

**R.M.K. ENGINEERING COLLEGE**  
**(An Autonomous Institution)**  
**B.TECH COMPUTER SCIENCE AND BUSINESS SYSTEMS**  
**REGULATIONS – 2020**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

1. To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics and computer science for the applications relevant to various business requirements.
2. To enrich graduates with the core competencies necessary for solving the business requirements of an enterprise.
3. To enable graduates to think logically, pursue lifelong learning and will have the capacity to understand technical issues related to computing and business systems and to design optimal solutions.
4. To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills to solve real world problems and meet the diversified needs of industry, academia and research.
5. To practice the profession with ethics, integrity, leadership and social responsibility with a good understanding of the changing societal needs.

**PROGRAM OUTCOMES (POs)**

**ENGINEERING GRADUATES WILL BE ABLE TO:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

**After the successful completion of the program, the graduates will be able to:**

1. Apply the core aspects of computer science and business system principles such as software design & development and data engineering for developing software products.
2. Identify and utilize the strengths of cutting edge technologies and strong analytical skills to develop quality software in scientific and business applications for the betterment of society and Industry.

- Decide on suitable career path immediately after graduating or after pursuing higher degree that would place them in an esteemed organization or create one of their own.

### **MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES**

A broad relation between the programme objective and the outcomes is given in the following table

<b>PROGRAMME EDUCATIONAL OBJECTIVES</b>	<b>PROGRAMME OUTCOMES</b>											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2	1	1								
2	3	3	3	3	2	1	2	1			2	2
3			3	3	3	2	2	1	1	1	2	3
4			3	3	3	2	3	2	1	1	2	3
5				3		2	2	3	3	2	2	2

### **MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES**

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

<b>PROGRAMME SPECIFIC OBJECTIVES</b>	<b>PROGRAMME OUTCOMES</b>											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	3	3	2	1	2	1			2	2
2			3	3	3	2	3	2	1	1	2	3
3				3		2	2	3	3	2	2	2

Contribution

1: Reasonable

2: Significant

3: Strong

**SEMESTER I**

S. NO.	COURSE TITLE	PROGRAMME OUTCOMES											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Discrete Mathematics	✓	✓	✓	✓								
2	Introduction to Statistics, Probability and Calculus	✓	✓	✓	✓								
3	Fundamentals of Computer Science + Lab	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
4	Principles of Electrical Engineering + Lab	✓	✓	✓	✓	✓	✓						✓
5	Fundamentals of Physics + Lab	✓	✓	✓	✓	✓	✓	✓	✓				
6	Business Communication and Value Sciences – I						✓		✓	✓	✓	✓	✓

**SEMESTER II**

S. NO.	COURSE TITLE	PROGRAMME OUTCOMES											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Linear Algebra	✓	✓	✓	✓								
2	Statistical Methods + Lab	✓	✓	✓	✓								
3	Data Structures and Algorithms + Lab	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
4	Principles of Electronics Engineering + Lab	✓	✓	✓	✓	✓	✓	✓	✓				✓
5	Fundamentals of Economics		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
6	Business Communication and Value Sciences – II						✓		✓	✓	✓	✓	✓

### SEMESTER III

S. NO.	COURSE TITLE	PROGRAMME OUTCOMES											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Computational Statistics + Lab	✓	✓	✓	✓								✓
2	Formal Language and Automata Theory	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
3	Computer Organization and Architecture	✓	✓	✓	✓	✓	✓	✓	✓				✓
4	Object Oriented Programming + Lab	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
5	Software Engineering + Lab	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
6	Financial Management						✓		✓	✓	✓	✓	✓

### SEMESTER IV

S. NO.	COURSE TITLE	PROGRAMME OUTCOMES											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Operating Systems + Lab (Unix)	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
2	Database Management Systems + Lab	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
3	Software Design with UML + Lab	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
4	Introduction to Innovation, IP Management and Entrepreneurship						✓		✓	✓	✓	✓	✓
5	Business Communication and Value Science - III						✓		✓	✓	✓	✓	✓
6	Operations Research + Lab						✓		✓	✓	✓	✓	✓
7	Marketing Research & Marketing Management						✓		✓	✓	✓	✓	✓

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**I - IV SEMESTER CURRICULUM AND SYLLABI**

<b>SEMESTER – I</b>								
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	20MA102	Discrete Mathematics	BS	3	3	0	0	3
2	20MA103	Introduction to Statistics, Probability and Calculus	BS	3	3	0	0	3
3	20IT101	Fundamentals of Computer Science + Lab	ES	6	2	2	2	4
4	20EE103	Principles of Electrical Engineering + Lab	ES	5	3	0	2	4
5	20PH103	Fundamentals of Physics + Lab	BS	5	3	0	2	4
6	20EL102	Business Communication and Value Sciences – I	HS	6	2	2	2	4
		Induction Program (Non Credit)	MC	3 Weeks				
<b>TOTAL</b>				<b>28</b>	<b>16</b>	<b>4</b>	<b>8</b>	<b>22</b>

<b>SEMESTER – II</b>								
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	20MA202	Linear Algebra	BS	5	3	2	0	4
2	20MA203	Statistical Methods + Lab	BS	5	3	0	2	4
3	20IT201	Data Structures and Algorithms + Lab	PC	6	2	2	2	4
4	20EC241	Principles of Electronics Engineering + Lab	ES	5	3	0	2	4
5	20IT202	Fundamentals of Economics	PC	2	2	0	0	2
6	20EL202	Business Communication and Value Sciences - II	HS	6	2	2	2	4
		Environmental Science and Engineering (Non Credit)	MC	3	3	0	0	0
<b>TOTAL</b>				<b>32</b>	<b>18</b>	<b>6</b>	<b>8</b>	<b>22</b>

SEMESTER – III								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	20MA304	Computational Statistics + Lab	BS	5	3	0	2	4
2	20CB301	Formal Language and Automata Theory	PC	7	3	2	2	5
3	20CB302	Computer Organization and Architecture	PC	5	3	0	2	4
4	20CB303	Object Oriented Programming + Lab	PC	5	3	0	2	4
5	20CB304	Software Engineering + Lab	PC	7	3	2	2	5
6	20CB305	Financial Management	PC	3	3	0	0	3
		Indian Constitution (Non-Credit)	MC	2	2	0	0	0
		Aptitude and Coding Skills – I (Non-Credit)	EEC	2	0	0	2	0
<b>TOTAL</b>				<b>36</b>	<b>20</b>	<b>4</b>	<b>12</b>	<b>25</b>

SEMESTER – IV								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	20CB401	Operating Systems + Lab (Unix)	PC	5	3	0	2	4
2	20CB402	Database Management Systems + Lab	PC	5	3	0	2	4
3	20CB403	Software Design with UML + Lab	PC	5	3	0	2	4
4	20CB404	Introduction to Innovation, IP Management and Entrepreneurship	EEC	3	3	0	0	3
5	20EL401	Business Communication and Value Science – III	HS	6	2	0	4	4
6	20CB405	Operations Research + Lab	PC	4	2	0	2	3
7	20CB406	Marketing Research & Marketing Management	PC	3	3	0	0	3
		Essence of Indian Traditional Knowledge (Non-Credit)	MC	2	2	0	0	0
		Aptitude and Coding Skills – II (Non-Credit)	EEC	2	0	0	2	0
		Universal Human Values 2: Understanding Harmony (Non-Credit)	MC	4	2	2	0	0
<b>TOTAL</b>				<b>39</b>	<b>23</b>	<b>2</b>	<b>14</b>	<b>25</b>



paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Check the validity of the arguments
- CO2: Analyze various proof techniques and application of principles
- CO3: Construct truth tables and optimize logic by maps
- CO4: Define various algebraic structures, axioms and properties
- CO5: Apply graph theory techniques to solve real life problems.

**TEXT BOOKS:**

1. J. P. Trembly & Manohar, Discrete Mathematical Structures with applications to computer science, 1<sup>st</sup> Edition, McGraw Hill Education,2017.
2. N. Herstein, Topics in Algebra, 2<sup>nd</sup> Edition, John Wiley and Sons,1975
3. M. Morris Mano, Digital Logic & Computer Design, 1<sup>st</sup> Edition, Pearson,2004.
4. J. A. Bondy and U. S. R. Murty, Graph Theory with Applications, 5<sup>th</sup> Edition, Macmillan Press, London, 1982.

**REFERENCES:**

1. Gilbert Strang, Introduction to linear algebra, 4<sup>th</sup> Edition, Wellesley-Cambridge Press,2009.
2. R. A. Brualdi, Introductory Combinatorics, 1<sup>st</sup> Edition, North-Holland, New York,1977.
3. N. Deo, Graph Theory with Applications to Engineering and Computer Science, 1<sup>st</sup> Edition, Prentice Hall, Englewood Cliffs, 2016.

**20MA103**

**INTRODUCTION TO STATISTICS,  
PROBABILITY AND CALCULUS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The Course will enable learners to:**

- Acquaint the students with the fundamental concept of statistics, probability and distributions.
- Impart the knowledge on basic concepts of differential calculus, integral calculus and multiple integrals.

**UNIT I INTRODUCTION TO STATISTICS 9**

Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Central tendency (Mean, Median and Mode) and dispersion (S.D, M.D, Q.D and Range). Bivariate data. Summarization, marginal and conditional frequency distribution.

**UNIT II PROBABILITY 9**

Concept of experiments – sample space – event – Definition of Combinatorial Probability – Conditional Probability – Baye's Theorem – Expected values and moments – mathematical expectation and its properties – Moments (including variance) and their properties – interpretation – Moment generating function.

**UNIT III DISCRETE PROBABILITY DISTRIBUTIONS 9**

Binomial – Poisson – Geometric distributions.

**UNIT IV CONTINUOUS PROBABILITY DISTRIBUTIONS 9**

Uniform – exponential – normal – chi-square – student - t – F distributions.

**UNIT V CALCULUS 9**

Basic concepts of differential calculus: Derivatives – product rule – quotient rule , Basic concepts of integral calculus: Definition of definite and indefinite integrals – substitution method – Integration by parts – Double integral – Area of a Double integral – Triple integral – Volume of a solids.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Apply the concepts of basic statistics, find mean, median, mode, standard deviation, mean deviation, quartile deviation and range for a given data.

CO2: Make use of probability concepts in problems of uncertainty.

CO3: Identify and apply the discrete and continuous distributions concepts in real life problems.

CO4: Evaluate the area and volume by using multiple integrals.

**TEXT BOOKS:**

1. Introduction of Probability Models, S.M. Ross, 10th Edition, Academic Press, New York, 2010.
2. A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, volume I & II, 1st Edition, World Press, 2013.
3. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publication, Delhi, 1965.

**REFERENCES:**

1. S.M. Ross, A first course in Probability, 8th Edition, Prentice Hall, 2010.
2. I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 9th Edition, PHI, 2017.
3. A.M. Mood, F.A. Graybill and, D.C. Boos, Introduction to the Theory of Statistics, 3rd Edition McGraw Hill Education, 1973.
4. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Thomson Learning, 2011.
5. M. D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education, 2002.

<b>20IT101</b>	<b>FUNDAMENTALS OF COMPUTER SCIENCE + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>

## **OBJECTIVES:**

**The Course will enable learners to:**

- Understand the problem-solving concepts
- Understand syntax and constructs of C Language
- Develop structured programs using basic programming constructs
- Understands pointers and arrays in C
- Understand UNIX system interface
- Understand and apply programming methods

## **UNIT I            GENERAL PROBLEM SOLVING CONCEPTS AND INTRODUCTION**

**TO C** **6+6**

**General problem Solving concepts:** Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops. **Imperative languages:** Introduction to imperative language; syntax and constructs of a specific language (ANSI C). Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation. Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and un- structured programming.

## **UNIT II            FUNCTION AND PROGRAM STRUCTURES** **6+6**

**Functions and Program Structure:** Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types, Standard Library.

**UNIT III POINTER AND ARRAYS****6+6**

**Pointers and Arrays:** Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions.

**UNIT IV STRUCTURES AND I/O****6+6**

**Structures:** Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields. **Input and Output:** Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O.

**UNIT V UNIX SYSTEM INTERFACE AND PRORAMMING METHOD****6+6**

**Unix system Interface:** File Descriptor, Low level I/O – read and write, open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator. **Programming Method:** Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.

**TOTAL: 60 PERIODS****LIST OF EXPERIMENTS:**

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
  - i. Small but tricky codes
  - ii. Proper parameter passing
  - iii. Command line Arguments
  - iv. Variable parameter
  - v. Pointer to functions
  - vi. User defined header
  - vii. Make file utility
  - viii. Multi file program and user defined libraries
  - ix. Interesting substring matching / searching programs
  - x. Parsing related assignments

**TOTAL: 30 PERIODS**

## OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Apply problem solving techniques to simple computational problems
- CO2: Understand the syntax and constructs of C language
- CO3: Develop structured programs using basic constructs in C
- CO4: Understand pointers and arrays in C
- CO5: Understand Unix system interface
- CO6: Apply various programming methods

## TEXT BOOKS:

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Pearson Education India, 2nd Edition, 2015.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

## REFERENCES:

1. B. Gottfried, Programming with C, Schaum Outline Series, Fourth Edition, 2018
2. Herbert Schildt, C: The Complete Reference, McGraw Hill, Fourth Edition, 2017
3. Yashavant Kanetkar, Let Us C, BPB Publications, 16th Edition, 2018.

<b>20EE103</b>	<b>PRINCIPLES OF ELECTRICAL ENGINEERING + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

## OBJECTIVES:

The Course will enable learners to:

- Study the basic concepts of electrical engineering.
  - Study the basic DC and AC networks used in electrical circuits.
  - Demonstrate the concepts of electrical statics and electro-mechanics.
  - Acquaint the knowledge about the measurement of electrical quantities.
- Demonstrate the concepts of electrical wiring and safety.

## UNIT I INTRODUCTION

9

Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols

in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff's laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

**UNIT II DC CIRCUITS**

**9**

Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

**UNIT III AC CIRCUITS**

**9**

AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Y- $\Delta$  & Y-Y).

**UNIT IV ELECTROSTATICS AND ELECTRO-MECHANICS**

**9**

Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

**UNIT V MEASUREMENTS AND SENSORS**

**9**

Introduction to measuring devices/sensors and transducers (Piezoelectric and thermocouple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS:**

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
2. Determination of resistance temperature coefficient
3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem)
4. Simulation of R-L-C series circuits for  $X_L > X_C$  ,  $X_L < X_C$
5. Simulation of Time response of RC circuit
6. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
7. Demonstration of measurement of electrical quantities in DC and AC systems.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Summarize the behavior electrical circuits
- CO2: Solve the DC circuits using network theorems
- CO3: Interpret the concepts of AC circuits
- CO4: Discuss the electrostatic and magnetic fields with circuit laws and analyze the performance of transformers
- CO5: Explain the various sensors and demonstrate electric wiring

**TEXT BOOKS:**

1. Electric Machinery, (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

## REFERENCES:

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. 2011
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

**20PH103**

**FUNDAMENTALS OF PHYSICS + LAB**

**L T P C**

**3 0 2 4**

## OBJECTIVES:

**The Course will enable learners to:**

- Impart the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.
- Illustrate the fundamentals of oscillatory systems and the analogy of mechanical and electrical systems.
- Explain various light concepts like interference, diffraction and polarization.
- Impart knowledge related to the importance of EM waves and quantum mechanics
- Introduce concepts of crystallography, band structure and thermodynamics
- Give idea of basic lasing action, various types of lasers and fiber optics

## UNIT I WAVES AND OSCILLATIONS

**9**

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring-mass system. Resonance- definition, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced oscillation and resonance in mechanical and electrical oscillators.

**UNIT II OPTICS****9**

Interference-principle of superposition-Young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's ring, Diffraction-Two kinds of diffraction-Difference between interference and diffraction. Fraunhofer diffraction at single slit-plane diffraction grating, Temporal and Spatial Coherence. Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

**UNIT III ELECTROMAGNETISM AND QUANTUM MECHANICS****9**

Basic Idea of Electromagnetism: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium. Quantum Mechanics: Introduction-Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box.

**UNIT IV CRYSTALLOGRAPHY AND THERMODYNAMICS****9**

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction. Semiconductor Physics: Conductor, Semiconductor and Insulator; Origin of Band Theory, Basic concept of Band theory. Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

**UNIT V LASER AND FIBER OPTICS****9**

Laser and Fiber optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO<sub>2</sub> and Neodymium YAG (Neodymium-doped Yttrium Aluminum Garnet); Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering, Fiber optics and applications, types of optical fibers.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS:**

1. Magnetic field along the axis of current carrying coil – Stewart and Gee
2. Determination of Hall coefficient of semi-conductor
3. Determination of Plank constant
4. Determination of wave length of light by Laser diffraction method
5. Determination of wave length of light by Newton's Ring method
6. Determination of laser and optical fiber parameters
7. Determination of Stefan's Constant

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Obtain solution of the oscillator using differential equation.

CO2: Analyze the intensity variation of light due to Polarization and interference

CO3: Explain fundamentals of electromagnetism and quantum mechanics and apply it in engineering problems

CO4: Find solution to thermal and electrical problems faced in computer devices.

CO5: Analyze working principle of lasers and to summarize its applications

**TEXT BOOKS:**

1. A Beiser ,Concepts of Modern Physics, (Fifth Edition), McGraw Hill International.
2. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
3. Sears & Zemansky -University Physics- (Addison-Wesley)
4. Jenkins and White, Fundamentals of Optics,(Third Edition), McGraw-Hill.
5. M.N. Avadhanulu and P.G. Kshirsagar, "A text book of Engineering Physics", S. Chand and Company, New Delhi, 2014.
6. R.K. Gaur and S.L. Gupta, "Engineering Physics", DhanpatRai Publications (P) Ltd., Eighth Edition, New Delhi, 2001.

**REFERENCES:**

1. Halliday, Resnick and Walker, Fundamentals of Physics, 9th Ed., John Wiley & sons (2011).

2. Richard P. Feynman, The Feynman Lectures on Physics - Vol. I, II and III: The New Millennium Edition (2012).
3. Neil W Aschroft and N David Mermin, "Solid State Physics", Harcourt College Publishers, 1976
4. S. O. Pillai, "Solid state physics", New Age International, 2015.
5. M A Wahab, "Solid State Physics", 3<sup>rd</sup> Edition, Narosa Publishing House Pvt. Ltd., 2015
6. Garcia,N.& Damask,A. "Physics for Computer Science Students" Springer-Verlag,2012.
7. Rogers, B., Adams,J & Pennathur, S., "Nanotechnology: Understanding Small System", CRC Press, 2014

<b>20EL102</b>	<b>BUSINESS COMMUNICATION AND VALUE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>SCIENCE – I</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Define the key concepts of Values and life skills
- Equip the learners to identify and understand what life skills are and their importance in leading a happy and well-adjusted life
- Motivate students to look within and Create a better version of self
- Illustrate the tenets of business communication
- Apply the basic communication practices
- Augment the learners to understand self-awareness, confidence and communication

**UNIT I**

**6+6**

Overview of LOL (include activity on introducing self), Class activity – presentation on favorite cricket captain in IPL and the skills and values they demonstrate, Self-work with immersion – interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them, Overview of business communication, Activity: Write a newspaper report on an IPL match, Activity: Record

a conversation between a celebrity and an interviewer, Self-awareness – identity, body awareness, stress management.

## **UNIT II**

**6+6**

Essential Grammar – I: Refresher on Parts of Speech – Listen to an audio clip and note down the different parts of speech followed by discussion, Tenses: Applications of tenses in Functional Grammar, Sentence formation (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g. Zindagi Na MilegiDobara where the characters use ‘the’ before every word).

## **UNIT III**

**6+6**

Communication Skills: Overview of Communication Skills, Barriers of communication, Effective communication, Types of communication- verbal and non – verbal – Role-play based learning, Importance of Questioning, Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening, expressing self, connecting with emotions, visualizing and experiencing purpose.

## **UNIT IV**

**6+6**

Email writing: Formal and Informal emails, activity,: Verbal communication Pronunciation, clarity of speech, Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, , significant abbreviations formal business vocabulary – Read Economic Times, Reader’s Digest, National Geographic and take part in a GD, using the words you learnt/liked from the articles. Group discussion using Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms words learnt, Written Communication: Summary writing, story writing, Build your CV – start writing your comprehensive CV including every achievement in your life, no format, no page limit, Project: Create a podcast on a topic that will interest college students, Life skill: Stress management, working with rhythm and balance, colours, and teamwork, Project: Create a musical using the learnings from unit

## **UNIT V**

**6+6**

Understanding Life Skills: Movie based learning – The Pursuit of Happiness, Introduction to life skills What are the critical life skills, Multiple Intelligences

Embracing diversity – Activity on appreciation of diversity, Life skill: Community service – work with an NGO and make a presentation, Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation

**TOTAL: 60 PERIODS**

### **PRACTICAL SESSIONS:**

1. Write a newspaper report on an IPL match.
2. Interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them
3. Record a conversation between a celebrity and an interviewer.
4. Skit based on communication skills.
5. Listen to recording and answer questions based on them.
6. Group Discussion.
7. Write your comprehensive CV including every achievement in your life, no format, no page limit.

### **LIST OF PROJECTS:**

1. Create a podcast on a topic that will interest college students
2. Apply the basic communication practices in different types of communication:  
Create a musical
3. Life skill: Community service – work with an NGO and make a presentation
4. Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation

**TOTAL: 30 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Recognize the need for life skills and values.
- CO2: Recognize own strengths and opportunities.
- CO3: Apply the life skills to different situations.
- CO4: Understand the basic tenets of communication.
- CO5: Apply the basic communication practices in different types of communication.
- CO6: Evaluate the importance of self-awareness, confidence and communication.

## REFERENCES:

1. Alan Mc'carthy and O'dell, English vocabulary in use, Cambridge University Press, 3<sup>rd</sup> Edition, 2017.
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Dr. Saroj Hiremath, Business Communication, Nirali Prakashan, 2017.

## WEB REFERENCES:

1. Train your mind to perform under pressure- Simon sinek  
<https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/>
2. Brilliant way one CEO rallied his team in the middle of layoffs  
<https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html>
3. Will Smith's Top Ten rules for success  
<https://www.youtube.com/watch?v=bBsT9omTeh0>

## ONLINE RESOURCES:

1. <https://www.coursera.org/learn/learning-how-to-learn>
2. <https://www.coursera.org/specializations/effective-business-communication>

**20MA202**

**LINEAR ALGEBRA**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

## OBJECTIVES:

**The Course will enable learners to:**

- Introduce the concepts of matrices and determinants.
- Impart the knowledge of vectors, linear combinations, vector space and linear transformations.
- Implement the concept of linear combinations in image processing and Machine learning.



## REFERENCES:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7<sup>th</sup> Edition.
2. Michael. D. Greenberg, "Advanced Engineering Mathematics", Pearson, 2<sup>nd</sup> Edition.
3. Gilbert Strang, "Introduction to linear algebra", Wellesley-Cambridge Press, 5<sup>th</sup> Edition.
4. P.N. Wartikar & J.N. Wartikar, "Applied Mathematics", Volume I & II, Pune Vidyarthi Griha Prakashan, 7<sup>th</sup> Edition, 1994.
5. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson Education International, 3<sup>rd</sup> Edition.
6. <https://machinelearningmastery.com/introduction-matrices-machine-learning/>

**20MA203**

**STATISTICAL METHODS + LAB**

**L T P C**

**3 0 2 4**

## OBJECTIVES:

**The Course will enable learners to:**

- Explain the fundamental concepts of random sampling and Test of hypothesis.
- Develop an understanding on the principles of estimation theory.
- Introduce the concepts of linear statistical models and non-parametric test.
- Impart the knowledge of time series analysis & forecasting.

## **UNIT I SAMPLING DISTRIBUTION**

**9**

Sampling Techniques – Random sampling – Sampling from finite and infinite populations – Estimates and standard error (sampling with replacement and sampling without replacement) – Sampling distribution of sample mean – stratified random sampling.

## **UNIT II THEORY OF ESTIMATION**

**9**

Estimation – Point estimation – criteria for good estimates (un-biasedness, consistency) – Methods of estimation including maximum likelihood estimation.



**TEXT BOOKS:**

1. I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", Prentice Hall India Learning Private Limited, 4<sup>th</sup> Edition, 2012.
2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", Volume I & II, World Press.
3. Chris Chatfield, "The Analysis of Time Series: An Introduction", Chapman & Hall/CRC, 6<sup>th</sup> Edition, 2004.

**REFERENCES:**

1. D.C. Montgomery and E. Peck, "Introduction to Linear Regression Analysis", Wiley-Inter science.
2. A.M. Mood, F.A. Graybill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill.
3. N. Draper and H. Smith, "Applied Regression Analysis", Wiley-Inter science.
4. R. Garrett Golemund, "Hands-on Programming with R", O'Reilly.
5. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Professional, 2<sup>nd</sup> Edition.

<b>20IT201</b>	<b>DATA STRUCTURES AND ALGORITHMS + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:****The Course will enable learners to:**

- Explore algorithm performance analysis
- Learn linear and non-linear data structures.
- Recognize and distinguish the applications of various linear and non-linear data structures.
- Analyse the concepts of tree and graph data structures.
- Understand the concept of files and its operations.
- Able to incorporate various searching and sorting techniques in real time scenarios.

**UNIT I      INTRODUCTION TO ALGORITHM & DATA ORGANISATION      6+6**

Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

**UNIT II      LINEAR DATA STRUCTURE      6+6**

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

**UNIT III      NON LINEAR DATA STRUCTURES      6+6**

Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree), Operations & Applications of Non-Linear Data Structures

**UNIT IV      GRAPHS AND FILES      6+6**

**Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. **File:** Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

**UNIT V      SEARCHING AND SORTING      6+6**

Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heapsort, Introduction to Hashing

**TOTAL: 60 PERIODS**

**LIST OF EXPERIMENTS:**

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Analyse the various data structure concepts.
- CO2: Apply the different linear data structures to problem solutions.
- CO3: Apply the different non-linear data structures to problem solutions.
- CO4: Exemplify the concept of files and its operations.
- CO5: Understand files accessing mechanisms.
- CO6: Critically analyse the various sorting algorithms.

**TEXT BOOKS:**

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. Ullman, Pearson.

**REFERENCES:**

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), (Thirty First Edition), Pat Morin, UBC Press.

**20EC241 PRINCIPLES OF ELECTRONICS ENGINEERING + L T P C**  
**LAB**

**3 0 2 4**

**OBJECTIVES:**

**The Course will enable learners to:**

- Study the operation of semiconductor diodes and their characteristics
- Acquire knowledge about the operation and characteristics of BJT under various configurations
- Introduce the structure and terminal characteristics of FET and MOSFET
- Understand the concepts of feedback and operational amplifiers with its applications



**UNITV          DIGITAL ELECTRONICS FUNDAMENTALS****9**

Difference between analog and digital signals, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

**TOTAL: 45 PERIODS****LIST OF EXPERIMENTS:**

1. Semiconductor Diodes and application,
  - a. Characteristics of PN junction diode
  - b. Zener diode characteristics & Regulator using Zener diode
  - c. Clipper , clamper & FWR
2. Transistor circuits
  - a. Common Emitter Input Output characteristics
  - b. Common Base Input Output characteristics
3. JFET, oscillators and amplifiers.
  - a. FET characteristics
  - b. Characteristics of amplifier
  - c. Design of basic oscillator circuits
4. Opamp based experiments (Analysis using Simulation Spice)
  - a. Opamp as inverting amplifier, non-inverting amplifier, voltage follower
  - b. Opamp applications-summer, subtractor
  - c. Opamp applications-Differentiator and Integrator
5. Digital experiments
  - a. Simplification, realization of Boolean expressions using logic gates/Universal gates.
  - b. Realization of Half/Full adders and Half/Full Subtractors using logic gates.
  - c. Construction of simple Decoder & Multiplexer circuits using logic gates.
  - d. Realization of Synchronous Up/Down counter.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Explain the characteristics of diode

CO2: Describe the equivalence circuits of transistors

CO3: Acquire the knowledge on feedback amplifiers and operational amplifiers.

CO4: Describe the simple digital logic circuits

**TEXT BOOKS:**

1. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press.
2. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education.
3. Digital Logic & Computer Design, M. Morris Mano, Pearson

**REFERENCES:**

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky.
2. Solid State Electronic Devices, 6<sup>th</sup> Edition, Ben Streetman, Sanjay Banerjee
3. Electronic Principle, Albert Paul Malvino.
4. Electronics Circuits: Discrete & Integrated, D Schilling C Belove T Apelewicz R Saccardi.
5. Microelectronics, Jacob Millman, Arvin Grabel.
6. Electronics Devices & Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj

**20IT202****FUNDAMENTALS OF ECONOMICS****L T P C****2 0 0 2****OBJECTIVES:**

**The Course will enable learners to:**

- Explain the fundamental principles of micro economics relevant to managing an organization.
- Describe the fundamental principles of macroeconomics to have the understanding of economic environment of business.

- Understand the various aspects of India's economy.

**UNIT I INTRODUCTION 6**

Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).

**UNIT II CONSUMER ANALYSIS 6**

Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects - Derivation of a Demand Curve;

**UNIT III PRODUCTION AND COSTING 6**

Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect; Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

**UNIT IV MACROECONOMIC REFORMS 6**

National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports; Money - Definitions; Demand for Money - Transactionary and Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model.

**UNIT V POLICY GOVERNANCE 6**

Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Become familiar with both principles of micro and macroeconomics.

CO2: Understand about approaches to consumer behaviour and relation between production and cost function.

CO3: Describe and discuss on interaction of product and factor market.

CO4: Get awareness about importance and development of Indian economy and economic reforms.

CO5: Have thorough knowledge in the areas of inflation, unemployment, monetary policy, fiscal policy and international trade.

**TEXT BOOKS:**

1. Microeconomics, Pindyck, Robert S., and Daniel L. Rubinfeld.
2. Macroeconomics, Dornbusch, Fischer and Startz.
3. Economics, Paul Anthony Samuelson, William D. Nordhaus.

**REFERENCES:**

1. Intermediate Microeconomics: A Modern Approach, Hal R, Varian.
2. Principles of Macroeconomics, N. Gregory Mankiw.

<b>20EL202</b>	<b>BUSINESS COMMUNICATION AND VALUE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>SCIENCES – II</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Strengthen the reading skills.
- Enhance effective writing, presentation and group discussion skills
- Identify personality traits and help learners evolve as a better team player.
- Provide the learners with an introduction to the key concepts of
  - a) Morality
  - b) Behavior and beliefs
  - c) Diversity & Inclusion

Use tools of structured written communication: Good and Bad Writing. Common errors, punctuation rules, use of words. Research, read and generate a report on a social issue. Understand tools for Lucid writing: Catherine Morris and Joanie McMahon's writing techniques. SATORI – Participants share the personal take away acquired from GD, writing and reading skills activities. Use electronic/social media to share concepts and ideas: Launch an E Magazine.

## **UNIT II**

**6+6**

Understand the basics of presentation- Introduction to basic presentation skills & ORAI app. Speed Reading session: Introduction to skimming and scanning. Develop materials to create an identity for an organization dedicated to a social cause. Create Vision, Mission, Value statement, tagline and Design a logo. Introduction to basic presentation skills & ORAI app. Prepare and publish the Second episode of the E Magazine. Speed Reading session: Introduction to skimming and scanning

## **UNIT III**

**6+6**

Create communication material to share concepts and ideas. Ad campaign- Brain storming session discuss and explore the means of articulating and amplifying the social issue their NGOs are working for. Use electronic/social media to share concepts and ideas. Design a skit- a) write the script articulating the message of their respective NGOs. Read out the script. Promote the play through a social media and gather your audience. Discussion and Theory :Identify individual personality types and role in a team. (1) Theory to find out from the participants their views, observations and experiences of working in a team(2) Intro of Dr. Meredith Belbin and his research on team work and how individuals contribute. (3) Belbin's 8 Team Roles and Lindgren's Big 5 personality traits.(4) Belbin's 8 team player styles.

## **UNIT IV**

**6+6**

Identify individual personality types and role in a team: (1) Team Falcon Practical to identify individual personality traits with Belbin's 8 team player styles(2) Similar personality types to form groups (3) Groups present their traits - Use the electronic/social media to share concepts and ideas. Basic concepts of Morality and Diversity: Ten minutes of your time – a short film on diversity. Play the video. Theory to connect the key take away of the film to the concept of empathy.

## **UNIT V**

**6+6**

Basic concepts of Morality and Diversity. Research on a book, incident or film based on the topic of your respective NGO- Write a review in a blog. Diversity & Inclusion- Different forms of Diversity in our society. Discussion on TCS values, Respect for Individual and Integrity. Use tools of structured written communication to generate awareness for a cause

**TOTAL: 60 PERIODS**

### **PRACTICAL SESSIONS:**

1. Group Practical – As a group, they will work on the social issue identified by them. Research, read and generate a report based on the findings. Plan and design an E Magazine.
2. Each group will form an NGO. Create Vision, Mission, Value statement, tagline and Design a logo. individual write up to be written and evaluated for the E- magazine. Prepare and publish the Second episode of the E Magazine.
3. Design a skit- a) write the script articulating the message of their respective NGOs. Read out the script. (Skit time-5 minutes). Promote the play through a social media and gather your audience. Prepare and publish the third episode of the E Magazine.
4. Groups to create a story – 10 minutes of a person's life affected by the social issue groups are working on. Narrate the story in first person.
5. Research on a book, incident or film based on the topic of your respective NGO and Write a review in a blog on the topic.
6. Teams to video record interviews of people from diverse groups (Ask 5 questions). Share the recordings in YouTube.
7. Prepared speech- Every student will narrate the challenges faced by a member of a diverse group in 4 minutes (speech in first person).Prepare and publish the final episode of the E Magazine.
8. Revisit your resume Include your recent achievements in your resume.

### **LIST OF PROJECTS:**

1. Each team to look for an NGO/ social group in the city which is working on the issue their college group is supporting.
2. Spend a day with the NGO/ social group to understand exactly how they work and the challenges they face.

3. Render voluntary service to the group for one day.
4. Invite the NGO/ social group to address their university students for couple of hours. Plan the entire event, decide a suitable venue in the university, gather audience, invite faculty members etc. (they need to get their plan ratified their professor). Outcome-- Host an interactive session with the NGO spokesperson.
5. The groups to present their experience of a day with the NGO and inspire students to work for the cause.

**TOTAL: 30 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Understand and use tools of structured written communication
- CO2: Use electronic/social media to share concepts and ideas
- CO3: Understand the basics of presentation and apply effective techniques to make presentations
- CO4: Apply the basic concept of speed reading, skimming and scanning.
- CO5: Identify individual personality types and role in a team.
- CO6: Understand the basic concepts of Morality and Diversity and argue on a topic based on morality and diversity
- CO7: Articulate opinions on a topic with the objective of influencing others.

### **REFERENCES:**

1. Dr. A.P.J Abdul Kalam and Arun Tiwari, Guiding Souls : Dialogues on the purpose of life, Prabhat Prakashan, 1st Edition, 2005
2. Dr. A.P.J Abdul Kalam and Acharya Mahapragya, The Family and the Nation, Harper Collins Publishers India, 2015
3. Dr. A.P.J Abdul Kalam and Y.S.Rajan, The Scientific India: A twenty First Century Guide to the World around Us, Penguin Books India Pvt. Ltd, 2011
4. Dr. A.P.J Abdul Kalam, Forge Your Future: Candid, Forthright, Inspiring, Penguin Books India Pvt. Ltd, 2014.
5. Peter H. Diamandis and Steven Kotler, Abundance: The Future is Better Than You Think, Free Press, 2012.
6. Simon Sinek, Start with Why: How Great Leaders Inspire Everyone to Take Action, Penguin Books India Pvt. Ltd, 2011.

7. Sandra Moriarty, Nancy D. Mitchell and William D. Wells, Advertising & IMC: Principles and Practice, Pearson Education India ,2016.

#### **WEB REFERENCES:**

1. Ethics Fundamentals And Approaches To Ethics  
<https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf>
2. A Framework for Making Ethical Decisions
3. <https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions>
4. Five Basic Approaches to Ethical Decision-  
[http://faculty.winthrop.edu/meelerd/docs/rolos/5\\_Ethical\\_Approaches.pdf](http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf)

#### **ONLINE RESOURCES:**

1. <https://youtu.be/CsaTslhSDI>
2. [https://m.youtube.com/watch?feature=youtu.be&v=IKvV8\\_T95M](https://m.youtube.com/watch?feature=youtu.be&v=IKvV8_T95M)
3. <https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y>
4. [https://m.youtube.com/watch?v=dT\\_D68RJ5T8&feature=youtu.be](https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be)
5. <https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be>
6. <https://www.coursera.org/specializations/effective-business-communication>

<b>ENVIRONMENTAL SCIENCE AND ENGINEERING (Non Credit Course )</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>

#### **OBJECTIVES:**

The goal of this course is to enlighten and sensitize the students on environmental conservation and social issues. The course is designed to:

- Appreciate the natural resources of environment, which are inherently created for supporting life.
- Learn scientific and technological solutions to current day pollution issues.
- Study the interrelationship between living organisms and environment



conservation of biodiversity (in-situ and ex-situ conservation) - India as a mega-diversity nation – hot-spots of biodiversity in India

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8**

**Sustainable development** – sustainable development goals - water conservation, rain water harvesting, watershed management – resettlement and rehabilitation - consumerism and waste products, value education.

**Disaster management**- floods, drought, earthquake, tsunami, cyclone and landslides - case studies. **Environmental ethics**- issues and possible solutions – environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

**Introduction** - population growth, variation among nations, population explosion, family welfare programme – women and child welfare - environment and human health –endemic/epidemic/pandemic, COVID – 19, HIV / AIDS– role of information technology in environment and human health – environmental impact assessment- case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Illustrate the importance and conservation of natural resources.

CO2: Assess the impact of various pollutants and suggest appropriate pollution control methods.

CO3: Explain the basic structure of ecosystem and the conservation of biodiversity.

CO4: Analyze the social issues related to environment and recommend suitable solutions.

CO5: Investigate the trends in population explosion and assess its impact.

#### **TEXT BOOKS:**

1. Anubha Kaushik and C. P. Kaushik, “Perspectives in environmental studies”,





**Upon completion of the course, the students will be able to:**

- CO1: Analyse the multiple linear regression models.
- CO2: Estimate the multivariate analysis of variance and covariance.
- CO3: Distinguish discriminant and component analysis.
- CO4: Apply the factor analysis techniques in data analysis.
- CO5: Correlate the concepts of cluster analysis in data analytics.

**TEXT BOOKS:**

1. T.W. Anderson, "An Introduction to Multivariate Statistical Analysis", 3<sup>rd</sup> Edition, John Wiley & Sons, New Jersey, 2003.
2. J.D. Jobson, "Applied Multivariate Data Analysis", Vol I & II, 1<sup>st</sup> Edition, Springer Science + Business Media, LLC, New York, 1992.
3. H. Kris, "Statistical Tests for Multivariate Analysis", Springer, New York, 2011.
4. M. Lutz, "Programming Python", 4<sup>th</sup> Edition, O'Reilly Media, 2010.
5. Tim Hall and J.P Stacey, "Python 3 for Absolute Beginners", 1<sup>st</sup> Edition, Apress, 2009.
6. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", 1<sup>st</sup> Edition, Apress, 2005.

<b>20CB301</b>	<b>FORMAL LANGUAGE AND AUTOMATA THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>2</b>	<b>5</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the Chomsky language hierarchy, to construct automata for any given pattern and find its equivalent regular expressions.
- Design CFG for any given language and prove its equivalence
- Design CSG for any given language and prove its equivalence
- Understand the need for Turing machines and their capability
- Understand undecidable problems

<b>UNIT I</b>	<b>AUTOMATA FUNDAMENTALS</b>	<b>REGULAR EXPRESSION</b>	<b>AND</b>	<b>LANGUAGES AND FINITE AUTOMATA</b>	<b>9+6+6</b>
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Introduction: Alphabet - languages and grammars - productions and derivation- Chomsky hierarchy of languages - Regular expressions and languages - deterministic finite automata (DFA) and equivalence with regular expressions - nondeterministic finite automata (NFA) and equivalence with DFA - regular grammars and equivalence with finite automata - properties of regular languages - Kleene's theorem - pumping lemma for regular languages - Myhill-Nerode theorem and its uses - minimization of finite automata.

## **UNIT II      CONTEXT- FREE LANGUAGES AND PUSHDOWN AUTOMATA**

**9+6+6**

Context-free grammars (CFG) and languages (CFL) - Chomsky and Greibach normal forms - nondeterministic pushdown automata (PDA) and equivalence with CFG - parse trees - ambiguity in CFG - pumping lemma for context-free languages - deterministic pushdown automata - closure properties of CFLs.

## **UNIT III      CONTEXT- SENSITIVE LANGUAGES**

**9+6+6**

Context-sensitive grammars (CSG) and languages - linear bounded automata and equivalence with CSG.

## **UNIT IV      TURING MACHINES**

**9+6+6**

The basic model for Turing machines (TM) - Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties - variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs - unrestricted grammars and equivalence with Turing machines - TMs as enumerators.

## **UNIT V      UNDECIDABILITY AND COMPLEXITY**

**9+6+6**

**Undecidability:** Church-Turing thesis - universal Turing machine - the universal and diagonalization languages - reduction between languages and Rice's theorem - undecidable problems about languages.

**Basic Introduction to Complexity:** Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP - NP-completeness - Cook's Theorem - other NP-Complete problems.

**TOTAL: 105 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Construct automata, regular expression for any pattern
- CO2: Write Context free grammar for any construct
- CO3: Design Turing machines for any language.
- CO4: Propose computation solutions using Turing machines.
- CO5: Derive whether a problem is decidable or not.

**TEXT BOOKS:**

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, 2008.
2. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou, 2010.

**REFERENCES:**

1. Automata and Computability, Dexter C. Kozen.
2. Introduction to the Theory of Computation, Michael Sipser.
3. Introduction to Languages and the Theory of Computation, John Martin.
4. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S. Johnson.

<b>20CB302</b>	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Know the basic principles and operations of digital computers.
- Design Arithmetic and Logic Unit for various fixed- and floating-point operations.
- Develop pipeline architectures for RISC Processors.
- Understand Parallel Processor and Various Memory systems.
- Understand the peripheral devices and their characteristics.

**UNIT I BASIC STRUCTURE OF COMPUTERS & MACHINE INSTRUCTIONS 9+6**

Functional blocks of a computer: CPU, memory, input-output subsystems, control

unit. Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

**UNIT II DATA REPRESENTATION & COMPUTER ARITHMETIC 9+6**

Data representation: Signed number representation, fixed and floating-point representations, character representation.

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

**UNIT III BASIC PROCESSING & CONTROL UNIT 9+6**

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

**UNIT IV PARALLEL PROCESSING & MEMORY 9+6**

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Memory system design: Semiconductor memory technologies, memory organization.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

**UNIT V I/O SYSTEMS 9+6**

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Understand the basic principles and operations of digital computers.

CO2: Design Arithmetic and Logic Unit.

CO3: Perform fixed- and floating-point operations

CO4: Develop pipeline architectures for RISC Processors.

CO5: Understand Parallel Processor Architectures

CO6: Understand Various Memory systems & I/O interfacing.

#### **TEXT BOOKS:**

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 2017.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, 2007
3. Computer Organization and Embedded Systems, Carl Hamacher, 2012.

#### **REFERENCES:**

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.

<b>20CB303</b>	<b>OBJECT ORIENTED PROGRAMMING + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

#### **OBJECTIVES:**

**The Course will enable learners to:**

- Understand & represent any given business problem statement in object-oriented notation.
- Understand Object Oriented programming concepts like data abstraction, encapsulation and basics of Java.
- Analyse inheritance and polymorphism.

- Understand and collections in Java.
- Employ multithreaded programming.

## **UNIT I INTRODUCTION 9**

**Procedural programming, An Overview of C:** Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (C-way), Library Functions (*string, math, stdlib*), Command line arguments, Pre-processor directive

**Some difference between C and Java:** Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, Operator new and delete Single line comments, JavaDoc, Characteristics of Java, The Java Environment, Java Source File -Structure.

## **UNIT II OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 9**

**The Fundamentals of Object-Oriented Programming:** Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Class and Object, Scope of Class, Member Function of a Class, private, protected and public access specifier, this keyword, Constructors and Destructors.

## **UNIT III INHERITANCE AND POLYMORPHISM 9**

Inheritance — Single and Multiple, Class Hierarchy, super classes- sub classes – Protected members — constructors in sub classes — abstract classes and methods-final methods and classes, Polymorphism through dynamic binding, overriding. Interfaces — defining an interface, implementing interface, differences between classes and interfaces and extending interfaces

## **UNIT IV ARRAYS, COLLECTIONS AND EXCEPTION 9**

Arrays – One & Multi-Dimensional, Object Class and cloning, equals and hashCode methods, Collections- List (ArrayList,LinkedList,Vector,Stack), Properties, Set(HashSet,TreeSet,LinkedHashSet), Map(Treemap,hashmap,treemap), Queue (Priority Queue, DeQueue), Iteration, Ordering using Comparable & Comparator, Generics –Compile Time Type Safety, Upper and Lower Bounded, and with wild cards

Exception Handling – Checked and Un-Checked Exception, Custom Exception, Throws and Throw Keywords, Try-Catch-Finally, Try with Resources, Exception vs Runtime exception vs Throwable vs Error

## **UNIT V MULTI-THREADING & IO**

**9**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, Fork and Join, wait, sleep, notify & yield. Concurrent locks, Synchronized Collections(Concurrent Map, synchronized List, synchronized Map, synchronized Set, synchronized SortedSet) Atomic data types (AtomicInteger, AtomicLong, AtomicIntegerArray), CountdownLatch, BlockingQueue

Java IO – Files, Pipes, Streams, Byte and Char arrays, Readers & Writers, Input and Output Stream, Byte Array Input and Output, Buffer Input and output

**TOTAL: 45 PERIODS**

### **LIST OF EXERCISES:**

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- ♣ First 100 units – Rs. 1 per unit
- ♣ 101-200 units – Rs. 2.50 per unit
- ♣ 201 -500 units – Rs. 4 per unit
- ♣ > 501 units – Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- ♣ First 100 units – Rs. 2 per unit
- ♣ 101-200 units – Rs. 4.50 per unit
- ♣ 201 -500 units – Rs. 6 per unit
- ♣ > 501 units – Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following
  - a. Append – add at end
  - b. Insert – add at particular index
  - c. Search
  - d. List all string starts with given letter
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Design and Develop application in OOD & Principles

CO2: Apply Object Oriented programming concepts like Data Abstraction, Encapsulation in Java.

CO3: Analyse and apply different types of inheritance and polymorphism

CO4: Use collections for solving real-time problems.

CO5: Develop multi-threaded applications in Java.

**TEXT BOOKS:**

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.

<b>20CB304</b>	<b>SOFTWARE ENGINEERING + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>2</b>	<b>5</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the different models and milestones in a software project
- Understand fundamental concepts of software project management
- Understand the various software design methodologies
- Learn various testing and maintenance measures
- Understand knowledge driven development

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9+6</b>
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Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline. Basic concepts of life cycle models – different models and milestones. **Software Quality and Reliability:** Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation

## **UNIT II SOFTWARE PROJECT MANAGEMENT 9+6**

Software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

## **UNIT III SOFTWARE REQUIREMENTS ANALYSIS, DESIGN AND CONSTRUCTION 9+6**

Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – decision tables, event tables, state transition tables, Petri nets; Requirements documentation through use cases; Introduction to UML, introduction to software metrics and metrics based control methods; measures of code and design quality.

## **UNIT IV SOFTWARE TESTING 9+6**

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction-based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.

## **UNIT V PROBLEM SPACE UNDERSTANDING 9+6**

Appreciation of IT companies transforming industry, Problem Space Understanding- Knowledge Driven Development (KDD) and domain knowledge framework- Learning multiple domains using the domain knowledge framework-Linking domain knowledge to software development via an example- A KDD case study implemented in Agile

**TOTAL: 45 PERIODS**

### **LIST OF EXERCISES:**

Development of requirements specification, function-oriented design using SA/SD, object-oriented design using UML, test case design, implementation using C++ and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle

- Develop the software project start-up, prototype model, using software engineering methodology and object-oriented design using UML for at least two real time scenarios
- Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure
- Software Requirement Analysis –Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
- Data Modeling –Use work products –data dictionary.
- Software Designing -Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
- Prototype model –Develop the prototype of the product.

**TOTAL: 30 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Understand engineering approach to software development, software quality and reliability.

CO2: Manage project schedule, estimate project cost and effort required.

CO3: Summarize the concepts of software requirement analysis and design.

CO4: Identify the need for software metrics and measure of code and design quality.

CO5: Compare and contrast various testing methodologies.

CO6: Analyze problem space understanding and Knowledge driven development.

**TEXT BOOKS:**

1. Software Engineering, Ian Sommerville
2. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino
3. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Michael Jackson

**REFERENCES:**

1. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton, Shari Lawrence Pfleeger
2. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee

<b>20CB305</b>	<b>FINANCIAL MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the fundamental concepts of financial management
- Understand valuation of securities.
- Analyse operating and financial leverages.
- Comprehend and apply the concepts of capital budgeting.
- Understand cash management.

**UNIT I      INTRODUCTION      9**

**Introduction:** Introduction to Financial Management - Goals of the firm - Financial Environments. **Time Value of Money:** Simple and Compound Interest Rates, Amortization, Computing more that once a year, Annuity Factor.

**UNIT II      VALUATION OF SECURITIES      9**

**Valuation of Securities:** Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. **Risk & Return:** Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

**UNIT III OPERATING & FINANCIAL LEVERAGE 9**

**Operating & Financial Leverage:** Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study. **Cost of Capital:** Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L

**UNIT IV CAPITAL BUDGETING 9**

**Capital Budgeting:** The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods. **Working Capital Management:** Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

**UNIT V CASH MANAGEMENT 9**

**Cash Management:** Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring. **Accounts Receivable Management:** Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Understand the fundamental concepts of financial management
- CO2: Apply valuation of securities and calculate the risk & return in portfolio management.
- CO3: Analyse the cost structure of a company using operating and financial leverages.
- CO4: Develop capital budgets and to estimate working capital.
- CO5: Apply cash management in business.

**TEXT BOOKS:**

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill, 2007.
2. Srivastava, Misra: Financial Management, OUP, 2011

**REFERENCES:**

1. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.
2. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14th edition, Cengage, 2015
3. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011.
4. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012

**INDIAN CONSTITUTION  
(Non Credit)****L T P C****2 0 0 0****OBJECTIVES:****The Course will enable learners to:**

- Have some knowledge about Indian Constitution.

**UNIT I INTRODUCTION****6**

Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution.

**UNIT II FUNDAMENTAL RIGHTS****6**



- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

### **List of Exercises:**

#### **1. English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

#### **2. Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

#### **3. Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

#### **4. Automata Fix – Phase I**

Logical, Compilation and Code reuse

**TOTAL: 30 PERIODS**

### **OUTCOMES:**

#### **Upon completion of the course, the students will be able to:**

- CO1: Develop vocabulary for effective communication and reading skills.
- CO2: Build the logical reasoning and quantitative skills.
- CO3: Develop error correction and debugging skills in programming.

**20CB401**

**OPERATING SYSTEMS + LAB**

**L T P C**

**3 0 2 4**

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basic concepts of operating systems.
- Understand Processes and Threads
- Analyse various CPU Scheduling algorithms.
- Understand the concept of Deadlocks.
- Analyse various memory management schemes.
- Understand I/O management and File systems.

**UNIT I INTRODUCTION TO OPERATING SYSTEMS AND PROCESS 9**

**Introduction:** Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

**UNIT II PROCESS MANAGEMENT AND THREADS 9**

**Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

**Scheduling algorithms:** Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

**Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

**UNIT III PROCESS SYNCHRONISATION AND DEADLOCKS 9**



- Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
- UNIX Filters
- Shell programming
- Programming with the standard I/O
- UNIX system calls

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Implement the various System calls
- CO2: Understand the concepts of Processes
- CO3: Apply various processor scheduling algorithms and thread mechanism
- CO4: Analyse process synchronization and deadlock problems
- CO5: Apply various memory management techniques to given situation
- CO6: Apply various file management techniques

**TEXT BOOKS:**

1. *Operating System Concepts Essentials*. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 2009.
2. *Operating Systems: Internals and Design Principles*. William Stallings.
3. *Operating System: A Design-oriented Approach*. Charles Patrick Crowley.

**REFERENCES:**

1. *Operating Systems: A Modern Perspective*. Gary J. Nutt.
2. *Design of the Unix Operating Systems*. Maurice J. Bach.
3. *Understanding the Linux Kernel*, Daniel Pierre Bovet, Marco Cesati.

<b>20CB402</b>	<b>DATABASE MANAGEMENT SYSTEMS + LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basic concepts of Database, why its required and what its benefits & advantage
- Apply effective relational database design concepts.
- Know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- How to efficiently model and design various database objects and entities
- Implement efficient data querying and updates, with needed configuration

## **UNIT I INTRODUCTION 9**

**Introduction:** Introduction to Database. Hierarchical, Network and Relational Models. **Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

## **UNIT II RELATIONAL QUERY LANGUAGE 9**

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

## **UNIT III QUERY PROCESSING AND STORAGE 9**

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. **Storage strategies:** Indices, B-trees, Hashing.

## **UNIT IV TRANSACTION PROCESSING 9**

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

## **UNIT V DATA BASE SECURITY AND ADVANCED DATABASES 9**

**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Object oriented and object relational

databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

**TOTAL: 45 PERIODS**

**LIST OF EXERCISES:**

Case Study using real life database applications, Perform the following task.

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
- Build PLSQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to show case ACID Properties with sample queries with appropriate settings

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Able to design and deploy an efficient & scalable data storage node for varied kind of application requirements

CO2: Map ER model to Relational model to perform database design effectively

CO3: Write queries using normalization criteria and optimize queries

CO4: Compare and contrast various indexing strategies in different database systems

CO5: Appraise how advanced databases differ from traditional databases.

**TEXT BOOKS:**

1. Abraham Silberschatz, Henry F.Korth, S. System 6 th Edition, Tata McGraw Hill,2011.
2. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.

**REFERENCES:**

1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
2. Foundations of Databases. Serge Abiteboul, Richard Hull, Victor Vianu.

<b>20CB403</b>	<b>SOFTWARE DESIGN WITH UML + Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

## **OBJECTIVES:**

### **The Course will enable learners to:**

- Understand the fundamentals of object-oriented modelling
- Capture the requirements specification for an intended software system
- Translate the analysis phase to design modeling
- Understand the concept of UML modeling
- Design with static UML diagrams.
- Design with the UML dynamic and implementation diagrams.

## **UNIT I INTRODUCTION TO AN OBJECT-ORIENTED TECHNOLOGIES AND THE UML METHOD. 9**

Software development process: The Waterfall Model vs. The Spiral Model. -The Software Crisis, description of the real world using the Objects Model. -Classes, inheritance and multiple configurations. -Quality software characteristics. - Description of the Object Oriented Analysis process vs. the Structure Analysis Model. **Introduction to the UML Language.** Standards. -Elements of the language. -General description of various models. -The process of Object Oriented software development. -Description of Design Patterns. - Technological Description of Distributed Systems.

## **UNIT II REQUIREMENTS ANALYSIS USING CASE MODELING 9**

Analysis of system requirements. -Actor definitions. -Writing a case goal. -Use Case Diagrams. -Use Case Relationships. - Use case Modeling – Relating Use cases – include, extend and generalization – When to use Use-cases

## **UNIT III INTERACTION DIAGRAMS 9**

Description of goal. -Defining UML Method, Operation, Object Interface, Class. - Sequence Diagram. -Finding objects from Flow of Events. - Describing the process of



8. Test the software system for all the scenarios identified as per the usecase diagram

**TOTAL: 30 PERIODS**

## **OUTCOMES**

**Upon completion of the course, the students will be able to:**

- CO1: Express software design with UML diagrams
- CO2: Design software applications using OO concepts.
- CO3: Identify various scenarios based on software requirements
- CO4: Covert the analysis phase to design modelling
- CO5: Analyse the static structure diagrams
- CO6: Analyse the dynamic structure diagrams

## **TEXT BOOKS:**

1. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit.
2. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.

## **REFERENCES:**

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
2. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2000
3. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.
4. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999



Innovation, Incubation and Entrepreneurship in Corporate Context Technology-driven  
Social Innovation and Entrepreneurship Manage Innovation, IP and Entrepreneurship  
Programs – Processes, Governance and Tools

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Understand the basics of Innovation and Entrepreneurship
- CO2: Manage an innovation program
- CO3: Create, protect, assetize and commercialize intellectual property
- CO4: Understand opportunities and challenges for entrepreneurs
- CO5: Developing mindsets to pursue entrepreneurship.
- CO6: Identify and discover market needs

**TEXT BOOKS:**

1. Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth  
Navi Radjou, Jaideep Prabhu, Simone Ahuja, John Wiley & Sons

**REFERENCES:**

1. Identifying Entrepreneurial Opportunities: Cognition and Categorization in  
Nascent Entrepreneurs, Matthew J. Karlesky
2. <http://www.businessdictionary.com/definition/entrepreneurship>.
3. <https://www.infoentrepreneurs.org/en/guides/use-innovation-to-grow-your-business/>
4. <http://sourcesofinsight.com/innovation-life-cycle/>
5. <https://www.investottawa.ca/>
6. <https://www.Lead-innovation.com>

**20CB405**

**OPERATIONS RESEARCH + LAB**

**L T P C**

**2 0 2 3**

**OBJECTIVES:**

**The Course will enable learners to:**

- Provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.
- Solve real-time problems
- Handled balanced and unbalanced transportation problems
- Manage inventory control
- Use queuing techniques

## **UNIT I INTRODUCTION**

**6+6**

**Introduction to OR:** Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

## **UNIT II LINEAR PROGRAMMING**

**6+6**

**Linear Programming:** Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Linear algebra – Vectors, Matrices, Linear Independence / Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions. Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis. Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations. Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

## **UNIT III TRANSPORTATION AND ASSIGNMENT PROBLEMS**

**6+6**

**Transportation and Assignment problems:** TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.

AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution. **PERT – CPM:** Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths,

Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

#### **UNIT IV INVENTORY CONTROL**

**6+6**

**Inventory Control:** Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known / unknown stock out situations, models under prescribed policy, Probabilistic situations.

#### **UNIT V QUEUING THEORY**

**6+6**

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models. **Simulation Methodology:** Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

**TOTAL: 60 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Understand the characteristics of different types of decision-making environments
- CO2: Use the optimization techniques for use engineering and Business problems
- CO3: Build and solve Transportation Models and Assignment Models
- CO4: Manage inventory control
- CO5: Apply queuing theory for solving real world problems

#### **TEXT BOOKS:**

1. Operations Research: An Introduction, 10th Edition. Hamdy A. Taha, University of Arkansas. 2017, Pearson
2. Linear Programming. K.G. Murthy.

## REFERENCES:

1. Linear Programming. G. Hadley.
2. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
3. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
4. Elements of Queuing Theory. Thomas L. Saaty.
5. Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
6. Management Guide to PERT/CPM. Wiest & Levy.
7. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

<b>20CB406</b>	<b>MARKETING RESEARCH AND MARKETING MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

### The Course will enable learners to:

- Understand basic marketing concepts
- Comprehend the dynamics of marketing.
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research
- Apply Internet marketing strategies.

## UNIT I INTRODUCTION

9

**Marketing Concepts and Applications:** Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. **Marketing Planning & Environment:** Elements of Marketing Mix, analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social **Understanding the consumer:** Determinants of consumer behavior, Factors influencing consumer behavior

## UNIT II MARKET SEGMENTATION AND PRODUCTION MANAGEMENT 9

**Market Segmentation:** Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning **Product Management:** Product Life cycle concept, New Product development &

strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

### **UNIT III PRICING, PROMOTION AND DISTRIBUTION STRATEGY 9**

**Pricing, Promotion and Distribution Strategy:** Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

### **UNIT IV MARKETING RESEARCH 9**

**Marketing Research:** Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research **Data Analysis:** Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

### **UNIT V INTERNET MARKETING 9**

**Internet Marketing:** Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing **Business to Business Marketing:** Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Understand the marketing concepts and its evolution
- CO2: Analyze the market based on segmentation, targeting and positioning
- CO3: Leverage marketing concepts for decision making on product, price, promotion mix and distribution
- CO4: Apply the concepts of market research and analyse data using statistical tools
- CO5: Apply internet marketing strategies for businesses

### TEXT BOOKS:

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Management – V.S. Ramaswamy and S. Namakumari
4. Marketing Research – Rajendra Nargundkar
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindler

### REFERENCES:

1. Marketing Management – Rajan Saxena
2. Marketing Management – S.A. Sherlekar
3. Service Marketing – S.M. Zha
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication

**20EL406**

**BUSINESS COMMUNICATION & VALUE  
SCIENCE – III**

L	T	P	C
2	0	4	4

### OBJECTIVES:

**The Course will enable learners to:**

- Improve their technical writing skills.
- Apply self-analysis techniques like SWOT & TOWS.
- Identify the key concepts of:
  - Pluralism & cultural spaces
  - Cross-cultural communication
  - Science of Nation-building
- Develop vocabulary of a general kind and enhance their grammatical accuracy.

### UNIT I STRATEGIC PLANNING

**6+12**

Reunion- Recap activity on the earlier learning after a 6 months break- SWOT and Life Positions- Meet Dananjaya- Debrief on the video-How it relates to SWOT- Motivational Stories- YouTube videos on Maslow's Theory. Practical: Create your SWOT- SWOT Vs. TOWS (The Balancing Act)- Research on TOWS and find out how you can turn your threat into an opportunity.

**UNIT II      CROSS-CULTURAL COMMUNICATION      6+12**

Rivers of India – Group activity- Learn and Exchange-Awareness and respect for pluralism in cultural spaces- Global, glocal, translocational- Cross-cultural communication - Group discussion on the implications of cross-cultural communication. Practical: Presentation on what are the strengths identified, to survive in the VUCA World.- Present their findings and approaches as groups. They need to explain the idea of motivation with the help of examples.

**UNIT III      VERBAL AND NON-VERBAL COMMUNICATION      6+12**

Gender awareness- Verbal and non-verbal communication - Role of science in nation-building - Introduce the topic and discuss the role of scientists and mathematicians from ancient India- Groups present their findings- Role of science post-independence. Practical/Discussion: Cross- cultural communication A. Verbal and non-verbal communication (approach is through videos). B. Let participants have a group discussion on the implications of cross-cultural communication- Culture shock.

**UNIT IV      THE FUTURE OF HUMAN COMMUNICATION      6+12**

Voice of the Future - AI in Everyday Life - Communicating with machines- Ted talk videos- Debate in the presence of an external moderator. **Practical:** AI in Everyday Life- Design your college in the year 2090.

**UNIT V      TECHNICAL WRITING      6+12**

Introduction to technical writing - Basic rules of technical writing through examples- Dr Bimal Ray's videos. **Practical:** Each group will make a presentation on the following: 1. Sell Analytics and Insight to the local tea seller.2. Explain the concept of Cloud to your 87-year-old grandmother.3. Introduce the concept of friendly robots to a class 3 kid.

**TOTAL: 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- CO1: Apply SWOT in real-life scenarios.
- CO2: Differentiate between the different cultures of India.
- CO3: Identify the common mistakes made in cross-cultural communication.
- CO4: Summarize the role of science in nation-building.
- CO5: Recognize the importance of AI.
- CO6: Identify and apply the best practices of technical writing.

## REFERENCES:

1. Anderson, Paul V. Technical Communication, Cengage Learning Pvt. Ltd. New Delhi, 2007.
2. Budinski, Kenneth G. Engineer's Guide to Technical Writing, ASM International, 2001.
3. Samson T, et al. Effective Business Communication. Cambridge University Press India Pvt. Ltd., New Delhi, 2020.
4. Smith-Worthington, D. & Jefferson, S. Technical Writing for Success. 3rd Edition, South-Western Cengage Learning, USA, 2011.
5. Examples of Technical Writing for Students  
<https://freelance-writing.lovetoknow.com/kinds-technical-writing>
6. 11 Skills of a Good Technical Writer  
<https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/>
7. 13 benefits and challenges of cultural diversity in the workplace  
<https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/>
8. <https://youtu.be/CsaTslhSDI>
9. [https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8\\_T95M](https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M)
10. <https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y>
11. [https://m.youtube.com/watch?v=dT\\_D68RJ5T8&feature=youtu.be](https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be)
12. <https://m.youtube.com/watch?v=7sLLEdBqYYY&feature=youtu.be>

## ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (Non -Credit)

L	T	P	C
2	0	0	0

## OBJECTIVES:

### The Course will enable learners to:

- Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- Make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life

## UNIT I INTRODUCTION TO TRADITIONAL KNOWLEDGE 6

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

## UNIT II PROTECTION OF TRADITIONAL KNOWLEDGE 6

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

**UNIT III      LEGAL FRAMEWORK AND TK****6**

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

**UNIT IV      TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 6**

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

**UNIT V      TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS                  6**

Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

**TOTAL: 30 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- CO1: Facilitate the students with the concepts of Indian traditional knowledge.
- CO2: Analyse and apply traditional knowledge to their day-to-day life.

**TEXT BOOKS:**

1. Knowledge System in India, by Amit Jha, 2009.

**REFERENCES:**

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. Knowledge Traditions and Practices of India Kapil Kapoor, Michel Danino.
3. <https://www.youtube.com/watch?v=LZP1StpYEPM>
4. <http://nptel.ac.in/courses/121106003/>

**UNIVERSAL HUMAN VALUES 2:  
UNDERSTANDING HARMONY  
(Non -Credit)**

L	T	P	C
2	2	0	0

**OBJECTIVES:**

**The Course will enable learners to:**

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

**COURSE TOPICS:**

The course has 28 lectures (2 lecture hours) and 14 practice sessions (2 Tutorial hour) in 5 Units:

**UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

1. Purpose and motivation for the course, recapitulation from Universal HumanValues-I
2. Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

## **UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. 'Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

## **UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order-from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education

etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

#### **UNIT IV      UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE**

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

#### **UNIT V      IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS**

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems.

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: Would become more aware of themselves, and their surroundings (family, society, nature);

CO2: Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: Would have better critical ability.

CO4: Would become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

CO5: Would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**TEXT BOOKS:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, ExcelBooks, NewDelhi, 2010

**REFERENCES:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India – by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom – Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland (English)

**APTITUDE AND CODING SKILLS – II**  
**(Non -Credit)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.
- Apply data structures and algorithms in problem solving.

**List of Exercises:**

**1. English – Phase II**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

**2. Logical Reasoning – Phase II**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

**3. Quantitative Ability - Phase II**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

**4. Automata Fix – Phase II**

Logical, Compilation and Code reuse

**5. Automata - Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

**TOTAL: 30 PERIODS**

**OUTCOMES:****Upon completion of the course, the students will be able to:**

CO1: Develop advanced vocabulary for effective communication and reading skills.

CO2: Build an enhanced level of logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

CO4: Apply data structures and algorithms in problem solving.