

**DEVI AHILYA VISHWAVIDYALAYA, INDORE  
INSTITUTE OF ENGINEERING & TECHNOLOGY**



**FACULTY OF ENGINEERING**

**SCHEME OF EXAMINATION (CBCS)  
&  
COURSE OF CONTENTS**

**M.Sc. (Applied Mathematics)  
(Specialization in Computing & Informatics)  
Batch 2015– 2016 and onwards**

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**DEVI AHILYA VISHWAVIDYALAYA, INDORE**  
**INSTITUTE OF ENGINEERING & TECHNOLOGY**

**Proposed Scheme for CBCS of**  
**M.Sc. (Applied Mathematics)**  
**with specialization in Computing and Informatics**  
 Batch 2015– 2016 and onwards  
**(Subject to Revision)**

<b>SEM I</b>				
S.No.	Sub Code	Sub Name	Number of Credits L-T-P	Type
1.	AM1PC1	Algebra	3-1-0	Core
2.	AM1PC2	Discrete Mathematics	3-1-0	Core
3.	AM1PC3	Numerical Analysis / Integral Equations	3-1-0	Core
4.	AM1SS1	Advanced Communication Skills	2-0-0	Skill
5.	AM1GEx	<b>Generic Elective I</b>	3-1-0	Generic
6.	AM1PR1	Computer Lab-I (MATLAB)	0-0-2	Practical
7.	AM1CV1	Comprehensive Viva I	0-0-4	Viva
<b>Total Credit for SEM I</b>			<b>20 actual + 4 Virtual credits</b>	
<b>List of Generic Elective I</b>				
1.	AM1GE1	Computer Architecture/ Digital Electronics and Computer Organization	3-1-0	
2.	AM1GE2	Advanced Special Functions	3-1-0	
3.	AM1GE3	Financial Accounts	3-1-0	

<b>SEM II</b>				
S.No.	Sub Code	Sub Name	Number of Credits L-T-P	Type
1.	AM2PC1	Real Analysis / Measure Theory	3-1-0	Core
2.	AM2PC2	Advanced Differential Equations	3-1-0	Core
3.	AM2PC3	Theory of Computation	3-1-0	Core
4.	AM2ECx	<b>Discipline Elective I</b>	3-0-0	Disc. Elec.
5.	AM2EMx	<b>Discipline Elective II</b>	3-0-0	Disc. Elec.
6.	AM2PR2	Computer Lab-II (Of Subject of Discipline Elective -I)	0-0-2	Practical
7.	AM2CV2	Comprehensive Viva II	0-0-4	Viva
<b>Total Credit for SEM II</b>			<b>20 actual + 4 Virtual credits</b>	
<b>List of Discipline Elective I</b>				
1.	AM2EC1	Object Oriented Programming with Core Java	3-0-0	
2.	AM2EC2	Comp. Graphics /Multimedia	3-0-0	
<b>List of Discipline Elective II</b>				
1.	AM2EM1	Operations Research-I	3-0-0	
2.	AM2EM2	Soft Computing Techniques	3-0-0	

(PTO)

<b>SEM III</b>				
S.No.	Sub Code	Sub Name	Number of Credits L-T-P	Type
1.	AM3PC1	Topology	3-1-0	Core
2.	AM3PC2	Database Theory	3-1-0	Core
3.	AM3PC3	Mathematical Statistics	3-1-0	Core
4.	AM3SS2	Life Management Skills	2-0-0	Skill
5.	AM3GEx	<b>Generic Elective II</b>	3-1-0	Generic
6.	AM3PR3	Computer Lab-III (Research Tools)	0-0-2	Practical
7.	AM3CV3	Comprehensive Viva III	0-0-4	Viva
<b>Total Credit for SEM III</b>			<b>20 actual + 4 Virtual credits</b>	
<b>List of Generic Elective II</b>			3-1-0	
1.	AM3GE1	OS/Microprocessor	3-1-0	
2.	AM3GE2	Integral Transforms	3-1-0	
3.	AM3GE3	Financial Management		

<b>SEM IV</b>				
S.No.	Sub Code	Sub Name	Number of Credits L-T-P	Type
1.	AM4PC1	Complex Analysis	3-1-0	Core
2.	AM4PC2	Analysis of Algorithm	3-1-0	Core
3.	AM4PC3	Functional Analysis	3-1-0	Core
4.	AM4ECx	<b>Discipline Elective III *</b>	3-0-0	Disc. Elec.
5.	AM4EMx	<b>Discipline Elective IV *</b>	3-0-0	Disc. Elec.
6.	AM4Dxx	<b>Discipline Elective V *</b>	0-2-4	Diss. Work
7.	AM4PR4	Computer Lab-IV (Of Subject of Discipline Elective -III)	0-0-2	Practical
8.	AM4CV4	Comprehensive Viva IV	0-0-4	Viva
<b>Total Credit for SEM IV</b>			<b>20 actual + 4 Virtual credits</b>	
<b>List of Discipline Elective III</b>				
1.	AM4EC1	Advanced Java	3-0-0	
2.	AM4EC2	Unix / Linux Administration	3-0-0	
3.	AM4EC3	Computer Network/ Internet & Web Technology	3-0-0	
<b>List of Discipline Elective IV</b>				
1.	AM4EM1	Operations Research-II	3-0-0	
2.	AM4EM2	Mathematical Modeling	3-0-0	
3.	AM4EM3	Number Theory/Cryptography	3-0-0	
<b>List of Discipline Elective V</b>				
1.	AM4DW1	<b>Dissertation (Minor)*</b>	0-0-4	
2.	AM4DS1	Seminar	0-2-0	

\* Student will select either **Discipline Elective III and IV or Discipline Elective V**. Internal evaluation of Dissertation work will be based on monthly Seminars (showing progress of work done) and Attendance of students. Final marking will be a combination of Internal and External evaluation.

# Sem-I

# Program-Core

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics			
				<b>Semester- I</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM1PC1: Algebra</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** To study the abstractions such as groups, rings, fields, vector space and linear transformations.

**Prerequisite(s):** Matrices, Determinants, Polynomials.

### COURSE OF CONTENTS

#### UNIT I

Groups, subgroups, cosets, Lagrange's theorem, normal subgroups, quotient groups, homomorphism, isomorphism theorems, Cayley's theorem, permutation groups, conjugacy, Sylow theorems, direct sums, structure theorem for finite abelian groups, Normal and subnormal series, composition series, Jordan holder theorem, solvable and nilpotent groups.

#### UNIT II

Rings, integral domains, ideals, prime ideals, maximal ideals, homomorphisms, Quotient rings, fields, characteristic of an integral domain, prime fields. Euclidean domains, unique factorization domains, principal ideal domain, polynomial rings, unique factorization in polynomial rings, Eisenstein's criterion of irreducibility, Noetherian and Artinian rings.

#### UNIT III

Review of Basic Concepts of Vector space, bases, dimension, direct sums, dimension of a direct sum, Quotient space, Linear transformation, Nullity theorem, Rank of a matrix, Characteristic polynomials, Theorems on Eigen values and Eigen vectors, Cayley- Hamiltonian theorem., direct sum, Jordan form, diagonalization, Dual space, Annihilators.

#### UNIT IV

Modules, Sub modules, Quotient modules, Homomorphism and Isomorphism theorems, cyclic modules, simple modules, free modules, Schur's lemma.

#### UNIT V

Finite Field Extension, algebraic and transcendental extension, splitting fields, separable and inseparable extension, perfect field, normal extensions, Galois group, solvability by radicals.

#### BOOKS RECOMMENDED:

- [1] I.N.Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
- [2] Fraleigh J.B, A First Course in Abstract Algebra, Seventh Edition, Pearson Education, 2002.
- [3] S.Kumaresan, Linear Algebra, A Geometric Approach, Prentice - Hall of India, 2000.
- [4] S. Lang, Linear Algebra, Undergraduate Texts in Mathematics, Springer-Verlag, New York, 1989.
- [5] A.R. Vasishtha, Modern Algebra, Prakashan Media Ltd, Meerut, India, 2002
- [6] Artin Michael , Algebra , Pearson Education Inc. , 2007 .

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>	<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics
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			Semester- I				
Subject Code & Name	Instructions Hours per Week			Credits			
	L	T	P	L	T	P	Total
AM1PC2: Discrete Mathematics	3	1	-	3	1	-	4
<b>Duration of Theory Paper:</b> 3 Hours							

**Objective:** To provide the fundamentals of formal techniques for solve the problems in computational domain and algorithm development.

**Prerequisite(s):** NIL

### COURSE OF CONTENTS

#### UNIT I

**Set Theory:** Operation and Algebra; Principle of Inclusion and Exclusion; Computer Representation.

**Proposition Logic:** Logic Connectives; Truth Tables; Propositional equivalences, predicates, Quantifiers, Method of Proof.

**Mathematical induction:** Strong induction; Well-ordering; Recursive definitions, Structural Induction.

#### UNIT II

**Counting Techniques:** Law of Product and Sum; Permutation, Combination, Pigeon Hole Principle; Tree Diagram. **Function:** Types of Functions; Hashing.

**Application of Group theory:** Group Coding.

#### UNIT III

**Relations:** Binary Relation and Properties; n-ary relation and their applications to Databases, Closures of relations; Equivalence, Partial ordered and Compatible relations, Lattices.

**Boolean algebra:** Gate Algebra; Logic Algebra; Switching Algebra.

#### UNIT IV

**Graph Theory:** Terminology; Graph Representation; Graph isomorphism; Connectedness; Euler and Hamilton Graphs; Shortest Paths, Planar graphs, Euler's formula, Kuratowski's theorem. Graph colouring, chromatic number,

**Trees:** Terminology; Tree Traversals; Prefix Codes; Spanning Trees.

#### UNIT V

**Overview of the topics:** Automata & Grammar; Analysis of algorithms; Fuzzy logic.

**Recurrence Relations:** Solution of Homogeneous and non-homogeneous recurrence relation with constant coefficients using Boole's operator method, method of undetermined coefficients and generating functions. Simultaneous recurrence relation.

#### BOOKS RECOMMENDED:

- [1] Kenneth H. Rosen, Discrete Mathematics and its Applications, 7<sup>th</sup> ed., Tata McGraw-Hill Edition 2007.
- [2] Kolman, Busby & Ross, Discrete Mathematical Structures, 6<sup>th</sup> edition, Pearson Education, 2008.
- [3] C.L.Liu, Introduction to Discrete Mathematics, McGraw Hill, 1986.
- [4] Trembley and Manohar, Discrete Mathematical structures for Computer Science, McGraw Hill, 1986.
- [5] Narsingh Deo, Graph Theory with Applications to Engineering. & Computer Science, 4<sup>th</sup> ed., Prentice Hall of India, 2004.

Devi Ahilya University, Indore, India Institute of Engineering & Technology			MSc – I Year (Applied Mathematics) with Specialization in Computing & Informatics				
			Semester- 1				
Subject Code & Name	Instructions Hours per Week			Credits			
	L	T	P	L	T	P	Total
AM1PC3:Numerical Analysis /							

<b>Integral Equations</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** Study of algorithms and techniques that use numerical approximation for the problems of mathematical analysis. Study Integral equations which are important in many applications such as radiative energy transfer and the oscillation of a string, membrane, or axle.

**Prerequisite(s):** NIL

### COURSE OF CONTENTS

#### UNIT I

Errors and Approximation: Representation of integers and fractions, fixed point and floating point arithmetic, error propagation, loss of significance, condition and instability, computational method of error propagation. Solution of Nonlinear Equations: Iterative methods of 2<sup>nd</sup> degree- Muller's method, Chebyshev's method, multi-point method, modified secant and Newton Raphson method, Methods for multiple roots, convergence of methods.

#### UNIT II

Solution of Linear Systems: Elimination with and without pivoting, triangular factorization, error and residual of an approximate solution. Backward errors and iterative improvement, relaxation method. Polynomial Interpolation: Existence and uniqueness of interpolation polynomial, error of the interpolating polynomial, Interpolation using differences, spline interpolation, hermite interpolation, piecewise interpolation, approximations.

#### UNIT III

Extrapolation methods, Numerical differentiation, Numerical Integration: Newton Cote's integration methods, Gaussian integration methods, composite integration methods, Romberg Integration, double integration. Solution of ODEs: Initial and boundary value problems, difference equations, Routh Hurwitz criterion, single step method, Multistep method, Predictor-Corrector methods, Stability analysis, Shooting methods and finite difference methods.

#### UNIT IV

Integral Equations: Preliminary concepts, formulation of integral equations, and classification of linear integral equations. Integral differential equations, conversions of ordinary differential equations to integral equations, finite difference approximations. Volterra Integral Equations: Basic concepts - Relationship between Linear differential equations and Volterra integral equations - Resolvent Kernel of Volterra Integral equation - Solution of Integral equations by Resolvent Kernel - The Method of successive approximations - Convolution type equations.

#### UNIT V

Fredholm Integral equations: Fredholm equations of the second kind, Fundamentals – Method of successive approximations, Constructing the resolvent Kernel with the aid of iterated Kernels, recurrence relation and determinant method - Integral equations with degenerate Kernels, eigen numbers and eigen functions, solution of homogeneous integral equations with degenerate Kernel - nonhomogeneous symmetric equations - Fredholm alternative.

#### BOOKS RECOMMENDED:

1. Shanti Swarup and Shiv Raj Singh, Integral Equation, 22nd edn., Krishna Prakashan, 2012
2. A.B. Chandramouli, Integral equation with Boundary Value Problems, 2nd edition, Shiksha Sahitya Prakashan, 2008-2009.
3. Conte S.D. and deBoor C., Elementary Numerical Analysis - An Algorithmic Approach; 3rd edn., McGraw Hill, 1981.
4. Computer Oriented Numerical Methods: Raja Raman V., Prentice Hall 1988.
5. Jain N.K., Iyengar, S.R.K. and Jain R.K., Numerical methods for scientific and Engineering Computations, Wile Eastern Ltd., 1984.
6. S.S. Sastry, Introductory methods of Numerical Analysis, 3rd ed., Prentice Hall of India, 1998.
7. G. Shanker Roa, Numerical Analysis, 3rd edition, new age International (p), Limited Publishers.
8. M. D. Raisinghania, Integral Equation & Boundary Value Problems, 7th edition, S. Chand., 2007.
9. Froberg C.E., Numerical Mathematics - Theory and Computer Applications; Benjamin Cummings Pub. Co., 1985.



# Soft -Skill

Devi Ahilya University, Indore, India Institute of Engineering & Technology				MSc – I Year ( <u>Applied Mathematics</u> ) with Specialization in <u>Computing &amp; Informatics</u> Semester- I			
Subject Code & Name	Instructions Hours per Week			Credits			
AM1SS1: Advanced Communication Skill	L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours	2	-	-	2	-	-	2

**Objective:** The course aims to develop the basics of interpersonal communication and public speaking, so as to improve the communication skills and ability to understand others.

**Prerequisites:** Nil

### COURSE OF CONTENTS

#### UNIT I

**Fundamentals of Communication:** Definitions, importance, forms of communication, process of communication, various channels of communication, barriers for effective communication & ways to overcome them. Listening and its importance: Definition, barriers for effective listening, improving listening abilities, exercises and cases

#### UNIT II

**Communication skills:** Importance of communication, Art of communicating, Elements of interpersonal communication, Verbal Communication, Non-verbal Communication, Body Language, exercises and cases.

#### UNIT III

**Group Discussions:** Definition, importance, process, effectively participating in Group Discussions, Dos and Don'ts, Practicing by mock Group Discussions.

**Interviews:** Types of Interview, Role of Interviewee and Role of Interviewer, Commonly asked questions in an interview, Dos and Don'ts in an interview, Practicing by mock interviews.

#### UNIT IV

**Transactional Analysis:** Johari Window, FIRO-B, FIRO-B Self-exercise workshop.

**Written communication:** Report writing, Documentation, Business Correspondence, Preparation of manuals and Project Reports, E-mails, Types of e-mails, e-mail protocol.

#### UNIT V

**Negotiation skills:** Need, Definition, Process of negotiation, various stages of negotiation, Essentials of effective negotiation, Strategies of negotiation.

#### BOOKS RECOMMENDED:

- [1] P.D. Chaturvedi, Mukesh Chaturvedi, Business Communication, Pearson Education, Singapore Pvt. Ltd. 2008.
- [2] K.K. Sinha, Business Communication, 2<sup>nd</sup> Ed., Galgotia Publishing Company, 2001.
- [3] R.C. Sharma, Krishna Mohan, Business Correspondence and Report Writing, 3<sup>rd</sup> Ed., Tata McGraw Hill, 2002.
- [4] Scot Ober, Contemporary Business Communication, 5<sup>th</sup> Ed., Biztantra, 2004.

# Generic-Electives

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (<u>Applied Mathematics</u>) with Specialization in <u>Computing &amp; Informatics</u></b>			
				<b>Semester- I</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM1GE1: Computer Architecture/ Digital Electronics &amp; Computer Organization</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** Aim of this course is to aware students about the hardware of computers, get acquainted with different number systems, their Inter-conversion and operations. Familiarized with different logic families & relative performance Ability to design various combinational circuits by solving & reducing Boolean equations, Familiarize with the internal working of modern computer systems

**Prerequisite(s):** Computer Programming

### COURSE OF CONTENTS

#### UNIT-I

Introduction to Computer Architecture, Memory Organization and Control Design: Introduction, CPU Organization, Instruction Sets, Memory Technology, Memory system, Caches, Basic concepts of control design, micro programmed Control and Pipeline Control.

#### UNIT II

Binary Systems: Digital Systems, Binary Numbers, Binary Codes, Error detecting Code. Computer Arithmetic Number Base Conversions, Octal and Hexadecimal – conversions. Boolean Algebra and Logic Gates, Functions Minterms and Maxterms – Laws and theorems of Boolean Algebra – Demorgan’s theorems – The Universal Building blocks – NAND & NOR gates as universal Building Blocks.

#### UNIT III

Simplification of Boolean Expressions : Canonical SOP and POS forms – Algebraic Simplification – Karnaugh Maps – SOP & POS Simplification – NAND / NOR implementation of Boolean expressions – Don’t care, conditions – Overlapping groups, eliminating redundant groups. Combinational Logic circuits : Half and Full Adders – Half and Full subtractors – BCD adder – parallel binary adder – Multiplexer & Demultiplexer – Encoder & Decoder.

#### UNIT IV

Sequential Logic circuits: NAND latch – SR, flipflop – JK flipflop – Edge triggering – PRESET and CLEAR inputs, Shift Register, Universal Shift register – Asynchronous and Synchronous counters – BCD counter.

#### UNIT V

Parallel Computer Models: Introduction - Flynn’s Classifications - Parallel & Vector Computer System - Attributes to performance - implicit and explicit parallelism - shared memory – multiprocessors – Uniform and Non-Uniform Memory Access and Cache only Memory Access Models – Distributed Memory Multicomputers – Multivector & SIMD Computers – PRAM and VLSI Module

#### BOOKS RECOMMENDED:

- [1] John P. Hayes, Computer Architecture and Organization, McGraw Hill, 3<sup>rd</sup> Ed., 1998.
- [2] Kai Hwang, Advanced Computer Architecture, McGraw Hill, 1993.
- [3] Stallings W., Computer Organization and Architecture, Designing for Performance, Prentice Hall, 2010.
- [4] Meena K, Principles of Digital Electronics, PHI Learning Pvt. Ltd., 2009
- [5] Thomas Bartee C, Digital Computer Fundamentals, TMH, 6<sup>th</sup> Edition, 1995.
- [6] Moris Mano, Computer Architecture and Logic Design, TMH Publications, ND, 2002.
- [7] Nicholas Carter, Computer Architecture Schaum Series Adaptation, 2<sup>nd</sup> edition, 2011.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				MSc – I Year ( <u>Applied Mathematics</u> ) with Specialization in <u>Computing &amp; Informatics</u>				
				Semester- I				
Subject Code & Name		Instructions Hours per Week			Credits			
AM1GE2: Advanced Special Functions		L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours		3	1	-	3	1	-	4

**Objective:** To study mathematical functions which are useful in mathematical analysis, physics, engineering fields and so on.

**Prerequisites:** Nil.

### COURSE OF CONTENTS

#### UNIT I

**Orthogonal polynomials:** Simple set, orthogonal set, orthogonal polynomials, zeros of orthogonal polynomials.

**The Gamma and Beta functions:** Gamma function, Euler or Mascheroni constant  $\gamma$ , a series for  $\Gamma'(z)/\Gamma(z)$ , the Euler product for  $\Gamma(z)$ , Beta function, the value of  $\Gamma(z)\Gamma(1-z)$ , Factorial function, Gauss multiplication theorem, Legendre's duplication formula.

#### UNIT II

**The Hyper geometric functions:** A simple integral form, evaluation of  $F(a, b, c, l)$ , the contiguous function relations, the hyper geometric differential equations, simple transformations.

**Generalized Hyper geometric functions:** The function  ${}_pF_q$ , Saalschutz's theorem, Whipple's theorem, Dixon's theorem, Confluent Hyper geometric function, basic properties of  ${}_1F_1$ , Kummer's theorems, Ramanujan's theorem.

#### UNIT III

**Bessel's functions:** Definition of  $J_n(x)$ , generating function, Bessel's differential equation, recurrence relations, Bessel's integral.

**Legendre's Polynomial:** Generating functions for Legendre's polynomials, recurrence relation, Rodrigue's formula, Murphy's formula, hyper geometric forms of  $P_n(x)$ , Bateman's generating function, Laplace's first integral form, orthogonality.

#### UNIT IV

**Hermite polynomials:** Hermite differential equation, definition of Hermite polynomials  $H_n(x)$ , generating functions, Rodrigue's formula, recurrence relation, orthogonality, expansion of polynomials, more generating functions.

**Laguerre Polynomials:** Laguerre polynomials  $L_n(x)$ , generating functions, Rodrigue's formula, recurrence relations, orthogonality, expansion of polynomials.

#### UNIT V

**Chebyshev polynomial:** Independent solution of Chebyshev's equation, generating function, recurrence relations, orthogonal properties.

**Jacobi polynomial:** Jacobi polynomials, Batemans generating function, Rodrigue's formula, orthogonal properties.

#### BOOKS RECOMMENDED:

- [1] Rainville, E.D., Special functions, the Macmillan Co., New York 1971.
- [2] Saran, N., Sharma S.D., Trivedi T.N., Special Functions, Pragati Prakashan, 1982.
- [3] Labder N.N., Special functions and their applications, Prentice Hall, New Jersey, USA, 1995.

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<b>Subject Code &amp; Name</b>				<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM1GE3: Financial Accounts</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
				<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>										

**Objectives:** To give an in-depth knowledge of all business mathematics and how they should be recorded, classified & interpreted to get a meaningful judgment of viability & profitability of the business. The course is designed to make students be able to prepare a set of financial statements for various forms of businesses and nonprofit entities, develop an ability to apply accounting concepts, principles and practices and be familiar with the basic tools for analyses of financial statements.

**Prerequisite(s):** NIL.

### COURSE OF CONTENTS

#### UNIT I

Introduction and purpose of accounting, uses of accounting information & basic accounting concepts. Accounting Structure: Process of accounting, Journal, Ledger & Trial balance, based on double entry book keeping.

#### UNIT II

Practical system of accounting: Cash book, sales & purchase of goods, Bill of exchange bank reconciliation statements.

#### UNIT III

Preparation of Financial Statements: Income statements, (Profit and Loss A/C), Statement of financial Position (Balance Sheet) and Adjustments, valuation of Assets and Depreciation methods (SLR & WDV). Cash and fund flow, Analysis of financial statements- Financial Ratio.

#### UNIT IV

Introduction to cost accounting: Elements of cost, Cost determination, Direct and Indirect cost, Cost centers & cost units, the behavior of cost.

#### UNIT V

Break Even Analysis: Leverages: operating, financial and combined. Inventory Management and Responsibility Accounting: Methods of Inventory Management and Material Issues. Responsibility Accounting Meaning, Preparation of Cost Sheet, Preparation of Tender, Production Accounts.

#### BOOKS RECOMMENDED:

1. T.S. Grewal, Introduction to Accountancy, S. Chand & Co. Ltd.,
2. Rovect Anthony, Accounting Principles, Rich & Irvin.
3. Financial Management, Khan and Jain.
4. Cost Accounting, SN Maheshwari

# Sem-II

# Program-Core



<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics				
				<b>Semester- II</b>				
<b>Subject Code &amp; Name</b>		<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2PC1: Real Analysis/ Measure Theory</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
		<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>								

**Objective:** To study the analytic properties of real functions and sequences, including convergence and limits of sequences of real numbers, the calculus of the real numbers, study measures whose main applications are in the foundations of the Lebesgue integral.

**Prerequisites:** Set theory, algebra of functions and sequence & series of Real and Complex numbers.

### COURSE OF CONTENTS

#### UNIT I

The Riemann-Stieltjes Integral, Definition and existence of the integral, properties of the integral, integration and differentiation, integration of vector-valued functions, rectifiable curves,

#### UNIT II

Rearrangements of terms of a series, Riemann theorem, Sequences and Series of Functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, uniform convergence and continuity, uniform convergence and integration, Uniform convergence and differentiation, equicontinuous families of functions, the Stone-Weierstrass Theorem, uniform convergence and Riemann-Stieltjes integral, Abels test for uniform convergence, Dirichlet's test for uniform convergence, power series, Abel's theorem.

#### UNIT III

Lebesgue outer measure, Measurable sets, Measurable functions, Borel and Lebesgue measurability, non measurable sets, Littlewoods three principles, non Borel measurable set, Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral.

#### UNIT IV

Measure space, Measurable functions, Integration, General convergence theorems, signed measure, product measure, inner measure.

#### UNIT V

$L^p$  spaces, convex functions, Jensen's Inequality, Minkowski and Holder inequalities, convergence and completeness of  $L^p$ , approximations in  $L^p$ .

#### BOOKS RECOMMENDED:

- [1] Halsey Royden, Real Analysis, Prentice Hall of India, New Delhi, 3<sup>rd</sup> Edition, 2010.
- [2] Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill Publishing Co. 3<sup>rd</sup> edition, 1976.
- [3] R. G. Bartle and D.R. Sherbert, Introduction to Real analysis, 3<sup>rd</sup> Ed., 2000.
- [4] H. K. Pathak, Real Analysis, Shiksha Sahitya Prakashan, Meerut, 2010.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2PC2: Advanced Differential Equations</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** To Study various properties like existence and uniqueness of solutions, methods for approximating solutions as well as applications by modeling virtually in different fields.

**Prerequisite(s): Nil.**

### COURSE OF CONTENTS

#### UNIT I

Existence of solution, uniqueness of solution, method of successive approximation, system of differential equation, dependence of solution on initial condition and parameters, maximum and minimum solution, variation of solutions.

#### UNIT II

Exact Linear Differential Equations of nth order – condition of exactness for a linear equation of order n. Integrating factors. Non-linear differential equation of particular forms-exact non-linear differential equations. Riccati,s Equation, Homogeneous equations.

#### UNIT III

Series Solutions of second order Linear Differential Equations, Method of Frobenius, Total differential Equation- Necessary & Sufficient condition for the total Differential Equations, Solution of a Total Equation involving four variables.

#### UNIT IV

Partial Differential equations of first order – formulation and Classification of partial differential equations, Langrange’s linear equation, Particular forms of non-linear partial differential equations, Charpit’s method. Linear partial differential equations with constant coefficients. Homogeneous equations, Non homogeneous equation.

#### UNIT V

Partial differential equations of second order with variable coefficients, Monge’s Methods, Separation of variables, canonical forms, Elliptic, Parabolic and Hyperbolic differential equations, Green’s Functions.

#### BOOKS RECOMMENDED:

- [1] Rai Singhania, Advanced Differential Equations & Integral Transform.
- [2] Zafar Ahsan, Differential Equations and their Application, Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
- [3] Sankara Rao, K., Introduction to Partial Differential Equations, Prentice Hall of India Pvt. Ltd., New Delhi 1997.
- [4] Earl A. Coddington, An Introduction to ordinary Differential Equations, Tata McGraw Hill, 2009.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2PC3: Theory of Computation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** To familiarize students about theoretical and mathematical aspects of computer science.

**Prerequisite:** Basics of Discrete Maths.

### COURSE OF CONTENTS

#### UNIT I

**Automata Theory:** Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts to Automata Theory, Finite Automata: An Informal Picture of FA, DFA, NFA, Equivalence of NFA and DFA, FA with  $\epsilon$ -transitions: Eliminating  $\epsilon$ -transitions-Conversion of NFA with  $\epsilon$  to NFA without  $\epsilon$ , Conversion of NFA without  $\epsilon$  to DFA, Conversion of NFA to DFA (direct method), Moore and Mealy machines.

#### UNIT II

**Regular Expressions (RE) and Languages:** Regular Expressions – Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Arden's Theorem, FA and RE: DFA to RE, RE to DFA (RE to s-NFA & e-NFA to DFA and RE to DFA-direct method), FA limitations, Properties of Regular Languages: pumping lemma for regular languages, closure and decision properties of regular languages, Equivalence and minimization of automata, Lexical analysis and finding patterns in text

#### UNIT III

**Context Free Grammars (CFG) and Languages:** Context Free Grammar- Definition, derivations, languages of a grammar, sentential form, Parse Tree, Ambiguity in grammars and languages, Properties of CFL- Normal forms- Chomsky Normal Form and Greibach Normal Form, Eliminating unit productions, useless production, useless symbols, and  $\epsilon$ -productions, Regular Grammar and Finite Automata, FA to RG and RG to FA, Inter-conversion between left linear and right linear regular grammar

#### UNIT IV

**Push Down Automata (PDA):** The Language of PDA, CFG to PDA, PDA to CFG, Deterministic Push Down Automata - Regular language and DPDA, DPDA and CFL, DPDA and ambiguous grammar, Non-deterministic Push Down Automata, The pumping lemma for CFL, Closure properties of CFL, Chomsky Hierarchy.

**Turing Machine:** Notation, the language of TM, TM and Halting, Programming techniques to TM, Extensions to basic TM, Comparison between FA, PDA.

#### UNIT V

Petri nets and its Applications; Programming Language Semantics; Verification of Programs; Formal and Type Systems; Computational Complexity. Complexity of Computing using HLL programs and Automata models; Formal Semantics of programming Languages; Verification of Programs.

#### BOOKS RECOMMENDED:

- [1] Cohen, Introduction to Computer Theory, John Wiley, 1990.
- [2] P Linz, An Introduction to Formal languages and Automata, 3/e, Narosa Pub. 2003.
- [3] J. Martin, Introduction to Languages and the Theory of Computation, 3/e, Tata McGraw Hill, 2005.
- [4] J.Hopcroft and J.D. Ullman, Introduction to Languages, Automata and Computation, Addition Wesley, 1981.
- [5] K L P Mishra and N Chandraskran, Theory of Computer Science, PHI Learning Pvt. Ltd., 2006.

# **Discipline-Electives-I**

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2EC1: Object Oriented Programming with Core Java</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** To familiarize with the Object oriented concepts through Java programming.

**Prerequisite:** Computer Programming.

### COURSE OF CONTENTS

#### UNIT-I

**Introduction to Java:** Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables, Memory concepts, decision making operators, Naming Conventions. . Type conversion & casting, Operators, Control Statements, break and continue Statements. Static Method, static field and Math Class, Argument Promotion and Casting,

#### UNIT-II

**Introduction to Java classes and objects:** Introduction to Class, Objects, Methods and Instance Variables, Primitive type Vs Reference Type, Initializing Objects with Constructors Scope of declaration and Method Overloading.

**String Handling:** The String constructors, String operators, Character Exaction, String comparison, String Buffer.

**Arrays:** Enhanced for Statement, Passing Arrays to Method, Multidimensional Arrays, Variable-Length Argument lists, Using Command-line Arguments. final Instance Variables, this reference, static import, overloaded Constructors, Garbage collection and method finalize, Overloading methods, Parameter passing.

#### UNIT-III

**Inheritance:** Relationship between Superclasses and Subclasses, Using super, Constructor in Subclasses, The Object Class, Object Copying in Java.

**Polymorphism:** Method overriding, upcasting, Dynamic Method Dispatch, final Method and classes, Abstract classes and Methods, instance of operator, Downcasting, Class class, Runtime type Identification

**Packages:** Defining a Package, Understanding CLASSPATH, Access Protection, Importing packages, creating own packages.

**Interfaces** Defining an Interface, Properties of interface, advantages of interface achieving multiple inheritance through interfaces, Variables in Interfaces, Comparable interface.

#### UNIT IV

**Exception Handling:** Introduction, overview of doing it and keywords used, when to use it, Java Exception Hierarchy, finally block, chained exceptions, declaring new exception types, preconditions and postconditions.

**Multithreading:** What are threads, The java thread model, Thread priorities, Thread life cycle, Creating thread and executing thread, Thread Synchronization, producer-consumer problem without Synchronization, Producer-consumer problem with Synchronization, Other class and Interfaces in java.util. concurrent, Monitor and Monitor Locks, Thread Groups, Synchronization, Inter-thread Communication.

#### UNIT V

**Streams and Files:** Introduction, Data Hierarchy, Files and Streams, Sequential-access Text Files, Object Serialization, Random-Access files, Java Stream class Hierarchy.

**Introduction To GUI:** Introduction, Overview of swing Components, Introduction to Event Handling, Common GUI Event Type and Listener Interfaces, How Event Handling Works, Adapter Classes, Layout Managers.

**Applets:** Applet basics, Applet Architecture, Applet life cycle methods, Applet HTML Tag and attributes, Executing applet in web browser and in the applet viewer.

#### BOOKS RECOMMENDED:

[1] Cay S.Horstmann, Core JAVA Vol-1, Pearson Education, 8<sup>th</sup> Ed., 2008.

- [2] Herbert Schildt, Java: The Complete Reference 7th Edition, Tata McGraw Hill, 2006.
- [3] Scott W Amber, The Object Primer, 2<sup>nd</sup> Ed., Cambridge, 2001.
- [4] Timothy, Budd, Object Oriented Programming, Pearson Education, 2001.
- [5] Kathy Sierra, Bert Bates, Head First Java, 2<sup>nd</sup> Edition, O'Reilly, 2005.
- [6] Balagurwamy, Programming with Java, 3<sup>rd</sup> Ed., Tata McGraw-Hill Education, 2006.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2EC2: Comp. Graphics / Multimedia</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** The goal of this course is to provide an introduction to the theory and practice of computer Graphics and Multimedia.

**Prerequisites:** Programming language: C++/JAVA.

### COURSE OF CONTENTS

#### UNIT I

Introduction to Computer Graphics, Application of Graphics, Display Devices: Refresh Cathode -Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Flat Panel Displays. Video cards/display cards Input Devices: Mouse, Trackball, Space ball, Data Glove, Joystick, Light pen, Scanner, Digital Camera, Touch Panels, Voice Systems. Hardcopy Devices: Printers and Plotters

#### UNIT II

Creation of two dimensional objects and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations. Graphics Primitives Algorithms for line, polygon and circle. Creation of simple three dimensional objects like cube, cone and cylinder and applying simple transformations like Translation, Scaling, Rotation, Composite transformations, projections –Parallel, Perspective.

#### UNIT III

Clipping: Clipping operations, Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithm, Nicholl-Lee-Nicholl Algorithm. Polygon clipping: Sutherland- Hodgeman Algorithm, Weiler Atherton Algorithm. Text clipping, Exterior clipping.

#### UNIT IV

Finding out visible surfaces and removal of hidden surfaces in simple objects using object space and image space algorithms, Image enhancement, Image transformation from color to gray scale and vice versa, Image manipulation and Image optimization for web - Usage of editing tools, layers, filters, special effects and color modes. Creation of simple Gif animated images with textual illustrations, Image Compression.

#### UNIT V

Color Models and Color Application: Color models: Properties of Light. Standard Primaries and the Chromaticity Diagram, XYZ Color Model, CIE Chromaticity Diagram. RGB Color Model, YIQ Color Model, CMY Color Model, HSV Color Model. Conversion between HSV and RGB Models. HLS Color Model, Color Selection and Application. Advancements in the technology in Computer Graphics.

#### BOOKS RECOMMENDED:

- [1] A.P.Godse, D.A.Godse, Computer Graphics and Multimedia, Technical Publications, 2009.
- [2] Donald Hearn and M. Pauline Baker, Computer Graphics, Second Edition, Prentice Hall of India, 1996.
- [3] David F. Rogers, Procedural Element of computer Graphics, McGraw Hill International, 1985.
- [4] William M. Newman Robert F. Sproull, Principles of Interactive Computer Graphics, McGraw Hill, 1979.
- [5] D. Foley, A. van Dam, S.K. Feiner, J.F. Hughes, and R.L. Philips, Introduction to Computer Graphics, Addison-Wesley, 1994.
- [6] D. P. Mukherjee, Fundamentals Of Computer Graphics And Multimedia, PHI, 2004.

# **Discipline-Electives-II**



<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2EM1: Operations Research-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** The course aims at making the students aware of the various techniques, which provides an analytical and objective basis for decisions. These techniques use scientific methods to problems arising from operations involving integrated men, machine and materials and provide a mathematical model to represent complex functional relationships.

**Prerequisite(s):** Basic knowledge of differentiation & integration of functions, vector algebra, determinants & matrices and calculus of finite difference.

### COURSE OF CONTENTS

#### UNIT I

Introduction to Operations Research, Linear Programming: Principles of Simplex Method, Simplex Method in Tabular Form, Big-M method, Two phase method, Duality and Dual Simplex Method, Degeneracy and Cycling.

#### UNIT II

Assignment models: Definition, Mathematical Representation, Formulation and Solution, Alternate optimal solution. Transportation Problems: Definition, Formulation and solution, Alternate optimal solution. Travelling salesman problem

#### UNIT III

Queuing Theory: Objectives and Different Characteristics of a Queuing System, classification of Queuing models, probability distribution of arrival and service times, Models (M/M/1, M/M/C, M/E<sub>k</sub>/1, M/D/1, D/D/1).

#### UNIT IV

Inventory management system, EOQ model with shortage, without shortage and with constraints.

#### UNIT V

Sequencing Models: Processing n jobs through two machines, m machines, and processing two jobs through m machines.

Simulation: Building a simulation model, Monte-Carlo simulation and applications.

#### BOOKS RECOMMENDED:

1. Hillier, F. S. and Lieberman, G. J. – Introduction to Operation Research, 8<sup>th</sup> Ed., New York, McGraw- Hill, 2005.
2. Taha, H. A. – Operations Research: An Introduction, 7<sup>th</sup> ed., Macmillan Publication Co., 2003.
3. Sharma, S.D. – Operations Research, Kedarnath Ramnath & Co., Meerut, 2004.
4. Dantzig G., Thapa M. Linear programming 1: Introduction, Springer, 1997.
5. P K Gupta & D S Hira, Operations Research, S. Chand., 2008.
6. J.K. Sharma, Operations Research: Theory and Application, 3<sup>rd</sup> Ed., Macmillan, 2006.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- II</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM2EM2: Soft Computing Techniques</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** To introduce the basic notions and study the techniques of Fuzzy Mathematics, neural network and genetic algorithm.

**Prerequisites:** Set theory, algebra of functions.

### COURSE OF CONTENTS

#### UNIT I

Crisp sets, Fuzzy sets and their basic concepts, operations on fuzzy sets, Fuzzy arithmetic, Fuzzy relations, Fuzzy relation equations based on sup – i composition and on Inf – wi composition.

#### UNIT II

Fuzzy measure, Evidence theory, Possibility theory, Fuzzy sets and possibility theory.

#### UNIT III

Fuzzy logic, Classical logic, Multivalued logic, Fuzzy propositions, Fuzzy quantifiers, inference from conditional fuzzy propositions. Methods of construction : An overview – Direct methods with one expert – Direct method with multiple experts – Indirect method with multiple experts and one expert – Construction from sample data.

#### UNIT IV

Basic concepts, Model of artificial neural Network (ANN), Neural Network architectures, learning methods, Back propagation networks, architecture of back propagation networks, Associative memory, Auto correlators, Adaptive resonance theory, Introduction to ART1 and ART2, Applications.

#### UNIT V

Fundamentals of Genetic Algorithms (GAs), history, basic concepts and biological background, working principle, encoding, fitness function, reproduction, Genetic modeling, various operators, crossover and mutation, convergence of Genetic Algorithm, Applications.

#### BOOKS RECOMMENDED:

- [1] Rajsekar, G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy logic and Genetic Algorithms: Synthesis and Applications, PHI, New Delhi, 2005.
- [2] G. J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, PHI, New Delhi, 2005.
- [3] H. J. Zimmerman, Fuzzy Set Theory and its Applications, Allied Publishers, 1996.
- [4] David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Kluwer Academic Publishers, Boston, MA, 1989.
- [5] B. Kosko, Neural networks and fuzzy systems, Prentice-Hall, 1993.

# Sem-III

# Program-Core

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics <b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3PC1: Topology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** To Study the properties of space, dimension, and transformation that are preserved under continuous deformations including stretching and bending, but not tearing or gluing. This includes properties such as connectedness, continuity, compactness and boundary.

**Prerequisite(s):** Basics of sets and functions.

### COURSE OF CONTENTS

#### UNIT I

Countable and uncountable sets, Axiom of choice, Cardinal numbers, Schroeder-Bernstein theorem, Cantor's theorem, continuum hypothesis, Zorn's lemma, Well-ordering theorem. Definition and examples of Topological spaces, Bases and subbases, relative topology, Kuratowski closure operator, neighbourhood systems. Closed sets and limit points, Closure of a set, Dense subsets, Interior, exterior and boundary of a subset, derived sets, continuous functions and homomorphism.

#### UNIT II

Connected spaces, Connectedness on the real line, Components, Locally connected spaces, Connectedness and product spaces.

#### UNIT III

Compactness, Continuous functions and compact sets, Basic properties of compactness, Compactness and finite intersection property, Sequentially and Countably compact sets, Local compactness, Countable compactness and Sequential compactness in metric spaces.

#### UNIT IV

First and second countable spaces, Lindelof's theorem, separable spaces, second countability and separability, Separation axioms.  $T_0$ ,  $T_1$ ,  $T_2$ ,  $T_3$ ,  $T_4$ , their characterization and basic properties, Urysohn's lemma, Tietze extension theorem.

#### UNIT V

Nets and Filters: Definition of Net, topology and convergence of Nets, Filters and their convergence, Ultra filters and compactness.

#### BOOKS RECOMMENDED:

- [1] George F. Simmons, Introduction to topology and modern analysis, McGraw Hill Book Company Inc., 2004.
- [2] K. D. Joshi, Introduction to topology, Wiley Eastern, 1983.
- [3] James R. Munkres, Topology, Prentice-Hall of India, 2<sup>nd</sup> Ed., 2000.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3PC2: Database Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objectives:** The course aims to familiarize the students with Database Management System and to develop skill for developing and managing database applications.

**Prerequisite(s):** NIL.

### COURSE OF CONTENTS

#### UNIT-I

**Database Environment:** Basic concepts, Comparison with Traditional file processing system, Merits & demerits of database approaches, Ranges of Database applications; Components of Database Environment;

**Database Development Process:** Systems development process, Three-Schema Architecture for Database Development.

#### UNIT-II

**Database Analysis:** Business Rules; E-R Model Construct; Cardinality Constraints; Enhanced E-R Model & business Rules, Modeling Enhanced relationship – Specialization & Generalization, specifying constraints in Supertype/Subtype Relationship, Entity Clustering; Case Studies.

#### UNIT-III

**Database Design:** Relational Data Model – Codd's Rules, Integrity Constraints; Transforming EER Diagram into Relations; Functional Dependencies. Normalization and Denormalization.

**Physical Database Design:** File Organization, Physical Database Design Process, Index - Primary Key Index; Secondary Key Index; When to use Index; Improving file access performance; RAID Levels;

#### UNIT-IV

**SQL:** DDL, DML, DCL commands; processing single Table, Processing Multiple Table, Join operations;

**Advanced SQL:** PL/SQL Constructs – View, Triggers, Cursor, Exception Handling and Routines; Embedded SQL and Dynamic SQL, Transaction Processing – Properties, Schedules & Serializability Issues.

#### UNIT-V

**Relational algebra:** introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. **Calculus:** Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.

#### BOOKS RECOMMENDED:

- [1] J. Hoffer, M. Prescott, and F McFadden, Modern Database Management, 6/e, Pearson Education, 2006.
- [2] S. B. Navathe, R. Elmasri, S.K.Gupta, D.V.L.N. Somayajulu, Fundamentals of Database System, 4/e, Pearson Education, 2004.
- [3] A. Silberschatz, H. Korth, and S. Sudarshan, Database System Concepts, 5/e, McGraw-Hill, 2005.
- [4] C.J. Date, An Introduction to Database Systems, 7/e, Pearson Education, 2006.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – II Year (Applied Mathematics)</b> with Specialization in Computing & Informatics <b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3PC3: Mathematical Statistics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

**Objective:** To equip the student with the mathematical theory of statistics underlying the modern practices and applications of statistics to engineering, physics & astronomy, quality assurance & reliability, drug development, public health & medicine, the design of agriculture or industrial experiments, experiments of psychology and so forth.

**Prerequisites:** Elementary probability & statistics.

### COURSE OF CONTENTS

#### UNIT I

Review of probability –Random variable and Distribution function. Marginal and joint Probability distribution, Mathematical expectation of sum and product of random Variables. Moments, Cumulates and their interrelationship. Moment generating function and cumulate generating function, Binomial Normal and Poisson distribution with their properties.

#### UNIT II

Correlation and Regression; definition, regression coefficient; lines of regression; partial and multiple correlations, concept of estimation, definition of unbiasedness, Consistency and Efficiency, Statistical Decision making: Risk function, loss function; baye's approach.

#### UNIT III

Theory of Sampling, Standard error, Population and Sample Survey Methods, Test of significance for Mean, Variance, Proportion and correlation Coefficient., Sampling distribution- Chi-square test, t-test and F-distribution, Test of Hypothesis, Type I and II Error, Neyman's Pearson's Carpell Pearson's Lemma for Best Critical Region, Construction of test for mean and variance based on Neyman's Pearson's Lemma.

#### UNIT IV

Analysis of variance for one and two way classified data, Statistical Quality Control, Definitions, Control Charts, process capability, Acceptance Sampling: Single, Double and sequential sampling plans, O.C. curves, producer's and consumer's risk, A brief idea of Taguchi method.

#### UNIT V

Stochastic Process: Classification of stochastic processes, Autocorrelation function Poissonian Process-Queuing and birth and death process; Markovian process. Renewal theory. Reliability: Basic Concepts, Evaluation of system reliability.

#### BOOKS RECOMMENDED:

- [1] S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical statistics, Sultan Chand & Sons., 2000.
- [2] Freund John E, Mathematical statistics, PHI, N.D., 7<sup>th</sup> Ed., 2010.
- [3] Papoulis Athanasios and S. Unnikrishna Pillai, Probability, random variables and stochastic processes, Mc-graw Hill Book Co., 4<sup>th</sup> Ed. 2002.
- [4] S.C.Gupta, Fundamentals of Statistics, Himalaya Publishing House, Mumbai, 6<sup>th</sup> Ed., 2009.
- [5] K. S. Trivedi, Probability and statistics with reliability, queuing, and computer science applications, John Wiley & Sons, 2006.

[6] T. Veerarajan, Probability, Statistics And Random Processes, Tata McGraw-Hill Education, 2002.



# Soft -Skill

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3SS2: Life Management Skills</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	2	-	-	2	-	-	2
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** To learn about basic Life and Organizational skills.

**Pre-requisites:** Nil.

### COURSE CONTENTS

#### UNIT I

**Personality:** Defining Personality, Personality Determinants, Personality Traits, The Big 5 Model, Personality Attributes, Types of Personality, Personality Development.

**Motivation-** Maslow's Needs Hierarchy, Theory X- Theory Y, Herzberg's Two-factor theory, ERG theory, Vroom's Expectancy theory

#### UNIT II

**Life Skills for Personality Development:** Life Skills- Generic, Problem Specific and Area Specific Skills, Types - Social Skills, Thinking Skills, and Coping Skills.

**Social Skills and Negotiation Skills:** Self-Awareness: Definition, Types of Self- Self Concept, Body Image, Self Esteem, Techniques used for Self Awareness- Johari Window, SWOT Analysis, Empathy- Sympathy, Empathy & Altruism, Interpersonal Relationship- Definition, Factors affecting Relationships.

#### UNIT III

**Thinking Skills:** Thinking, Nature, Elements of Thought, Types of Thinking, Concept Formation, Reasoning, Creative & Critical Thinking - Definition, Nature, Stages, Problem Solving: Definition, Steps and Factors Influencing Problem Solving.

**Perception & Decision Making:** Importance of Perception, Factors influencing perception – Selective Perception, Halo effect, Projection, Stereotyping. Decision Making–Definition, Need, Process, Consequences.

#### UNIT IV

**Coping Skills:** Emotions - Definition, Characteristics, Types, Classification: Wheel Model, Two-Dimensional Approach, Emotional Intelligence & EQ.

Coping Strategies: Coping with Stress, Definition, Stressors, Sources of Stress, the General Adaptive Syndrome Model of Stress. Conflict Management- Sources, Impacts of Conflict and Conflict Resolution.

#### UNIT V

**Leadership:** Definition of Leadership Classification: Types of Leaders and Styles of Leadership, Managerial Grid, Characteristics and Functions of Leadership Values and Ethics of Leadership.

**Theories of leadership:** Leader Member Exchange Theory, Contingency Theory, Path- Goal Leadership Theory, Transformational Leadership Theory, Charismatic Theory.

#### BOOKS RECOMMENDED:

- [1] Stephen P. Robbins, Organizational Behaviour, Pearson Edu., 10<sup>th</sup> Ed., 2003.
- [2] Debra McGregor, Developing Thinking; Developing Learning. A Guide to Thinking Skills in Education, Open University Press, McGraw Hill House, 2007.
- [3] Kumar Mahi. Stress Coping Skills Ebook, Health & Medicine, Technology, 2009.
- [4] Stephen P. Robbins, Timothy A. Judge, Seema Sanghi, Organizational Behaviour, Dorling Kindersley (India) Pvt. Ltd., Pearson Edu., 2007.
- [5] Ryan Carey, The Effective Altruism Handbook, Published in 2015 by the Centre For Effective Altruism Oxford,

Oxfordshire United Kingdom.

[6] Life Skills – Skills for Life: A handbook, International Federation of Red Cross and Red Crescent Societies Reference Centre for Psychosocial Support, Paramedia 1662, Denmark. 1<sup>st</sup> edition, 2013.

[7] Jit S. Chandan , Organizational Behaviour, Vikas Publishing House, 3<sup>rd</sup> Ed., 2006.

# Generic-Electives

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3GE1: OS/Microprocessor</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

**Objective:** Aim of this course is to aware students about the hardware of computers, operating system management and to provide the fundamentals of microprocessor 8085.

**Prerequisite(s): Nil**

### COURSE OF CONTENTS

#### UNIT-I

##### **Introduction to Operating System**

Types of OS: Batch system, Multiprogramming, Time Sharing, Distributed & real time OS. Computer Structures and OS: System Architecture-I/O, Storage, Processor, System Components- OS Service, System Calls, Programs; System Design, Implementation and Generation, Case study.

#### UNIT-II

##### **Process and Storage Management**

Cooperation, Interprocess Communication. CPU Scheduling: Basic idea and Algorithms; Process Synchronization. Swapping, Segmentation, Paging and Contiguous Allocation. Virtual Memory: Demand Paging, Frame Allocation and Thrashing Demand Segmentation. File System: Access method, Directory Structure, File-System Management. Case study.

#### UNIT-III

##### **I/O Management**

I/O Interfacing, I/O Requests and Interrupts. Disk Management: Disk structure & Scheduling, Swapping and Stability Issues. Disk Reliability. Case Study.

#### UNIT-IV

##### **Introduction of 8085 Microprocessor and Addressing Modes:**

Architecture of 8085 processor. Register Architecture: Accumulator, Temporally Register and Flag Register. Program Counter, Stack pointer and Instruction register. Direct addressing mode and Register direct Addressing Mode. Register Indirect Addressing Mode, Immediate Addressing Mode and Implicit or Implied Addressing Mode.

#### UNIT-V

Processors and Memory Hierarchy: CISC & RISC Architectures – CISC Family – RISC , Scalar processors – Super Scalar Processors and their features – Very Long Instruction word Architecture vector & symbolic processors, Memory hierarchy.

#### **BOOKS RECOMMENDED:**

- [1] Silber Schatz and P.B. Galvin, Operating System Concepts, Addison Wesley, 1998.
- [2] P. K. Ghosh, P. R. Sridhar, 0000 to 8085, Introduction to Microprocessor PHI Learning Pvt. Ltd., 2009.
- [3] A.S. Godbole, Operating System, Tata McGraw Hill, 2005.
- [4] Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Prentice Hall PTR, 2002.
- [5] W. Stallings, Operating systems, 4th Edition, Pearson Education, 2003.
- [6] Y C Liu and G A Gibson, Microcomputer Systems, PHI, 2nd, Ed., 2003.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics <b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3GE2: Integral Transforms</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
<b>Duration of Theory Paper: 3 Hours</b>							

**Objective:** To study various types of integral transforms and their applications.

**Prerequisites:** Basics of Calculus.

### COURSE OF CONTENTS

#### UNIT I

Laplace transforms: Definitions, properties, Laplace transforms of some elementary functions, Convolution Theorem, Inverse Laplace transformation.

#### UNIT II

Fourier transforms: Definitions, Properties, Fourier transforms of some elementary functions, Convolution theorems, Fourier transform as a limit of Fourier Series.

#### UNIT III

Application of Laplace Transform to differential equations, Application of Laplace Transform to integral equation, Application of Laplace Transform to initial and Boundary Value Problems. Application of Fourier Transform to initial and Boundary Value Problems, Finite Fourier Sine and Cosine Transform, Inversion, Operational properties Fourier transform.

#### UNIT IV

Hankel's Transform: Definition, properties, Parseval's theorem, Finite Hankel's transform, Application of Hankel's transform in initial and boundary value problems.

#### UNIT V

Mellin's Transform: Definition, Mellin's Inversion theorem, properties, Convolution theorem.

#### BOOKS RECOMMENDED:

- [1] Sneddon I., The Use of Integral Transforms, Tata McGraw Hill, 1979.
- [2] Murray R. Spiegel, Laplace Transforms Schaum's Outline Of Theory and Problems Of Laplace Transforms, 1965.
- [3] Ram P Kanwal, Linear Integral Equations, Academic Press, 1971.
- [4] A. R. Vasishtha and R.K. Gupta, Integral Transforms, Krishna Prakashan Media Ltd, Meerut, India, 2000.
- [5] J.K. Goyal and K. P. Gupta, Integral Transforms, Pragati Prakashan, Meerut, India, 2013.

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics) with Specialization in Computing &amp; Informatics</b>			
				<b>Semester- III</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>AM3GE3: Financial Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

**Objectives:** To give an in depth knowledge of business finance and how they should be recorded, classified & interpreted to get a meaningful judgment of viability & decision making about the efficiently conduct of the business. The objectives of this course are to help the students learn the concepts, tools and skills of Financial Management and its application in the efficient conduct of business.

**Prerequisite(s):** NIL.

### COURSE OF CONTENTS

#### UNIT I

Scope of Financial Management, Time value of money: Introduction to various sources of finance Leverages, Meaning of leverage, Significance of operating & financial Leverage.

#### UNIT II

Capital Structure: Meaning of capital Structure Different Capital Structure Theories.

#### UNIT III

Working Capital Management: Concept of Working Capital, Management of cash Management of Inventories, Management of Account Receivable Management, Accountants Payable Over Trading & Under Trading.

#### UNIT IV

Long term investment Decision: Capital Budgeting , Cost Volume Profit Analysis.

#### UNIT V

Marginal Costing Introduction to marginal costing, Decision making in alternative, Choices, Dividend Policy in Practice.

#### BOOKS RECOMMENDED:

1. Dr. S. N. Maheshwari , Financial Management: Principles & Practice.
2. Khan M.Y. and Jain P.K. Financial Management, Tata McGraw Hill, New Delhi.
3. Keown, Arthu J., Martin, John D., Petty, J. William and Scott, David F, Financial Management. Pearson Education.
4. Pandey, I.M. financial Management, Vikas Publishing House, New Delhi.
5. R.P.Rastogi, “Graded Problems and Solutions in Financial Management”, Galgotia Publication, New Delhi.