	**AMTCA302**
SEMESTER - III		**HRS/WK – 5**
Allied-2		**CREDIT – 4**

OBJECTIVES

The course aims to introduce the concepts of Finite differences, Central differences, Interpolation for unequal intervals, Inverse interpolation and Solutions of simultaneous linear equations.

UNIT- I: FINITE DIFFERENCES

First and higher order differences-forward differences and Back ward differences-Properties of operators-Differences of a Polynomial-Factorial Polynomials – Operator E, Relation between Δ, ∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation(without proof) – simple problems.

UNIT-II: CENTRAL DIFFERENCES

Central difference Operators – Central differences formulae: Gauss Forward and Backward formulae(without proof) – simple problems – Sterling's formula(without proof) – simple problems – Bessel's formula(without proof) – simple problems.

UNIT – III: INTERPOLATING FOR UNEQUAL INTERVALS AND INVERSE INTERPOLATION

Divided differences – Newton's divided differences formula and Lagrange's formula – Estimating the Missing terms [with one or more missing values] - Lagrange's method and Reversion of series method [Using Newton's forward formula only]..

UNIT – IV: SOLUTION OF SIMULTANEOUS EQUATION

Gauss elimination method – matrix inversion method – Gauss – Jordan Method, Gauss – Seidal method – Crout's method [Three unknowns only].

UNIT – V: SOLUTION OF DIFFERENTIAL EQUATION

Solving second order differential equation, Rungekutta method, Euler's modified method, Euler's method, Adam's method.

TEXT BOOKS:

1. A.Singaravelu [2004], "Numerical Methods", Meenakshi Agency, Chennai
2. M.K.Venkataraman(1992), "Numerical methods for Science and Engineering", National Publishing Company., Chennai.

REFERENCE BOOKS :

1. S.Arumugham(2003), "Numerical Methods", New Gamma Publishing, Palayamkottai.
2. H.C.Saxena(1991), "Finite differences and Numerical Analysis", S.Chand& Co. Delhi
3. B.D.Gupta(2001), "Numerical Analysis", Konark Pub. Ltd., Delhi
4. P.Kandasamy, K.Thilagavathy (2003), "Calculus of Finite difference & Numerical Analysis", S.Chand& Company Ltd., New Delhi-55.

II – BCA	**RESOURCE MANAGEMENT TECHNIQUES**	**AMCA403S**
SEMESTER – IV		**HRS/WK – 5**
ALLIED -3	**For the students admitted from the year 2015**	**CREDIT – 4**

(For B.C.A. II – Year)

OBJECTIVE:

To expose the students to the basics of LPP, Transportation Problem, Sequencing Problem, Game Theory and Networks

UNIT –I:

Definitions of OR-Linear programming problem-Graphical solution -Simplex method – Artificial variables techniques – Big M method .

UNIT-II:TRANSPORTATION MODEL

Definition , Formulation of Transportation-North-west corner method –Matrix minima method-Vogel's Approximation method –solution of Transportation-modi's method

ASSIGNMENT MODELS: Definition of Assignment models- Formulation and solution of Assignment models-Special cases in Assignment problems

UNIT-III:SEQUENCING PROBLEM

Basic term used in sequencing-Processing n jobs through two machines-Processing n jobs through three machines- Processing two jobs through k machines.

UNIT –IV:GAME THEORY

Two person zero sum game-Basic terms –Maximin and Minimax principle-Games without saddle point –Mixed stratergies– graphical solution of 2xn and mx2 games -Dominance property.

UNIT –V:PERT/CPM NETWORKS:

Introduction –Network and basic component –Logical sequencing -Fulkerson's rule of the Network construction –Critical path Analysis &PERT analysis- PERT-Distinction between PERT and CPM .

TEXT BOOKS:

1.Kanti Swaru, Gupta P. K. and Manmohan[1999], "Operations Research", Sulthan Chand & Sons., Delhi.

REFERENCE BOOKS:

1.Gupta P. K and Hira D. S. [2000], "Problems in Operations Research", Sulthan Chand & Sons., Delhi.
2.J. K. Sharma, [2001], "Operations Research Theory and Applications", Macmillan, Delhi
3.Taha H. A.[2003], "Operations Research" , Macmillan Publishing Company, New York.
4.P.R. Vittal [2003], "Operations Research" , Margham Publications, Chennai.

II – B.Com	**BUSINESS MATHEMATICS** **For the students admitted from the year 2014**	**AMCM401**
SEMESTER - IV		**HRS/WK – 5**
ALLIED		**CREDIT – 4**

(For B.COM. II – Year)

OBJECTIVES:

The course aim is to introduce the concepts of operations on set and applications, to study the characteristic of analytical geometry, differential calculus, matrices and commercial arithmetic.

UNIT I:SET THEORY

Basic concepts – Subsets – Operations and Applications – Cartesian Product – Relations – Properties – Functions.

UNIT – II:ANALYTICAL GEOMETRY

Distance – Slope – Equation of Straight line – Interpretation – Break even analysis – Parabolas.

UNIT – III:DIFFERENTIAL CALCULUS

Limits – Continuity – Average & Marginal concepts – Differential coefficient concepets – Simple applications to Economics.

UNIT – IV:MATRICES

Addition of matrices –Scalar multiplication-Multiplication of a matrix by a matrix- Inverse of a matrix –Solution of a system of equation –Input output Analysis

UNIT – V:COMMERCIAL ARITHMETIC

Percentages – Simple and Compound interests – Arithmetic and Geometric Series – Simultaneous Linear equations.

TEXT BOOK :

1. "An Introduction to Business Mathematics", V. Sundaresan, S. D. Jaya Seelan, S. Chand& Company Ltd, New Delhi(2003).

Unit-I: Chap:2(Sec:2.1 – 2.7),
Unit-II: Chap:1(Sec:1.2-1.4,1.6-1.8),
Unit-III: Chap:3(Sec:3.1,3.2,3.4,3.5,3.11),
Unit-IV: Chap:8 (8.2-8.7),
Unit-V: Chap:7(7.1,7.2,7.3,7.5).

REFERENCE BOOKS:

1. "Business Mathematics", QaziZameeruddin, V. K. Kahanna, S. K. Bhambri, Vikas Publishing Pvt Ltd, New Delhi (1995).
2. "Business Mathematics", V. K. Kapoor, S. Chand & Company Ltd, New Delhi (1994).

II – BBM	**MATHEMATICS FOR COMPETITIVE EXAMS** **For the students admitted from the year 2014**	**AMBM401**
SEMESTER - IV		**HRS/WK – 5**
ALLIED		**CREDIT – 4**

(For BBM. II – Year)

OBJECTIVES:

The course aim is to introduce the concepts of operations on set and applications, to study the characteristic of analytical geometry, differential calculus, matrices and commercial arithmetic.

UNIT I:SET THEORY

Basic concepts – Subsets – Operations and Applications – Cartesian Product – Relations – Properties – Functions.

UNIT – II:ANALYTICAL GEOMETRY

Distance – Slope – Equation of Straight line – Interpretation – Break even analysis – Parabolas.

UNIT – III:DIFFERENTIAL CALCULUS

Limits – Continuity – Average & Marginal concepts – Differential coefficient concepets – Simple applications to Economics.

UNIT – IV:MATRICES

Addition of matrices –Scalar multiplication-Multiplication of a matrix by a matrix- Inverse of a matrix –Solution of a system of equation –Input output Analysis

UNIT – V:COMMERCIAL ARITHMETIC

Percentages – Simple and Compound interests – Arithmetic and Geometric Series – Simultaneous Linear equations.

TEXT BOOK :

1. "An Introduction to Business Mathematics", V. Sundaresan, S. D. Jaya Seelan, S. Chand& Company Ltd, New Delhi(2003).

Unit-I: Chap:2(Sec:2.1 – 2.7),
Unit-II: Chap:1(Sec:1.2-1.4,1.6-1.8),
Unit-III: Chap:3(Sec:3.1,3.2,3.4,3.5,3.11),
Unit-IV: Chap:8 (8.2-8.7),
Unit-V: Chap:7(7.1,7.2,7.3,7.5).

REFERENCE BOOKS:

1. "Business Mathematics", Qazi Zameeruddin, V. K. Kahanna, S. K. Bhambri, Vikas Publishing Pvt Ltd, New Delhi (1995).
2. "Business Mathematics", V. K. Kapoor, S. Chand & Company Ltd, New Delhi (1994).

QUESTION PATTERN

Time: 3Hrs
Max. Marks: 75

Section – A
5x2=10
Answer ALL Questions

Section – B
3x5=15
Answer any THREE Questions (Out of five)

Section – C
5x10=50
Answer ALL Questions (Either or Type)

QUESTION PATTERN (ALLIED MATHEMATICS –I &II)

Time: 3Hrs
Max. Marks:75

Section – A
Answer ALL Questions
5x3=15 (Each unit has one question)

Section – B
Answer ALL Questions (Either or Type)
5x6=30(Either or type each unit has two Questions)

Section – C
Answer any THREE Questions (Out of five)
3x10=30 (Each unit has one question)