SETHU INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

B.TECH COMPUTER SCIENCE AND BUSINESS SYSTEMS

REGULATIONS 2019

SYLLABUS CONTENT
(1st TO 8th SEMESTER)

(FOR THOSE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2020-2021 ONWARDS)

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Humanities & Social Sciences	**7**	**14**	**8.13**
Basic Sciences	**6**	**20**	**11.62**
Engineering Sciences	**15**	**32.5**	**18.89**
Professional Core	**24**	**60.5**	**35.17**
Professional Elective	**6**	**18**	**10.46**
Open Electives	**4**	**12**	**6.97**
Project Work	**5**	**15**	**8.72**
Mandatory Course	**5**	**-**	**-**
TOTAL	**72**	**172**	**100**

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
CSBS	**21**	**21**	**23.5**	**21.5**	**22.5**	**24.5**	**21**	**17**	**172**

Semester I

Course Code		Course Title	L	T	P	C
THEORY						
19UGM131	MC	Induction Programme				
19UEN102	HS	Business Communication & Value Science - I	2	0	0	2
19UMA103	BS	Probability and Inferential Statistical Techniques	3	1	0	4
19UPH104	BS	Physics for Computing Science	3	0	2	4
19UEE125	ES	Principles of Electrical Engineering	3	0	0	3
19UCB106	ES	Fundamentals of Computer Science	3	0	0	3
19UCB107	ES	Fundamentals of Economics	2	0	0	2
PRACTICAL						
19UEE128	ES	Electrical Engineering Laboratory	0	0	3	1.5
19UCB109	ES	Computer Programming Laboratory	0	0	3	1.5
		TOTAL	**16**	**1**	**8**	**21**
Total No. of Credits – 21						

Semester II

Course Code		Course Title	L	T	P	C
THEORY						
19UEN202	HS	Business Communication & Value Science – II	2	0	0	2
19UMA208	BS	Linear Algebra and Numerical Techniques	3	1	0	4
19UMA209	BS	Statistical Methods	3	0	0	3
19UCY204	HS	Environmental Science	3	0	0	3
19UEC225	ES	Principles of Electronics Engineering	3	0	0	3
19UCB206	PC	Introduction to Data Structures and Algorithms	3	0	0	3
PRACTICAL						
19UEC227	ES	Electronics Engineering Laboratory	0	0	3	1.5
19UCB208	PC	Data Structures and Algorithms Laboratory	0	0	3	1.5
		TOTAL	**17**	**1**	**6**	**21**
Total No. of Credits – 21						

Semester III

Course Code		Course Title	L	T	P	C
THEORY						
19UEN301	HS	Business Communication & Value Science – III	2	0	0	2
19UMA327	BS	Discrete Mathematics and Calculus	3	1	0	4
19UCB303	ES	Computational Statistics	3	0	0	3
19UCB304	PC	Object Oriented Programming	3	0	0	3
19UCB305	PC	Operating Systems Concepts	3	0	0	3
19UCB306	PC	Computer Organization and Architecture	3	0	0	3
PRACTICAL						
19UCB307	PW	Technical Seminar	0	0	2	1
19UCB308	PC	Computational Statistics Laboratory	0	0	3	1.5
19UCB309	PC	Object Oriented Programming Laboratory	0	0	3	1.5
19UCB310	PC	Operating Systems Laboratory	0	0	3	1.5
		TOTAL	**17**	**1**	**11**	**23.5**
Total No. of Credits – 23.5						

Semester IV

Course Code		Course Title	L	T	P	C
THEORY						
19UEN401	HS	Business Communication & Value Science – IV	2	0	0	2
19UCB402	PC	Computer Networks	3	0	0	3
19UCB403	PC	Introduction to Design and Analysis of Algorithms	3	1	0	4
19UCB404	PC	Database Management Systems	3	0	0	3
19UCB405	PC	Formal Languages and Automata Theory	3	1	0	4
19UCB406	PC	Python Programming	1	0	3	2.5
PRACTICAL						
19UCB407	PC	Computer Networks Laboratory	0	0	3	1.5
19UCB408	PC	Database Management Systems Laboratory	0	0	3	1.5
MANDATORY COURSES						
19UGM431	MC	Gender Equality	1	0	0	P/F
19UGM432	MC	Biology for Engineering Applications	2	0	0	P/F
		TOTAL	**18**	**2**	**9**	**21.5**
Total No. of Credits – 21.5						

Semester V

Course Code		Course Title	L	T	P	C
THEORY						
19UCB501	PC	Compiler Design	3	0	0	3
19UCB502	PC	Software Engineering	3	0	0	3
19UCB503	ES	Fundamentals of Management	2	0	0	2
19UCB504	PC	Mobile applications Development & Services	2	0	3	3.5
	PE	Professional Elective – I	3	0	0	3
	OE	Open Elective – I	3	0	0	3
19UGS531	BS	Reasoning and Aptitude	1	0	0	1
PRACTICAL						
19UCB507	PW	Creative Thinking and Innovations	0	0	2	1
19UCB508	PC	Compiler design Laboratory	0	0	3	1.5
19UGS532	HS	Soft Skills Laboratory	0	0	3	1.5
		TOTAL	**17**	**0**	**11**	**22.5**
Total No. of Credits –22.5						

Semester VI

Course Code		Course Title	L	T	P	C
THEORY						
19UCB601	ES	Marketing Research	2	0	0	2
19UCB602	ES	Business Strategy	2	0	0	2
19UCB603	PC	Artificial Intelligence	2	0	2	3
19UCB604	PC	Information Security	2	0	2	3
	PE	Professional Elective – II	3	0	0	3
	PE	Professional Elective III	3	0	0	3
	OE	Open Elective – II	3	0	0	3
PRACTICAL						
19UCB609	PW	Product Development Project	0	0	8	4
19UGS633	HS	Interpersonal Skills Laboratory	0	0	3	1.5
MANDATORY COURSES						
19UGM632	MC	Indian Constitution	1	0	0	0
		TOTAL	**18**	**0**	**15**	**24.5**
Total No. of Credits – 24.5						

Semester VII

Course Code		Course Title	L	T	P	C
THEORY						
19UCB701	ES	Financial Management	2	0	0	2
19UCB702	ES	Financial and Cost Accounting	2	0	0	2
19UCB703	ES	Human Resource Management	2	0	0	2
19UCB704	ES	IT Project Management	2	0	0	2
19UCB705	PC	Usability Design of Software Applications	3	0	0	3
	PE	Professional Elective IV	3	0	0	3
	OE	Open Elective – III	3	0	0	3
PRACTICAL						
19UCB707	PW	Summer Internship	0	0	0	1
19UCB708	PC	Usability Design of Software Applications Laboratory	0	0	3	1.5
19UCB709	PC	IT Workshop Scilab / Matlab	0	0	3	1.5
MANDATORY COURSES						
19UGM731	MC	Professional Ethics and Human values	2	0	0	0
		TOTAL	**19**	**0**	**6**	**21**
Total No. of Credits – 21						

Semester VIII

Course Code		Course Title	L	T	P	C
THEORY						
	PE	Professional Elective V	3	0	0	3
	PE	Professional Elective VI	3	0	0	3
	OE	Open Elective – IV	3	0	0	3
PRACTICAL						
19UCB801	PW	Project Work	0	0	16	8
		TOTAL	**9**	**0**	**16**	**17**
Total No. of Credits – 17						

TOTAL CREDITS –172

PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	L	T	P	C
COMPUTER SCIENCE					
19UCB901	Introduction to IoT	3	0	0	3
19UCB902	Data Mining Techniques	3	0	0	3
19UCB903	Robotics and Embedded Systems	3	0	0	3
19UCB904	Cloud Micro Services and Application	3	0	0	3
19UCB905	Quantum Computing and Applications	3	0	0	3
19UCB906	Cognitive Science and Analytics	3	0	0	3
19UCB907	Deep Learning for Computer Vision	3	0	0	3
19UCB908	Introduction to Block chain Technology and Application	3	0	0	3
19UCB909	Introduction to Industry 4.0	3	0	0	3
19UCB910	Advanced Social, Text and Media Analytics	3	0	0	3
19UCB911	Data Science for Engineering	3	0	0	3
19UCB912	Cryptology	3	0	0	3
19UCB913	Graph Theory and Applications	3	0	0	3
19UCB914	Software Quality Management	3	0	0	3
19UCB915	Introduction to Parallel and Distributed Algorithms	3	0	0	3
19UCB916	Fault Tolerant Computing Systems	3	0	0	3
19UCB917	Introduction to Ad Hoc and Sensor Networks	3	0	0	3
19UCB918	Computer Graphics and Multimedia	3	0	0	3
19UCB919	Information Retrieval Techniques	3	0	0	3
19UCB920	Information Storage Management concepts	3	0	0	3

19UCB921	Introduction to Mobile and Pervasive computing	3	0	0	3
19UCB922	Introduction to Human Computer Interaction	3	0	0	3
19UCB923	Software Project Management	3	0	0	3
19UCB924	Augmented Reality	3	0	0	3
19UCB925	Introduction to Data Analytics	3	0	0	3
19UCB926	Java Programming	3	0	0	3
19UCB927	Speech and Natural Language Processing concepts	3	0	0	3
19UIT911	Building Enterprise Applications	3	0	0	3
19UIT912	Software Testing	3	0	0	3
BUSINESS SYSTEMS					
19UCB928	Management Accounting	3	0	0	3
19UCB929	Strategic Management	3	0	0	3
19UCB930	Business Intelligence	3	0	0	3
19UCB931	Behavioral Economics	3	0	0	3
19UCB932	Enterprise Resource Planning	3	0	0	3
19UCB933	Total Quality Management	3	0	0	3

OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
19UCB971	Corporate Finance	3	0	0	3
19UCB972	R Programming	3	0	0	3
19UCB973	Computational Finance and Modeling	3	0	0	3
19UCB974	Machine Learning	3	0	0	3
19UCB975	Entrepreneurship Development	3	0	0	3
19UCB976	Business Analysis and DM Modeling using R	3	0	0	3
19UCB977	Perl Programming	3	0	0	3
19UCB978	Social Network Analysis	3	0	0	3
19UCB979	Introduction to Digital Marketing	3	0	0	3

LIST OF ONE CREDIT COURSES

Course Code	Course Title	L	T	P	C
19UCB861	Web Designing	1	0	1	1
19UCB862	Big Data Computing	1	0	0	1
19UCB863	Animation Graphics	0	0	2	1
19UCB864	Soft Computing	1	0	1	1
19UCB865	Visualization using Tableau	1	0	1	1
19UCB866	Wordpress Applications	0	0	2	1
19UCB867	Multimedia Technology	1	0	1	1
19UCB868	Adobe Illustrator	0	0	2	1
19UCB869	Software Testing Tools-TestRail	1	0	1	1
19UCB870	Mongo DB Atlas Database	0	0	2	1
19UCB871	Game Development	0	0	2	1
19UCB872	Drone Technology	0	0	2	1
19UCB873	Data processing with PySpark	0	0	2	1
19UCB874	Scala	0	0	2	1
19UCB875	Data Analysis using SQL	1	0	1	1
19UCB876	Node js	1	0	1	1

Semester I

Course Code		Course Title	L	T	P	C
THEORY						
19UGM131	MC	Induction Programme	3	0	0	3
19UEN102	HS	Business Communication & Value Science - I	2	0	0	2
19UMA103	BS	Probability and Inferential Statistical Techniques	3	1	0	4
19UPH104	BS	Physics for Computing Science	3	0	2	4
19UEE125	ES	Principles of Electrical Engineering	3	0	0	3
19UCB106	ES	Fundamentals of Computer Science	3	0	0	3
19UCB107	ES	Fundamentals of Economics	2	0	0	2
PRACTICAL						
19UEE128	ES	Electrical Engineering Laboratory	0	0	3	1.5
19UCB109	ES	Computer Programming Laboratory	0	0	3	1.5
		TOTAL	**16**	**1**	**8**	**21**
Total No. of Credits – 21						

19UGM131	INDUCTION PROGRAMME	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To rejuvenate the Body and Mind
- To strengthen Attitude and soft skills
- To practice Moral values of life.

UNIT I	PHYSICAL ACTIVITY	10 Hrs

Zumba - Bokwa Fitness – Yoga – Mediation – Fine Arts

UNIT II	CREATIVE ARTS	5 Hrs

Painting – Class Painting – Wall Painting – Art from waste

UNIT III	UNIVERSAL HUMAN VALUES & EMINENT SPEAKERS	5 Hrs

Ethical values – Ambition and Family Expectation, Gratitude, Competition and Excellence – Belief – Morality of life – Guest Lecture by Eminent personality

UNIT IV	LITERARY	

Elocution - Essay writing Competition - Impromptu Session - Dance and singing competition

UNIT V	PROFICIENCY MODULES	15 Hrs

Toastmaster club meet

UNIT VI	INDUSTRIAL & LOCAL VISIT	8 Hrs

Vaigai Dam – Theni - VOC- Port-Tuticorin - Madurai Radio City-Madurai - Aavin Milk –Madurai-NSS Activities.

UNIT VII	FAMILIARIZATION OF THE DEPT. AND INNOVATION	2 Hrs

Department Introduction and Purpose of Course - Eminent speakers – Scope and Feature of the Course - Latest Innovation

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Practice physical activities regularly.
- Implement creativity in drawing and waste material.
- Communicate their ideas effectively.
- Identify inputs and outputs of different industry process.
- Describe the scope and features of their programme of study.

REFERENCE BOOK:

1. Student Induction Programme: A Detailed Guide by AICTE, New Delhi.

19UEN102	**BUSINESS COMMUNICATION & VALUE SCIENCE – I**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES :

- To introduce the concepts of values, life skills and business communication
- To listen and speak during normal business activities such as interviews, meetings, telephone conversations and negotiations.
- To write business letters, emails, reports, articles and comprehend information on the Internet and other media.
- Enhance their communication skills by acquainting with the 2 important aspects of communication and helping them to overcome from stage fear.

UNIT I		**9 Hrs**

Values – Self exploration – Values of individuals: Presentation on favourite personality and the skills and values they demonstrate – interviewing a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them – **Writing**: newspaper report on an IPL match – record conversation between a celebrity and an interviewer

UNIT II		**9 Hrs**

Grammar -Tenses – Verbs – Helpings verbs – Subject-verb agreement – Articles – Prepositions – Conjunctions – Adjectives – Adverbs – Voice – Parts of Sentence – Identification of errors – **Effective Communication** - Types of Communication (Verbal, Written & Non-verbal Communication) – Tips to develop communication skills – Principles of Listening – The Process of Listening – Types of Listening.

UNIT III		**9 Hrs**

Writing - Letter Writing -Formal and Informal letter writing, application letters, Report writing academic and business report, Job application letter, Writing a Proposal

UNIT IV		**9 Hrs**

Reading - Reading articles – Paragraph writing, Summary writing, story writing - writing your comprehensive CV - Create a podcast on a topic.

UNIT V		**9 Hrs**

Interpersonal skills - Self - Assessment, Self - Appraisal, Team work, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Positive Attitude, Values and Belief Systems, Self-Esteem, Self - appraisal, Personal Goal setting, Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, and prioritization

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Recognize the need for life skills and values
- Use vocabulary effectively to present their ideas.
- Accomplish verbal and written communications.
- Write effectively in a wide range of formal letters.
- Prepare Business Proposals and Business Reports for various business purposes.
- Apply Life skills for achieving miles stones

TEXT BOOK:

1. Ms.Meenakshi Raman,Prakash singh : Business Communication, Published by Oxford Higher Education/Oxford University Press, 2012ISBN 10: 019807705X / ISBN 13: 9780198077053.

REFERENCE BOOKS:

1. Randolph Hudson. H & Bernard Selzler. J. Business Communication, Jaico Publishing House, 2006
2. Michael McCarthy, Felicity O'Dell, English Collocations in Use, Noida, Cambridge University Press, 2006.
3. Allan Pease, Body Language, New Delhi, Sudha Publications (P) Ltd, 2005.
4. Malcolm Goodale, Professional Presentations, New Delhi, Cambridge University Press, 2006.

19UMA103	PROBABILITY AND INFERENTIAL STATISTICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES :

- To make the student acquire sound knowledge of random variables emerge in real life problems and its standard distributions that can describe real life phenomena.
- Analyze the various data by different statistical sampling techniques.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- To make the student to understand the fundamentals relation between probability and statistics which will greatly help at data analysis and interpretation.

UNIT I	PROBABILITY AND RANDOM VARIABLE	8+3 Hrs

Probability: Concepts of experiments, Sample space, event - Combinatorial probability - Conditional probability – Baye's theorem. Random variable: Probability mass function - Probability density function - Properties – Mathematical expectation and its properties-Moments and its properties - Moment generating functions.

UNIT II	PROBABILITY DISTRIBUTIONS	9 +3 Hrs

Discrete Probability distributions: Binomial distribution -Poisson distribution - Geometric distribution. ContinuousProbability distributions: Uniform distribution - Exponential distribution - Gamma distribution - Normal distribution.

UNIT III	TWO DIMENSIONAL RANDOM VARIABLES	9 +3 Hrs

Joint Distribution - Discrete and continuous distributions - Marginal and Conditional Distributions – Correlation – Rank correlation - Linear Regression.

UNIT IV	INTRODUCTION TO STATISTICS	8+3 Hrs

Definition of Statistics - Basic Objectives - Collection of Data - Population - Sample - Representative Sample – Classification and Tabulation of Univariate data - Graphical representation - Frequency curves - Central tendency andDispersion - Applications.

UNIT V	TESTING OF HYPOTHESIS	8+3 Hrs

Sampling - Large sample test: Tests for Single mean- Test for difference between two means. Small sample test:Tests for mean (t test), F- test - Chi-square test for Goodness of fit and Independence of attributes.

SUPPLEMENT TOPIC (for internal evaluation only-)	3 Hrs

Evocation /Application of Mathematics, Quick Mathematics – Speed Multiplication and Division Applications of Matrices.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Understand the fundamental knowledge of concepts of probability.
- Apply the acquired knowledge of standard Distribution in real life phenomena.
- Compute the Correlation coefficient and line of regression for the given two dimensional random variable function or discrete rate.
- Explain the types of data by graphical representation and Frequency curves, central tendency and dispersion.
- Exemplify the basics concepts of statistics through various representation of data.
- Analyze the various collections of data in science / engineering problems using statistical inference techniques.

TEXT BOOKS:

1. S. M. Ross, “Introduction of Probability Models”, Academic Press, Springer Publication, 2000.
2. GREWAL B.S, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 42nd Edition, (2012).
3. GUPTA S.C, KAPOOR V.K. “Fundamental of Mathematical Statistics” 10th Edition,Sultan Chand and Sons, New Delhi 2002.

REFERENCE BOOKS:

1. SHARMA J.N , GOEL J.K “ Mathematical statistics“, 7th Edition, Krishna PrakashamMandis, Mearut,(1998).
2. WALPOLE. R.E., MYERS .R.H., MYERS S.L., and YE. K, “Probability and Statistics for Engineers and Scientists”, Pearson Education, New Delhi, 8th edition, (2007).
3. SPIEGEL M.R., SCHILLER J. and SRINIVASAN R.A., “Schaum’s Outlines Probability and Statistics”, Tata McGraw Hill, New Delhi, (2004).

4. JOHNSON R.A, and GUPTA C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, New Delhi, 8th Edition, (2011).
5. A.M. Mood, F.A. Graybill and D.C. Boes, —Introduction to the Theory of Statistics‖, 3rd edition, McGraw Hill Education, (2010).

19UPH104	PHYSICS FOR COMPUTING SCIENCE	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES :

- To learn the basic concepts of physics needed for computing engineering
- To apply the physics concepts in solving real time engineering problem
- To implement and visualize theoretical aspects in the laboratory
- To familiarize the students to handle various instruments and equipment

UNIT I	CRYSTAL PHYSICS	10 Hrs

Introduction – Classification of solids –Space lattice –Basis-Lattice parameter – Unit cell – Crystal system –Miller indices –d-spacing in cubic lattice - Calculation of number of atoms per unit cell – Atomic radius-Coordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal imperfection – Burger vector.

UNIT II	MODERN PHYSICS	12 Hrs

Principles of Laser- Characteristics of laser -Spontaneous and stimulated emission –Population inversion – Einstein's A and B coefficients - Pumping methods – Basic components of Laser - Types of lasers - CO2 laser – Semiconducting Diode Laser - Optical Fiber- Structure of an optical fiber- Types of optical fibers -Applications.

UNIT III	QUANTUM PHYSICS	10 Hrs

Introduction - Black body radiation – Planck's law of radiation- Wien's displacement law-Rayleigh Jeans law- – Compton Effect – Theory and experimental verification – Matter waves-Schrodinger's wave equation – Time dependent – Time independent equation – Particle in a one dimensional potential box - Scanning electron microscope.

UNIT IV	OSCILLATION AND WAVE PHYSICS	13 Hrs

Basic definition - Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-Resonance - Damped harmonic oscillator – heavy, critical and light damping- energy decay in a damped harmonic oscillator- quality factor- forced mechanical and electrical oscillators.

Types of interference of light - Newton's rings - Diffraction-Fresnel's diffraction - Fraunhofer's diffraction - Difference between interference and diffraction - Coherence - Temporal and Spatial Coherence.

Laboratory

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 : 45 Periods

COURSE OUTCOMES:

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

- Describe the different types of Crystal Systems, Lasers and Wave motions. **(Understand)**
- Apply the principles of Laser in optical fiber **(Apply)**
- Analyze the characteristics of Crystal structures,lasers and dual nature of matter in Industries.(Analyze)
- Apply the knowledge of quantum physics to solve the problem of One dimensional box using Schrodinger’s wave equation. to calculate Schrodinger time dependent and time independent wave equations.(Apply)
- Interpret the theoretical knowledge of light to determine the wavelength of Ordinary and Laser light using Interference and grating. **(Apply)**
- Analyze the structural Behavior Of Crystals and Optical properties of Fiber and light to select suitable material for Industrial Applications.(Analyze)

TEXT BOOKS:

1. Dr.M.N.Avadhanulu & Dr.P.G.Kshirsagar, “ A Textbook of Engineering Physics “, Revised Edition 2014, S.Chand Company and Private limited, New Delhi
2. Dr.V.Rajendren, Engineering Physics, 2009, Tata-McGraw-Hill Publishing company limited, New Delhi
3. Dr. P. Mani, “Physics for Computing Science”,2020, Dhanam Publications, Chennai.

REFERENCE BOOKS:

1. Basics of laser physics: for students of science and engineering http://www.springer.com/978-3-319- 50650-0
2. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012
3. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
4. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017.
5. Halliday and Resnick, Fundamentals of Physics, 11 th edition, John Wiley and Sons, Inc, 2018

19UEE125	PRINCIPLES OF ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
- To impart knowledge on the phenomenon of resonance in series and parallel circuits and also to obtain the transient response of RC, RL and RLC circuits.
- To provide knowledge on the principles of electrostatics and electromechanical energy conversion devices.
- To learn the electrical measurement concepts and energy saving methods by different ways of illumination.

UNIT I	INTRODUCTION	6 Hrs

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	6 Hrs

Simplifications of networks using series - parallel, Star/Delta transformation. Superposition theorem, Thevenin‘s theorem, Norton‘s Theorem, Maximum Power Transfer theorem.

UNIT III	AC CIRCUITS	6 Hrs

AC waveform definitions, Average value, RMS value, form factor, peak factor, study of RL series circuit, RC series circuit, RLC series and 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.

UNIT IV	PRINCIPLE OF ELECTROSTATICS	3 Hrs

Electrostatic field, electric field intensity, 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.

UNIT V	PRINCIPLE OF ELECTROMECHANICS	3 Hrs

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 VI	MEASUREMENTS AND SENSORS	6 Hrs

Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) 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.

COURSE OUTCOMES:

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

- Analyse DC and AC circuits and apply circuit theorems.
- Realize series and parallel resonant circuits.
- Evaluate power in three phase AC circuits.
- Understand the principles of electrostatics and electromechanical energy conversion devices.

TEXT BOOKS:

1. V.K. Mehta, “Basic Electrical Engineering”, S. Chand and Company Ltd., New Delhi.
2. B.L.Theraja, “A Textbook of Electrical Technology”, Vol. I Basic Electrical Engineering, S. Chand and Company Ltd., New Delhi.
3. R.Muthusubramanian, S.Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill Publishers, Edition 1, 2010.
4. H.Partab, “Art and Science of **Utilization** of Electrical Energy”, DhanpatRai and Co., New Delhi, 2004.

REFERENCE BOOKS:

1. A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, “Electric Machinery”, Sixth Edition Tata McGraw Hill.
2. J. Nagrath and Kothari, “Theory and problems of Basic Electrical Engineering”, Second Edition Prentice Hall of India Pvt. Ltd.

3. Edward Hughes, “Electrical Technology”, Tenth Edition, Pearson Education Publication.

Vincent. Del. Toro, “Electrical Engineering Fundamentals”, Second Edition, Prentice Hall, India.

19UCB106	FUNDAMENTALS OF COMPUTER SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the concepts in problem solving for computing
- To familiarize the programming constructs of C
- To explain the concepts of arrays, functions, pointers, structures in C

UNIT I	INTRODUCTION	9 Hrs

Definition and basic organization of computers – classification of computers – Software – Types of software – types of programming paradigms - Translators: compiler and interpreter – Problem solving tools: Algorithms – Flowchart – Pseudo code.

UNIT II	INTRODUCTION TO C	9 Hrs

Introduction to C language – Structure of C program - Character set – token – identifiers – reserved words – Comments - data types – constants – printf() function - variables – scanf() function - operators – expression – declaration statement – assignment statement - conversion of algorithm in to program – Solving simple problems involving arithmetic computations and sequential logic to solve.

UNIT III	C PROGRAMMING CONSTRUCTS	9 Hrs

Flow of execution – branching constructs: if, if – else, else if ladder, switch, break – looping constructs: while, do. While, for, break and continue – Solving problems involving decision making and iterations

UNIT IV	ARRAYS, FUNCTIONS AND POINTERS	9 Hrs

Array definition – Array declaration – initialization – accessing elements –string manipulation. Functions: definition – prototype – function call – functions with arguments and without arguments – Parameter passing methods – recursive functions – Solving problems using non-recursive and recursive functions.

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Pointer to functions.

UNIT V	STRUCTURES,UNION AND FILES	9 Hrs

Structures and Union: Definition – variable declaration – initialization – accessing members – Solving problems using structures and union - pointer to structures - self-referential structures – Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

COURSE OUTCOMES:

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

- Utilize problem solving tools in solving computing problems.[Apply]
- Apply the knowledge of arithmetic & sequential logic to solve problems related to mathematical expressions. [Apply]

- Identify suitable control constructs to provide solutions to computer applied complex engineering problems. [Analyze]
- Formulate problems to provide solutions to computer applied complex engineering problems using modularity.[Analyze]
- Apply the knowledge of permanent storage of data to solve computer applied complex engineering problems. [Apply]
  Design solutions for computer applied complex engineering problems that meet specified needs.[Create]

TEXT BOOKS :

1. Balagurusamy, E, "Programming in AnsiC",Eigthh Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2019.
2. Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011

REFERENCE BOOKS :

1. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.
2. Kernighan.B.W,Ritchie.D.M,"The C Programming language", Pearson Education,Second Edition, 2006.
3. Stephen G.Kochan, "Programming in C", Pearson Education India,Third Edition, 2005.
4. Anita Goel ,Ajay Mittal, " Computer Fundamentals and Programming in C"", Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried, " Programming with C ", Schaum's Outlines, Tata McGraw-Hill,Second Edition, 2006.
6. PradipDey, ManasGhosh, "Fundamentals of Computing and Programming in C", Oxford University Press, First Edition, 2009.

19UCB107	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To impart the knowledge of micro economics that deals with the study of economic decision making by individuals and individual firms.
- To Acquire the knowledge of the economic behavior of firms operating in perfect and imperfect competition.
- To know the various concepts in macroeconomics that deals with the performance and behaviour of an economy.
- To study the role of money and credit creation by banks in the economic development of a nation.

UNIT I	INTRODUCTION TO MICROECONOMICS	6 Hrs

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	WELFARE ECONOMICS	6 Hrs

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

UNIT III	BOUNDLESS ECONOMICS	6 Hrs

Tax and Subsidies - Inter temporal Consumption -Suppliers- Income Effect; Theory of Production - Production Function and Isoquants - 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	INTRODUCTION TO MACRO ECONOMICS	6 Hrs

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

UNIT V	MONETARY POLICY	6 Hrs

Money -Definitions; Demand for Money Transaction and Speculative Demand; Supply of Money - Banks Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model, Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

TOTAL:30 Periods

COURSE OUTCOMES:

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

- Apply the basic principles and concepts of microeconomics for economic decision making. **(Apply)**
- Select the appropriate microeconomic demand-supply concepts to solve the business problems. **(Apply)**
- Develop a strategy that measure, critique and interpret consumer‘s behavior in decision making. **(Apply)**
- Make use of the different production and cost functions to derive product decision. **(Apply)**
- Analyze with the macroeconomics components and Keynesian Multiplier to solve the real time economy problems. **(Analyze)**
- Examine the banking and central bank‘s monetary policy concepts in economic development of a nation**. (Evaluate)**

TEXT BOOKS:

1. Pindyck, Robert S and Daniel L. Rubinfeld , Microeconomics, Eighth Edition, 2015 .
2. Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012.
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Nineteenth Edition, McGraw-Hill Education, 2010

REFERENCE BOOKS:

1. Hal R, Varia, Intermediate Microeconomics: A Modern Approach, Eighth Edition Affiliated East-West Press, 2006
2. N. Gregory Mankiw, Principles of Macroeconomics, Seventh Edition, Cengage Learning, 2018.

WEB REFERENCES:

1. https://data.oecd.org/economy.htm
2. https://www.focus-economics.com
3. https://www.rbi.org.in

19UEE128	ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To teach methods of experimentally analysing electrical circuits and transducers.

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 $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$.
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 : 45 Periods

COURSE OUTCOMES:

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

- Demonstrate the behavior of RLC circuits with electrical quantities.[Understand]
- Experimentally analyze the electric circuits and transducers [Analyze]
- Simulate the time response characteristics of RC and RLC Circuits [Apply]

19UCB109	COMPUTER PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES :

- Familiarize with programming environment
- Familiarize the implementation of programs in C

LIST OF EXPERIMENTS

- **Familiarization with Integrated Development Environment (IDE)**(Compile, Debug)
- **Problems involve arithmetic computations and sequential logic**
  1. Write a program to calculate the slope of a line, given the data for coordinates of the end points of the line.
  2. Write a program to convert polar coordinates to Cartesian coordinates
  3. Write a program to compute the volume of a cylinder with diameter d and height h and print diameter, height and the volume.
- **Problems involve decision making**
  1. Design a calculator to perform the following operations addition, subtraction, multiplication, division
  2. Write program to find the given year is leap year or not
- **Problems involve iterations**
  1. printing simple series,
  2. Fibonacci sequence
- **Problems involve 1D arrays**
  1. Design an one dimensional array with height of the person and find how many persons are above the average height
  2. Write a program to input a set of integer numbers, count and sum the positive numbers and also count and sum the negative numbers then print the count and sum of all positive numbers and negative numbers.
- **Problems involve 2D arrays**
  1. Design a two dimensional array with height and weight of the persons and compute the body mass index of individuals.
  2. Write a program to multiply two matrices
- **Problems involve structures**
  1. Generate salary slip of an employee and print the salary details of an employee whose first name is “aaa”.
  2. Compute internal marks of students for five different subjects
- **Problems involve functions**
  1. Write a program to check the given number is prime or not using function
  2. From a given paragraph perform the following using inbuilt in functions
     a. Find the total number of words
     b. Capitalize the first word of each sentence
     c. Replace a given word with another word
- **Problems involve recursive functions**
  1. Find the GCD of the given number

- **Problems with File concepts**
  1. Insert, update, delete and append telephone details of an individual's using file

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Write programs to solve problems involving computations. [Apply]
- Provide computing solutions through programs using sequential and iteration logics[Apply]
- Formulate problems to provide modular solutions using recursion.[Analyze]
- Access data stored in secondary storage in sequential and random manner.[Apply]
- Design solutions for computer applied complex Engineering Problems that meet specified needs. [Create]

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS

SOFTWARE

OS – UNIX CLONE (LICENSE FREE LINUX)

COMPILER – C

Semester II

Course Code		Course Title	L	T	P	C
THEORY						
19UEN202	HS	Business Communication & Value Science – II	2	0	0	2
19UMA208	BS	Linear Algebra and Numerical Techniques	3	1	0	4
19UMA209	BS	Statistical Methods	3	0	0	3
19UCY204	BS	Environmental Science	3	0	0	3
19UEC225	ES	Principles of Electronics Engineering	3	0	0	3
19UCB206	PC	Introduction to Data Structures and Algorithms	3	0	0	3
PRACTICAL						
19UEC227	ES	Electronics Engineering Laboratory	0	0	3	1.5
19UCB208	PC	Data Structures and Algorithms Laboratory	0	0	3	1.5
		TOTAL	**17**	**1**	**6**	**21**
Total No. of Credits – 21						

19UEN202	**BUSINESS COMMUNICATION & VALUE SCIENCE – II**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES :

- To identify the correct tense form in the sentence
- To make a presentation of English in various Business avenues.
- Apply Creative thinking for expressing their innovative ideas.
- Understand the working environment for their successful career.

UNIT I		**9 Hrs**

Grammar- Application of tenses,**Vocabulary** - Job title and describing jobs; **Listening** - Listening to company culture; **Reading** - Quiz; **Writing** - Writing formal and semi formal business letters; Email writing- Formal and Informal, email writing structure, Skimming and Scanning -Application of reading and writing skills.

UNIT II		**9 Hrs**

Vocabulary –Collocations, Jargons related to Shares and stock**,** Words related to finance, Words related to employment. **Writing** – Memo **Speaking -** Role play on various business situation.

UNIT III		**9 Hrs**

Public Speaking: Basics of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review. **Presentation Skills:** PowerPoint presentations, Effective ways to structure the presentation, importance of body language. **Leadership skills and Requirements of the Skill:** Understanding good Leadership behaviours, Learning the difference between Leadership and Management, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback **Problem Solving Skill:** Problem solving skill, Confidence building.

UNIT IV		**9 Hrs**

Company culture – Dress code, interacting with Co-workers, Telephone Etiquettes,Understand the importance of professional behaviour at the work place, Empathy, Importance of the first impression **Listening**-Listening to audio and video speech of business people.

UNIT V		**9 Hrs**

Working Environment –Cultural issues at the workplace, caste, religion, language issues class, regionalism, religion and poverty: the different identities of Indian Employees and employers and how to include everyone **Professional Ethics -** Truthfulness and confidentiality, Autonomy and informed consent, Beneficence, Non maleficence, Justice.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the correct usage of tense in the sentence
- Make a presentation of English in various Business avenues.
- Apply interpersonal skills to be a good leader.
- Apply Creative thinking for expressing their innovative ideas.
- Acquire a holistic vision and growth to become an integrated personality.

REFERENCE BOOKS:

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Strategic Communication by Charles Marsh
5. English vocabulary in use Alan Mccarthy and Odell
6. Business Communication Dr. Saroj Hiremath

19UMA208	LINEAR ALGEBRA AND NUMERICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES :

- Understand the basic concepts of matrices and their Eigen values and Eigen vectors to solve the system of equations.
- To acquaint the student with the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and Eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- To apply the general theory of Mathematical systems involving addition and scalar multiplication of vectors has applications in all Engineering field
- To apply the concept of Inner product space in orthogonalization.

UNIT I	MATRICES	9+3 Hrs

Eigen value and eigenvector of a real matrix – Characteristic equation – Properties – Cayley – Hamilton theorem (excluding Proof) – Orthogonal reduction –(transformation of a symmetric matrix to diagonal form) – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II	MATRIX DECOMPOSITION	9+3 Hrs

Positive definite matrix -Gauss Elimination method - Gauss Jordan method - LU decomposition - Singular valuedecomposition

UNIT III	NUMERICAL SOLUTIONS AND INTERPOLATION TECHNIQUES	9+3 Hrs

Newton – Raphson method – Gauss Seidel method – Eigen values of a matrix by Power method – Lagrange's interpolation – Newton's divided difference interpolation – Newton's forward and backward difference interpolation.

UNIT IV	VECTOR SPACES	9+3 Hrs

Linear dependence of vectors, basis, dimension, linear transformations (maps), range and kernel of a linear map, rank and nullity inverse of a linear transformation rank nullity theorem , composition of linear maps, matrix associated with a linear map.

UNIT V	INNER PRODUCT SPACE	9 +3Hrs

Inner product space, Norm of a vector matrix vector, Orthogonally of vectors - Projections - Gram-Schmidt orthogonalization – QR decomposition.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Compute Characteristic Equation, Characteristic roots and use the applicability of Cayley – Hamilton theorem to find the Inverse of matrix which is very important in Engineering and applications.
- Demonstrate basic concepts and to solve the complex Engineering problems using Matrix.
- Implement the various matrix techniques in solving the system of linear equations.
- Employ a number of techniques to solve linear and nonlinear equations.
- Use Interpolation technique for equal and unequal intervals to find new data points within the range of known data points.
- Appreciate the Numerical techniques of interpolation and error approximation in various intervals in real life situations.
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Understand the orthogonal form and geometric properties of vector by inner product method.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- To diagonalize the symmetric and non-symmetric matrix using singular value decomposition and principal component analysis.

TEXT BOOKS:

1. VEERARAJAN.T “Engineering Mathematics” Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. GREWAL B.S, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 42nd Edition, (2012).
3. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Numerical Methods, S.Chand& Company Ltd., New Delhi, 2rd Edition, (2012).
4. DAVID, C., LAY, “Linear Algebra and its applications” 4th Edition Published by Addison Wesley / Pearson, 2011

REFERENCE BOOKS:

1. Michael. D. Greenberg, “Advanced Engineering Mathematics”, Second Edition, Pearson,

2002.

2. Gilbert Strang, “Introduction to linear algebra”, Fifth Edition, ANE Books, 2016..
3. David C. Lay, “Linear Algebra and its applications” 3rd Edition updated Pearson Education, (2005).

4. RAMANA.B.V, “Higher Engineering Mathematics” Tata McGraw Hill, New Delhi, 11th Reprint (2010).
5. Peter, D. Lax, “Linear Algebra and its applications” 2nd Edition Wiley-Interscience Publication, (2007).

19UMA209	STATISTICAL METHODS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- The main objective of this course is to provide students with the foundations of statistical and probabilistic analysis mostly used in various applications in engineering.
- To understand the fundamental concepts of estimation methods.
- To understand the fundamental concepts of programming in R.

UNIT I	DESIGN OF EXPERIMENTS	9 Hrs

Completely randomized design – Randomized block design – Latin square design.

UNIT II	ESTIMATION	9 Hrs

Point estimation - criteria for good estimates (Un-biasedness & Consistency) - Methods of estimation includingmaximum likelihood estimation. Sufficient Statistic: Concept & examples - Complete sufficiency - Application inestimation.

UNIT III	NON-PARAMETRICINFERENCE	9 Hrs

Comparison with parametric inference - Use of order statistics - Sign test - Wilcoxon signed rank test – Mann – Whitney test - Run test - Kolmogorov-Smirnov test - Spearman's and Kendall's test.

UNIT IV	TIME SERIES ANALYSIS	9 Hrs

Basics of Time Series Analysis - Forecasting – Stationary – ARIMA Models: Identification - Estimation – Forecasting

UNIT V	R PROGRAMMING	9 Hrs

Introduction to R - Functions - Control flow and Loops - Working with Vectors and Matrices - Reading in Data – Writing Data – Working with Data – Manipulating Data – Simulation – Linear model – Data Frame - Graphics in R.

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Design and analyze a process, to evaluate which process inputs have a significant impact on the process output using design of experiments.

- Understand the basic concepts of Statistical Inference and Estimation methods .
- Use the appropriate non parametric hypothesis testing procedures based on inferences.
- Apply the knowledge of time series analysis in economics and engineering.
- Understand Introductory R language fundamentals, basic syntax and how to use R; what R is and how it is used to perform data analysis.
- Understand and use the various graphics in R for data visualization.

TEXT BOOKS:

1. R. Miller, J.E. Freund and R. Johnson, “Probability and Statistics for Engineers”, Fourth Edition, Pearson, 2015.
2. Goon, M. Gupta and B.Dasgupta, “Fundamentals of Statistics (Vol. II)”, The Word Press, 1933.
3. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Second Edition, Addison-Wesley Professional, 2017.

REFERENCE BOOKS:

1. A.M. Mood, F.A. Graybill& D.C. Boes, “Introduction to the Theory of Statistics - ǁ ”, 3rd edition, McGraw Hill.
2. D.C. Montgomery and E. Peck, “Introduction to Linear Regression Analysis”, Third Edition, Wiley, 2010.
3. Garrett Grolemund, “Hands-on Programming with R”, Shroff Publishers& Distributors Pvt Ltd, 2018.
4. N. Draper & H. Smith, “Applied Regression Analysisǁ, 3rd edition, Wiley.
5. Chris Chatfield, “The Analysis of Time Series: An Introductionǁ, 6th edition, Chapman and Hall/CRC.

19UCY204	ENVIRONMENTALSCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To understand the concepts of Environment and ecosystem.
- To acquire knowledge about the impact of environmental pollution.
- To understand the importance of environmental issues in the society.
- To gain knowledge about the impact of environment related to human health.
- To gain knowledge in alternative energies.

UNIT I	ENVIRONMENT AND ECOSYSTEMS	9 Hrs

Definition, scope and importance of environment – Need for public awareness – Conceptofecosystem–Structureandfunctionofecosystem–Producers,consumersand decomposers-Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Aquatic ecosystems (c) Grasslandecosystem.

UNIT II	ENVIRONMENTALPOLLUTION	9 Hrs

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution- pollution case studies - Role of an individual in prevention of pollution –Disaster management: floods, earthquake, cyclone and landslides.

UNIT III	SOCIAL ISSUES ANDTHEENVIRONMENT	9 Hrs

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Environmental laws/Acts, (EPA).

UNIT IV	HUMAN POPULATION ANDTHEENVIRONMENT	9 Hrs

Population growth, variation among nations – Population explosion – Human rights – Family welfare programme – Environment and Human Health – Human Rights-Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health.

UNIT V	FUTURE POLICYAND ALTERNATIVES	9 Hrs

Introduction to future policy and alternatives-fossil fuels-nuclear energy-solar energy-wind energy - hydroelectric energy-geothermal energy - tidal energy – sustainability - green power-nanotechnology.

Total: 45 Periods

COURSE OUTCOMES:

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

- Express the concepts of an ecosystem. **(Understand)**
- Describe the impact of environmental pollution. **(Understand)**
- Explain the importance of environmental issues to the society. **(Understand)**
- Analyze the impact of environmental issues related to human health **.(Analyze)**
- Identify alternate energy sources for technological applications. **(Understand)**

TEXT BOOKS:

1. AnubhaKaushik, kaushik C.P., "Environmental Science and Engineering",Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph "Environmental Science and Engineering", Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering andScience', Pearson Education,Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science", Wadsworth PublishingCompany, Belmont, California, 2005.
3. De A.K., "Environmental Chemistry", Wiley Eastern Ltd., New Delhi,2001.
   Trivedi R.K., Goel P.K., "Introduction to Air Pollution", Techno-Science Publication, Jaipur,2005.

19UEC225	PRINCIPLES OF ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To study the operation of semiconductor diodes and their characteristics.
- To enable the student to understand the bipolar junction transistor configurations and its characteristics.
- To introduce the structure and terminal characteristics of FET and MOSFET.
- To enable the students to understand the fundamentals of digital circuits.

UNIT I	SEMICONDUCTORS	9 Hrs

Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers. **Diodes and Diode Circuits:** Formation of P-N junction, energy band diagram, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency.

UNIT II	BIPOLAR JUNCTION TRANSISTORS	9 Hrs

Formation of PNP / NPN junctions; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, current amplification factors for CB and CE modes

UNIT III	FIELD EFFECT TRANSISTORS	9 Hrs

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles.

UNIT IV	DIGITAL ELECTRONICSCOMBINATIONAL CIRCUITS	9 Hrs

Number systems, Boolean algebra, Basic and Universal Gates, Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder , Multiplexer/Demultiplexer, code converters.

UNIT V	DIGITAL ELECTRONICSSEQUENTIAL CIRCUITS	9 Hrs

Latches, Flip-flops: SR, JK, D, T, and Master-Slave, Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, shift registers and its types.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of semiconductor to understand the characteristics of PN and zenerdidode**.(Understand)**
- Apply the knowledge of semiconductor diode to design rectifiers **.(Apply)**
- Analyze the BJT terminal characteristics and its utilization. **(Analyze)**
- Understand the principles and configurations of Field Effect Transistors and its types**.(Understand)**
- Design combinational circuits using logic gates **.(Apply)**
- Design sequential circuit using appropriate flip-flops**.(Apply)**

TEXT BOOKS:

1. Electronics Devices & Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj
2. Digital Logic & Computer Design, M. Morris Mano.

19UCB206	INTRODUCTION TO DATA STRUCTURES & ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To impart the knowledge on algorithms and data structures for solving a problem
- To learn various searching and sorting techniques.

UNIT I	BASIC TERMINOLOGIES &INTRODUCTION TO ALGORITHM AND DATA ORGANISATION:	9

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:	9

Array, Linked-list and its types, Various Representations, singly linked lists- circularly linked lists- doubly-linked lists, Stack, Queue, Circular Queue, Operations & Applications of Linear Data Structures

UNIT III	NON LINEAR DATA STRUCTURES – TREES	9

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree -B+ Tree – Heap – Applications**.**

UNIT IV	NON LINEAR DATA STRUCTURES -GRAPHS	9

Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Dijkstra's Single source shortest Path Problem –Minimum Spanning Trees - Applications of graphs.

UNIT V	SEARCHING, SORTING AND HASHING ON VARIOUS DATA STRUCTURES:	9

Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing, File: Organization (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes**.**

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Determine time complexity of an algorithm. **(Apply)**

- Apply the different linear data structures to problem solutions. **(Apply)**
- Apply suitable tree data structures in solving computational problems. **(Apply)**
- Apply appropriate searching, sorting and hashing algorithms to access elements. **(Apply)**
- Identify suitable organization scheme in files to access elements. **(Apply)**
- Design solutions for real life problems using graph data structures. **(Create)**

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011.
2. Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third edition, PHI, 2010.

REFERENCE BOOKS:

1. Donald E. Knuth ,The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth,3rd edition, Pearson Education.
2. Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education, Special Indian Edition, 2014.
3. AlfredV.Aho, John E.Hopperoft, Jeffrey D.UIlman, Data Structures and Algorithms,Pearson Education,2002.
4. Pat Morin, Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed. Edition, AU Press, 2013.

19UEC227	ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- . To enable the students to identify the components and operation of semiconductor diodes and their characteristics.
- To enable the students to design digital logic circuits.

LIST OF EXPERIMENTS

1. Characteristic of PN junction diode
2. Characteristics of Zener diode
3. Half wave rectifier with capacitive filter.
4. 4.Full wave rectifier with capacitive filter.
5. 5.Bridge rectifier with capacitive filter.
6. 6.Characteristics of CBConfiguration.
7. 7.Characteristics of CE Configuration.
8. 8.Drain and transfer characteristics of JFET.
9. 9.Drain and transfer characteristics of MOSFET.
10. 10.Study of logic gates.
11. Design and implementation of Adder and subtractor.
12. 12.Design and Implementation of Code Convertor.
13. 13.Design and implementation of Multiplexer and Demultiplexer.
14. 14.Design and implementation of Shift registers.
15. 15.Design and implementation of Synchronous and Asynchronous counters.

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of diodes and transistors to identify device for various applications**.(Apply)**
- Apply the knowledge of semiconductor diodes to construct Rectifiers. **(Apply)**
- Design Combinational and Sequential Logic circuits. **(Apply)**

19UCB208	DATA STRUCTURES & ALGORITHMS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To implement various Data structures and Algorithms

LIST OF EXPERIMENTS

Implementation of Array – Insertion, Deletion.
Implementation of Singly Linked List
Implementation of Doubly linked List
Implementation of Stack and its Applications
Implementation of Queue
Implementation of Circular Queue
Implementation of Tree Traversals
Implementation of Binary search tree
Implementation of AVL Trees
Implementation of Topological sort
Implementation of Minimal Spanning Tree
Implementation of Shortest path Algorithm
Implementation of Bubble Sort, Insertion sort
Implementation of Breadth First Traversal and Depth First Traversal
Saving / retrieving non-linear data structure in/from a file

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Construct and Implement the list, stack and queue functionality for suitable applications. **(Apply)**
- Make use of tree structures to solve the problems involving hierarchical data. **(Apply)**
- Implement appropriate searching and sorting techniques, with an understanding of the trade-off between the time and space complexity. **(Apply)**
- Apply the knowledge of hashing for data indexing. **(Apply)**
- Design solutions for computer applied real world complex engineering problems using graph algorithms. **(Create)**

HARDWARE AND SOFTWARE REQUIRMENTS

Personal Computers – 30 Numbers

Operating System: Linux (any flavor) / Windows

Any C++ compiler compatible with Linux / Windows

Semester III

Course Code		Course Title	L	T	P	C
THEORY						
19UEN301	HS	Business Communication & Value Science – III	2	0	0	2
19UMA327	BS	Discrete Mathematics and Calculus	3	1	0	4
19UCB303	ES	Computational Statistics	3	0	0	3
19UCB304	PC	Object Oriented Programming	3	0	0	3
19UCB305	PC	Operating Systems Concepts	3	0	0	3
19UCB306	PC	Computer Organization Architecture	3	0	0	3
PRACTICAL						
19UCB307	PW	Technical Seminar	0	0	2	1
19UCB308	PC	Computational Statistics Laboratory	0	0	3	1.5
19UCB309	PC	Object Oriented Programming Laboratory	0	0	3	1.5
19UCB310	PC	Operating Systems Laboratory	0	0	3	1.5
		TOTAL	**17**	**1**	**11**	**23.5**
Total No. of Credits – 23.5						

19UEN301	BUSINESS COMMUNICATION & VALUE SCIENCE – III	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

The student should be made to:

- Promote specialized composing abilities
- Practice self-investigation strategies like SWOT and TOWS
- Comprehend key ideas of pluralism and social spaces
- Sharpen the culturally diverse correspondence
- Strengthen the study of country building

UNIT I		4

Standards of Communicative Writing, Formal and Business letters, Error Detection, Voice (Active & passive) Text Completion (Closed/ open Error Detection, Voice (Active & passive) Text Completion (Closed/ Open) Report composing - Basic principles of Report composing through models, Technical Proposal - "How might a voice partner develop in a long time from now?"

UNIT II		4

Writing SOP Essential standards of SWOT and Life Positions - Apply SWOT, in actuality, situations recognize how inspiration helps genuine Leverage inspiration, all things considered, situations The Balancing Act (Self Analysis) - Basic standards of SWOT and life positions. Ted chats on biomimicry

UNIT III		4

Pluralism in social spaces-Differentiate between the various societies of India-Define the terms worldwide, global and translocation-Differentiate between worldwide, global and translocation culture-Recognize the ramifications of multifaceted correspondence Common errors made in diverse correspondence - The jobs and relations of various genders

UNIT IV		4

Job of science in country building-Introduction to specialized composing Practice action on specialized composition - Evaluation on specialized composition -which means and meaning of contention; purposes behind struggle; negative and positive effect of contention, Tips to oversee struggle

UNIT V		4

Project- Visit provincial region/oppressed pieces of city to address a portion of the nearby issues; if important, propose a useful innovation answer for the issues.

TOTAL:20 Periods

Laboratory

EXPERIMENT 1 2 Hours

SWOT Vs. TOWS

The difficult exercise TED chats on Biomimicry and Stories

EXPERIMENT 2 2 Hours

Rhythms of India (Cultures in India)

Diverse Communication

EXPERIMENT 3 2 Hours

Role of science in Nation Building

EXPERIMENT 4 2 Hours

Job of science (Post-freedom)

Practice movement on Technical Writing

EXPERIMENT 5 2 Hours

Computer based intelligence in Everyday Life

Plan your school in the year 2050

Total Hours: 20+10=30 Periods

COURSE OUTCOMES:

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

- Distinguish the accepted procedures of specialized composition and apply specialized writing, all things considered, situations
- Apply and examine the essential standards of SWOT and life positions
- Distinguish and regard pluralism in social spaces
- Distinguish the normal mix-ups made in multifaceted correspondence
- Comprehend, examine and influence the force of inspiration, all things considered

REFERENCE BOOKS

1. Raman, Meenakshi and Sangeeta Sharma. Fundementals of Technical Communication. (2014)

2. Fine, Lawrence G. The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats . (2009)

WEB REFERENCES

1. https://freelance-writing.lovetoknow.com/kinds-technical-writing
2. https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/
3. https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/

ONLINE REFERENCES

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y

19UMA327	DISCRETE MATHEMATICS AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES :

The student should be made to:

- To make the student acquire sound knowledge to test the logic of program.
- To familiarize the student to be aware of generating functions.
- Apply the different differential and integral techniques in solving the real time engineering problems

UNIT I		9

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested Quantifiers - Rules of inference - Introduction to Proofs - basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT II		9

Permutations and Combinations - Mathematical inductions - Strong induction and well ordering- The basics of counting – The pigeonhole Principle – Recurrence relations – Solving Linear recurrence relations - Generating functions - Inclusion and exclusion and applications.

UNIT III		9

Algebraic systems - Semi groups and Monoids – Groups - Subgroups and Homomorphisms -Cosets and Lagrange's theorem - Ring & Fields – Vector Spaces (Definitions and examples).

UNIT IV		9

Limits of functions -Continuity -Derivatives: Derivatives -Differentiability - Rules - Properties - Differentiation of transcendental functions - Higher order derivatives - Implicit differentiation - Integration: Anti-derivatives – Riemann sum -Indefinite and Definite integration - Mean value theorem for definite integral - Fundamental theorem of calculus

UNIT V		9

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double integral - Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Volume as triple integral.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Apply logical structure of proofs and work symbolically with connections and quantifier to produce logical value , correct and clear argument. **[Apply]**
- Apply the knowledge of induction hypotheses and the principle of basic counting pigeonhole on problems related to counting. **[Apply]**

- Apply the knowledge of set with the operations for groups, rings and fields using elementary properties if necessary. **[Apply]**
- Apply Differentiation techniques to solve Maxima and Minima for given functions with several variables. **[Apply]**
- Apply integration to compute Multiple integrals, Area and Volume in addition to change of order and change of variables. **[Apply]**
- Understand the knowledge of principle of counting, integration and differentiation. **[Understand]**

TEXT BOOKS:

1. KENNETH H.ROSEN, "Discrete Mathematics and its Applications", Special Indian Edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 5th Edition, (2008).
2. TREMBLY J.P and MANOHAR R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 35th Re-print, (2008).
3. VEERAJAN.T,' Engineering Mathematics ' for semester III, Tata McGraw-Hill, New Delhi (2000).

REFERENCE BOOKS:

1. RALPH. P. GRIMALDI, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, New Delhi, 4th Edition, (2002).
2. TAMILARASI.A, and NATARAJAN.A.M, "Discrete Mathematics and its Applications", Khanna Publishers, New Delhi, 3rd Edition, (2008).
3. SEYMOUR LIPSCHUTZ and MARK LIPSON, "Discrete Mathematics", Schaum's Outlines, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).
4. VEERARAJAN, T. "Discrete Mathematics with Graph Theory and Combinatorics", Tata McGraw-Hill, New Delhi, 7th Edition, (2008).
5. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

19UCB303	COMPUTATIONAL STATISTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To expose the variables, expressions, control stations of R
- To use R Programming for Analysis of data and visualize outcome inform of graphs, charts
- To develop and understand the modern computational statistical approaches and their applications to different datasets.
- To apply principles of data science to analyze various business problems.
- To analysis data using various statistical tools like correlation and regression

UNIT I	INTRODUCTION TO R	9

Introduction, History and overview of R, elements and data structures, Sessions and Functions, Variables, Data Types, Vectors, Scalars, Conclusion, Data Frames, Lists, Matrices, Arrays, Classes, Data input/output, Data storage formats, Subsetting objects, Vectorization

UNIT II	PROGRAMMING IN R	9

R Programming, Arithmetic and Boolean Operators and values, Structures, Control Statements, Loops, Pointers in R, Recursion, Scoping Rules, Loop functions, Array and Matrices

UNIT III	DATA MANIPULATION	9

Math and Simulation in R, Functions, Math Function, Probability Calculation - Cumulative Sums and Products- Minima and Maxima- Data sorting, Linear Algebra Operation on Vectors and Matrices, Set Operation

UNIT IV	DATA VISUALISATION AND PROBABILITY DISTRIBUTION	9

Graphics, Creating Graphs, Customizing Graphs, lattice library- Visualization, Box plot, Histogram, Pareto charts, Pie graph, Line chart, Scatterplot,visualization tool-word cloud, Developing graphs, Probability Distributions: Normal, Binomial, Poisson and Other Distributions

UNIT V	STATISTICAL DATA ANALYSIS	9

Basic Statistics, Outlier, regression Analysis: Linear, Multiple, Logistic, Poisson, Survival Analysis, Nonlinear Models: Splines, Decision Tree.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to State the capabilities of R and its data, variable. [**Understand]**
- Ability to Apply R programming for manipulation of datasets. **[Apply]**
- Ability to Analyze various operators, control statements and scoping rules in R. [**Analyze]**

- Ability to design various graphs and distribution plots using R. **[Design]**
- Ability to Investigate various dataset using Statistical Tools available in R. **[Investigation]**
- Ability to conduct experiments of Computational using Modern Tool. [**Modern tool]**

TEXT BOOKS:

1. Norman Matloff, The Art of R Programming, Cengage Learning, ISBN: 9781593273842, No Starch Press, US-Publisher,2017
2. Larry Pace, Joshua Wiley, Beginning R -An Introduction to Statistical Programming, 2nd Edition, Apress, ISBN: 9781484203743, 2015

REFERENCE BOOKS:

1. Mark Gardener, Beginning R -The Statistical Programming Language, John Wiley & Sons, Inc., ISBN: 9781118164303, 2012.
2. Chris Brunsdon, Lex Comber, An Introduction to R for Spatial Analysis and Mapping, 2nd Revised Edition, Sage Publications Ltd (UK), ISBN: 9781446272954, 2019
3. Jared P. Lander, R for Everyone Advanced Analytics and Graphics, 2nd Edition, Addison-Wesley Professional PTG, ISBN: 9780134546926, 2017
4. Hamid Reza Pourghasemi, Spatial Modeling in GIS and R for Earth and Environmental Sciences, Elsevier (S&T), ISBN: 9780128152263, 2019
5. Michael J. Crawley, The R Book, 2nd Edition, Wiley-Blackwell, ISBN: 9780470973929, 2012

WEB REFERENCES:

1 https://www.edx.org/course/statistical-modeling-and-regression-analysis
2 https://people.duke.edu/~ccc14/sta-663/

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc19_mg13/preview
2 https://nptel.ac.in/courses/110106064/

19UCB304	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- Understand the features of Object-oriented programming
- Recognize the need of the concept's inheritance and polymorphism
- Develop C++ applications using OOP concepts, files, templates and exceptions

UNIT I	INTRODUCTION TO OBJECT ORIENTED PROGRAMMING	9 Hrs

Object oriented paradigm-Differences between Object Oriented Programming and Procedure oriented programming, Basic concepts of Object-Oriented Programming, Encapsulation, Inheritance and Polymorphism, Benefits of OOP, Structure of a C++ program, namespace, Data types, C++ tokens, Identifiers, Variables, Constants, Operators, Control structures & Loops.

UNIT II	FUNCTIONS, CLASSES AND OBJECTS	9 Hrs

Introduction of Classes, Class Definition, Defining a Members, Objects, Access Control, Class Scope, Scope Resolution Operator, Inline functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions.

UNIT III	CONSTRUCTORS, DESTRUCTORS, INHERITANCE	9 Hrs

Constructors, Destructors, Inheritance: Introduction to Constructors, Default Constructors, Parameterized Constructors, Copy Constructors, Multiple Constructors in a Class, Destructors. Inheritance: Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance, Hybrid Inheritance.

UNIT IV	POINTERS, VIRTUAL FUNCTIONS AND POLYMORPHISM	9 Hrs

Introduction to Memory management, new operator and delete operator, Pointers to objects, Pointers to Derived Classes, Polymorphism, Compile time polymorphism, Run time polymorphism, Virtual Functions, Overloading- Function Overloading, Operator overloading.

UNIT V	TEMPLATES AND EXCEPTION HANDLING	9 Hrs

Templates: Introduction to Templates, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters. Exception handling: Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to define, understand and explain concepts of Object-Oriented Programm **[Remember/Understand]**
- Apply knowledge of C++ constructs for developing programs/applications**. [Apply]**
- Analyze the given real time problem/s and develop complete solution/s after carefully selecting one or more of OOP technique/s. **[Analyze]**
- Design and implement object-oriented applications. **[Design]**

- Ability to Investigates various Solution for given problem. **[Investigation]**
- Ability to conduct experiments and implement simple C++ applications using Modern tool**. [Modern Tool]**

TEXT BOOKS:

1. E. Balagurusamy “Object Oriented Programming with C++”, McGraw Hill Education, 7th edition,2017.
2. Herbert Schildt, TMH “C++: the Complete Reference”, McGraw-Hill Education, 4th Edition,2002.

REFERENCE BOOKS:

1. S.B.Lippman and J.Lajoie “C++ Primer, 3rd Edition”, Pearson Education, 2012.
2. B.Stroutstrup “The C++ Programming Language”, 4th Edition, Pearson Education.2013.

WEB REFERENCES:

1 https://www.studytonight.com/cpp/cpp-and-oops-concepts.php
2 https://www.tutorialspoint.com/What-are-basic-Object-oriented-programming-concepts

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc16_cs17/preview
2 https://www.geeksforgeeks.org/basic-concepts-of-object-oriented-programming-using-c/
3 http://www.iitk.ac.in/esc101/05Aug/tutorial/java/concepts/index.html

19UCB305	OPERATING SYSTEM CONCEPTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To make the students learn different types of operating systems along with the components and services provided
- To understand the concept of process management and implementation of process scheduling in a multiprogramming environment using threads and scheduling algorithms
- To provide knowledge on the structure and operations of memory management and storage management

UNIT I	INTRODUCTION	6 Hrs

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.

UNIT II	PROCESS MANAGEMENT SYSTEM	11 Hrs

processes and threads: processes and Program, implementing processes: Process States and State transitions, Process Context & Process control Block, Context Save, Scheduling & Dispatching, Threads, Process Scheduling: Basic concepts, Scheduling Criteria, Scheduling Algorithms. Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling

UNIT III	PROCESS SYNCHRONIZATION AND DEADLOCKS	9 Hrs

Synchronization: Background, Critical Section Problem, Mutex locks, Semaphores, Classic Problems of Synchronization. Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock Detection and Recovery from deadlock.

UNIT IV	MEMORY MANAGEMENT SYSTEM	10 Hrs

Memory management strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table Virtual Memory Management: Background, Demand paging, copy on write, Page replacement algorithms, Allocation of frames, Thrashing.

UNIT V	FILE AND DISK MANAGEMENT SYSTEM	9 Hrs

Implementing File-system: File-System Structure, File-System Implementation, Directory Implementation, Allocation methods, Free-space management. Mass-storage structure: Disk Structure, Disk Attachment, Disk Scheduling. System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix.

TOTAL: 45Periods

COURSE OUTCOMES:

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

- Ability to Identify the basic concepts and design issues of operating systems**. [Understand]**
- Ability to Apply Various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms and Deadlock detection and avoidance in real world problems**. [Apply]**
- Ability to Analyze various process management concepts (including scheduling, synchronization and deadlocks), Memory Management strategies and Design considerations of file system. **[Analyze]**
- Design the hardware component to implement the virtual memory environment with the base knowledge of memory management methodologies**. [Create]**
- Ability to investigate the device management and engage in writing device drivers for Linux/Windows system as a case study. **[Investigation]**
- Ability to conduct experiments of OS using modern tools. MSCONFIG. **[modern tool]**

TEXT BOOKS:

1 Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley, 2018
2 William Stallings, “Operating Systems –Internals and Design Principles”, 8th Edition, Pearson Publications, 2014.
3 Maurice J. Bach, “Design of the Unix Operating Systems”, Prentice/Hall International., Inc,2016.

REFERENCE BOOKS:

1 Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2 Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
3 Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004.
4 Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004.

WEB REFERENCES:

1 http://geeksforgeeks.org/Operating Systems
2 https://www.tutorialspoint.com/operating_system

ONLINE RESOURCES:

1 https://www.coursera.org/courses?query=operating%20system
2 https://www.coursera.org/lecture/os-power-user/introduction-r0c5h
3 https://nptel.ac.in/courses/106106144/2

19UCB306	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand the basic hardware and software issues of computer organization
- To understand the representation of data at machine level
- To understand how computations are performed at machine level
- To understand the memory hierarchies, cache memories and virtual memories
- To learn the different ways of communication with I/O devices

UNIT I	INTRODUCTION TO COMPUTER ARCHITECTURE	9 Hrs

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

UNIT II	COMPUTER ARITHMETIC AND PARALLELISM	9 Hrs

MIPS Addressing for 32-Bit Immediate and Addresses - Parallelism and Instructions: Synchronization - Translating and Starting a Program - Addition and Subtraction - Multiplication - Division - Floating Point - Parallelism and Computer Arithmetic: Subword Parallelissm - Streaming SIMD Extensions and Advanced Vector-Extensions in x86.

UNIT III	PROCESSOR AND CONTROL UNIT	9 Hrs

Logic Design Conventions - Building a Datapath - A Simple Implementation Scheme - overview of Pipelining -Pipelined Datapath - Data Hazards: Forwarding versus Stalling - Control Hazards - Exceptions - Parallelism via Instructions - The ARM Cortex–A8 and Intel Core i7 Pipelines - Instruction–Level Parallelism and Matrix -Multiply Hardware Design language.

UNIT IV	MEMORY TECHNOLOGIES	9 Hrs

Memory Technologies - Basics of Caches - Measuring and Improving Cache Performance - dependable memory hierarchy - Virtual Machines - Virtual Memory - Using FSM to Control a Simple Cache - Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks - Advanced Material: Implementing Cache Controllers.

UNIT V	STORAGE SYSTEMS	9 Hrs

Disk Storage and Dependability - Parallelism and Memory Hierarchy: RAID levels - performance of storage systems - Introduction to multi-threading clusters - message passing multiprocessors.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to Identify the basic concepts and design issues of Computer Organization and Architecture**. [Understand]**
- Ability to apply the concepts of basic functional units to demonstrate the working of computational system**. [Apply]**
- Ability to analyze the design issues in the development of processor and other components to articulate improvement in computer design. **[Analyze]**
- Ability to design memory modules and Arithmetic Logic unit by analyzing performance issues. **[Design]**
- Ability to investigate the hardware and software systems of computer to develop efficient coding for sequential and pipeline architectures**. [Investigation]**
- Ability to solve the real-world problem using the modern tools. ATL CSIM **[Modern tool]**

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design:The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Smruti Ranjan Sarangi, “Computer Organization and Architecture”, McGraw Hill Education, 2015.

REFERENCES:

1. V. Carl Hamacher, Zvonko G. Varanesic, Safat G. Zaky, “Computer Organization”, Sixth Edition, McGraw-Hill Inc., 2012.
2. William Stallings, “Computer Organization and Architecture”, Eighth Edition, Pearson Education, 2010.

19UCB307	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The student should be made to:

- To engage the student in integrated activities of reading, research, discussion and presentation around a designated subject.

DESCRIPTION:

This course is introduced to enrich the communication skills of the student and to create awareness on recent development in Computer Science and Business Systems through Technical presentation. In this course, a student has to present at least two technical papers or recent advances in engineering/technology that will be evaluated by a committee constituted by the Head of the Department.

COURSE OUTCOMES:

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

- Identify and formulate a technical problem to reach substantiated conclusion using basic technical knowledge. **[Understand]**
- Applying the basic engineering knowledge. **[Apply]**
- Apply management principles to function as a team. **[Apply]**
- Analyze the appropriate techniques and tools to solve the problem. **[Analyze]**
- Investigate the various models for given scenario**. [Investigation]**
- Ability to use the appropriate tool for their presentation and communicate the technical information effectively. **[Modern tool]**

19UCB308	COMPUTATIONAL STATISTICS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- To expose the variables, expressions, control stations of R
- To use R Programming for Analysis of data and visualize outcome inform of graphs, charts
- To develop and understand the modern computational statistical approaches and their applications to different datasets.
- To apply principles of data science to analyze various business problems.
- To use R software to carry out statistical computations

LIST OF EXPERIMENTS

1. Install R and R Studio
2. Creation and manipulation of Vectors, Matrices, Arrays, Lists, Factors and Data Frames
3. Install of Packages and scripts for Importing and Exporting Data
4. Implement Control structures and Functions
5. Visualize Statistical Graphs using Scatter Plots, Box Plots, Whisker Plot, Histograms
6. Perform Data exploration and visualization techniques over a dataset.
7. Perform Data Query using SQL and R.
8. Create a data set and do statistical analysis on the data

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Use R software to carry out statistical computations and state the capabilities of R and its data, variable. **[Understand]**
- Apply R programming for manipulation of datasets**. [Apply]**
- Analyze dataset using Statistical Tools available in R**. [Analyze]**
- Design various graphs and distribution plots using R. **[Design]**
- Investigate various datasets using R. **[Investigate]**
- Ability to conduct experiment using Modern tool. **[modern tool]**

HARDWARE AND SOFTWARE REQUIRMENTS

- Desktop systems with R, R Studio
- Operating System: Linux (any flavor) / Windows

19UCB309	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- To study about different OOPS concepts.
- To familiarize with constructors, inheritance, polymorphism, templates and exception handling.
- To develop applications using files in C++.

LIST OF EXPERIMENTS

1. Programs on concept of classes and objects
2. Programs using friend functions
3. Programs using static polymorphism
4. Programs using constructors
5. Programs using inheritance
6. Programs on dynamic polymorphism
7. Programs on exception handling
8. A hospital wants to create a database regarding its indoor patients. The information to store includes
    - Name of the patient
    - Date of admission
    - Disease
    - Date of discharge

    Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).
9. Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department, of type string. Supply a method to string that prints the manager s name, department and salary. Make a class Executive inherit from Manager. Supply a method to String that prints

the string Executive followed by the information stored in the Manager superclass object. Supply a test program that tests these classes and methods.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Ability to understand the concepts of Object-Oriented Programming. **[Remember/Understand]**
- Apply object-oriented programming concepts to solve real time problems **[Apply]**
- Analyze the given real time problem/s and develop complete solution/s. **[Analyze]**
- Develop software applications using templates, exception handling and files in In C++. **[Design]**
- Ability to Investigates various Solution for given problem. **[Investigation]**
- Ability to conduct experiments and implement simple C++ applications using Modern tool**. [Modern Tool]**

HARDWARE AND SOFTWARE REQUIRMENTS

- Operating System: Linux (any flavor) / Windows
- Any C++ compiler compatible with Linux / Windows

19UCB310	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- Study the working concepts of CPU scheduling
- Understand various file allocation strategy
- Learn various file organization techniques
- Understand the resource allocation concepts relevant to deadlock
- Implement page replacement algorithms
- Solve problem relevant to memory management

LIST OF EXPERIMENTS

1. Analysis and Synthesis of Basic Linux Commands
2. Programs using Shell Programming
3. Implementation of Unix System Calls
4. Simulation and Analysis of Non-pre-emptive and Pre-emptive CPU Scheduling Algorithms
5. Simulation of Producer – Consumer Problem using Semaphores and Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6. Simulation of Banker's Algorithm for Deadlock Avoidance
7. Analysis and Simulation of Memory Allocation and Management Techniques
8. Implementation of Page Replacement Techniques
9. Simulation of Disk Scheduling Algorithms
10. Implementation of File organization Techniques
11. Design an efficient Traffic Control System to avoid traffic congestion in Metro Cities. Use Process Synchronization, Scheduling, Deadlock and Memory Management concepts to implement the system.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the concepts of Operating systems and its Techniques**. [Understand]**
- Apply the knowledge of CPU scheduling to solve problems relevant to multi process. **[Apply]**

- Analyze various file organization techniques in the operating system **[Analyze]**
- Design the solutions to the resource allocation problem which leads to deadlock, page replacement algorithms and memory management **[Design]**
- Investigate various file allocation strategies to simulate in the operating systems **[Investigate]**
- Simulate the given scenario using Modern tool. **[Modern tool]**

HARDWARE AND SOFTWARE REQUIRMENTS

- Operating System: Linux (any flavor) / Windows
- Any C++ compiler compatible with Linux / Windows

Semester IV

Course Code		Course Title	L	T	P	C
THEORY						
19UEN401	HS	Business Communication & Value Science – IV	2	0	0	2
19UCB402	PC	Computer Networks	3	0	0	3
19UCB403	PC	Introduction to Design and Analysis of Algorithms	3	1	0	4
19UCB404	PC	Database Management Systems	3	0	0	3
19UCB405	PC	Formal Languages and Automata Theory	3	1	0	4
19UCB406	PC	Python Programming	1	0	3	2.5
PRACTICAL						
19UCB407	PC	Computer Networks Laboratory	0	0	3	1.5
19UCB408	PC	Database Management Systems Laboratory	0	0	3	1.5
MANDATORY COURSES						
19UGM431	MC	Gender Equality	1	0	0	P/F
19UGM432	MC	Biology for Engineering Applications	2	0	0	P/F
		TOTAL	**18**	**2**	**9**	**21.5**
Total No. of Credits – 22.5						

19UEN401	BUSINESS COMMUNICATION & VALUE SCIENCE – IV	L	T	P	C

		2	**0**	**0**	**2**

COURSE OBJECTIVES :

The student should be made to:

- Recognize the accepted procedures of informative composition.
- Comprehend the significance of the ability to appreciate people on a profound level in close to home and expert lives.
- Understand what stress means forever and work.
- Utilize the prescribed procedures to oversee pressure.
- See how to make new businesses and public talking.

UNIT I	**WORKING ENVIRONMENT AND BUSINESS WRITING**	**6**

Significance of variety in working environment: Diversity in professional workplaces - Principles of Communicative Writing - Formal and Business letters - best practices for composing strategic plans – involving diagrams and charts in open composition – the capacity to appreciate people on a deeper level - public talking at working environment and genuine situations – pretends

UNIT II	**CORPORATE SOCIAL RESPONSIBILITY**	**6**

Significance of Corporate Social Responsibility (CSR) - ascribes expected to work and fill in a professional workplace

UNIT III	**Criticism AND EMOTIONAL INTELLIGENCE**	**6**

Picture Management - best practices to share and get criticism – Applying the capacity to appreciate people at their core, in actuality, situations

UNIT IV	**Numerous INTELLIGENCES AND CONFLICT MANAGEMENT**	**6**

Numerous insights and learning styles in relational associations - effect of struggles – rules to oversee clashes - key highlights of corporate manners – business colloquialisms and corporate terms

UNIT V	**STRESS, TIME MANAGEMENT AND PROJECT WORK**	**6**

Effect of pressure throughout everyday life and work – overseeing pressure - best practices to oversee pressure - significance of using time productively – best time usage rehearses.

TOTAL:30 Periods

COURSE OUTCOMES:

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

- Perceive the best act of Communicative composition.
- Apply the capacity to understand individuals at their core, all things considered, situations.
- Distinguish the prescribed procedures of stress the board.

- Perceive the qualities expected to work and fill in a professional workplace.
- Apply the prescribed procedures of public talking.

REFERENCE BOOKS:

1 Daniel Goleman, Emotional Intelligence: Why it can Matter More than IQ.
2 Ryback David, Putting Emotional Intelligence to Work.
3 Dale Carnegie, How to Develop Self Confidence and Improve Public Speaking - Time - TestedMethodsof Persuasion.
4 TED Talks, 'The official TED guide to public speaking: Tips and tricks for givingunforgettable speechesand presentations'.

WEB REFERENCES:

1 https://www.tata.com/about-us/tata-group-our-heritage
2 https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and- ethics/articleshow/41766592.cms

ONLINE RESOURCES:

1 https://youtu.be/reu8rzD6ZAE
2 https://youtu.be/Wx9v_J34Fyo
3 https://youtu.be/F2hc2FLOdhI
4 https://youtu.be/wHGqp8lz36c

19UCB402	COMPUTER NETWORKS	L	T	P	C

		3	**0**	**0**	**3**

COURSE OBJECTIVES:

The student should be made to:

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

UNIT I	INTRODUCTION AND PHYSICAL LAYER	**9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II	DATA-LINK LAYER & MEDIA ACCESS	**9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III	NETWORK LAYER	**9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV	TRANSPORT LAYER	**9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V	APPLICATION LAYER	**9**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP- Basic concepts of Cryptography and digital signature – Firewalls.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic layers and its functions in computer networks. **[Understand]**
- Apply the concepts of all layers to solve problems in Network. **[Apply]**
- Analyze algorithms in different layers to solve problem that occur in real world. **[Analyze]**
- Design protocols for various functions in network. **[Design]**
- Evaluate the performance of a network. **[Evaluate]**
- Select and apply appropriate concept to design algorithm using Modern tool NS2. **[Modern tool]**

TEXT BOOK:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2017.

REFERENCES BOOKS:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2021.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open-Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

19UCB403	INTRODUCTION TO DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The student should be made to:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

UNIT I	INTRODUCTION	9+3

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization

UNIT II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9+3

Brute Force – Computing an – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9+3

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim‘s algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

UNIT IV	ITERATIVE IMPROVEMENT	9+3

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

UNIT V	BACKTRACKING, BRANCH AND BOUND TECHNIQUES	9+3

Backtracking – n-Queens problem – Hamiltonian Circuit Problem– Subset Sum Problem- Graph Coloring; Branch and Bound– Assignment problem–Knapsack Problem – Traveling Salesman Problem.

TOTAL:45(L)+15(T)= 60 Periods

COURSE OUTCOMES:

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

- Understand the fundamental needs of algorithms in problem solving. **[Understand]**
- Critically solve different algorithm design techniques for a given problem. **[Apply]**
- Analyze the time complexity of recursive and non-recursive algorithms and other techniques. **[Analyze]**
- Design efficient algorithm using Branch and Bound Technique and optimize using Greedy Technique**. [Design]**
- Adapt the best suitable algorithmic technique to solve real world problems on evaluating the performance of various algorithmic techniques. **[Evaluate]**
- Select and apply appropriate algorithm to solve problem using Modern tool usage. **[Modern tool]**

TEXT BOOKS:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, —Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.
2. Harsh Bhasin, —Algorithms Design and Analysis‖, Oxford university press, 2016.
3. S. Sridhar, —Design and Analysis of Algorithms‖, Oxford university press, 2014.

WEB REFERENCE:

1. http://nptel.ac.in/

19UCB404	DATA BASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to

- Understand the database architecture, data models, conceptualize and design database.
- Process the SQL queries and optimize it.
- Impart knowledge in transaction processing and database security

UNIT I	DATABASE ARCHITECTURE AND DATA MODEL	9

DATABASE ARCHITECTURE AND DATA MODEL 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 AND DATABASE DESIGN	9

RELATIONAL QUERY AND DATABASE DESIGN 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	DATABASE QUERY LANGUAGE AND PROGRAMMING LANGUAGE EXTENSION TO SQL (PL/SQL))	9

DATABASE QUERY LANGUAGE: Basic SQL- Data types –Types of Constraints, Views, Simple and Complex Queries.PROGRAMMING LANGUAGE EXTENSION TO SQL– Fundamentals, Control Structures, PL/SQL –Cursor, Trigger, Procedure, and Function.

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	NOSQL DATABASE	9

The CAP Theorem - Document-Based NOSQL Systems and MongoDB - NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems. Introduction to NOSQL Graph Databases and Neo4j.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to Understand the concept of dbms and the models for designing database. **[Understand]**
- Apply the concept of SQL and Relational Algebra to solve real time Problem**. [Apply]**
- Analyze the various db design techgnique for a given scenario**. [Analyze]**
- Design E-R diagram or database for given scenarioand find solutions to a broad range of query and remove the anomalies using normalization. **[Design]**
- Evaluate a real database application using a database management system. **[Evaluate]**
- Ability to conduct experiments of db using Modern tool MySQL,Oracle**.[Modern tool]**

REFERENCE BOOKS:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.
2. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
3. Fundamentals of Database Systems. R. Elmasri and S. Navathe.
4. Foundations of Databases. Serge Abiteboul, Richard Hull, VictorVianu.

19UCB405	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The student should be made to

- To describe the mathematical foundations of computation and conduct mathematical proofs for computation and algorithms.
- To understand the Formal Languages, computational models -Finite Automata, Regular Expressions, Grammars, Push Down Automata, Turing Machine.
- To gain knowledge in Computational theory.

UNIT I	REGULAR LANGUAGES AND FINITE AUTOMATA	9

Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finiteautomata: Regular expressions and languages, deterministic finite automata (DFA) and equivalencewith regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

UNIT II	GRAMMARS	9

Grammar Introduction– Types of Grammar – Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols – Unit productions – Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF.

UNIT III	PUSHDOWN AUTOMATA	9

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL – pumping lemma for CFL – problems based on pumping Lemma.

UNIT IV	TURING MACHINES	9

Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines – The Halting problem – Partial Solvability – Problems about Turing machine.

UNIT V	UNDECIDABILITY	9

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages. Applications of finite automata - string matching algorithms, network protocols and lexical analyzers

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of finite automata, Grammars, Pushdown Automata and Turing machine**. [Understand]**
- Apply mathematical and formal techniques to solve problem. **[Apply]**
- Analyze a given Finite Automata machine and find out its Language. **[Analyze]**
- Design Finite Automata, Pushdown Automata machine for given language/Grammar **[Design]**
- Evaluate the abstract model of computing Finite Automata, Push down Automata, Turing Machine model and their power to recognize Languages. **[Evaluate]**
- Solve Complex problem using Modern tool. **[Modern tool]**

TEXT BOOKS:

1. Hopcroft, J.E. Motwani, R. and Ullman, J.D "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2014.
2. Martin, J., "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009
2. Lewis, H. and Papadimitriou, C.H "Elements of the Theory of Computation", 2nd Edition, Pearson Education/PHI, 2003
3. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, Cengage Learning,2013
4. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishers, New Delhi,2011
5. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NPCompleteness", 1979

WEB REFERENCES:

1 1 www.jflap.org/
2 automatonsimulator.com/
3 http://www.jflap.org/tutorial/grammar/bruteforceCFG/index.html
4 https://turingmachinesimulator.com/

19UCB406	PYTHON PROGRAMMING	L	T	P	C
		1	0	3	2.5

COURSE OBJECTIVES:

The student should be made to

- To familiarize the logical constructs of programming
- To illustrate programming in Python.

UNIT I	INTRODUCTION TO PYTHON AND CONTROL CONSTRUCTS	5 Hrs

Introduction to python – features of python – modes of working with python. Values and data types: numbers, Boolean, strings; variables, expressions, statements, tuple assignment, precedence of operators, comments – print function-Control Constructs-Flow of execution – Iteration

UNIT II	FUNCTIONS AND PACKAGES	5 Hrs

Functions - function definition and use, flow of execution, parameters and arguments; parameters, local and global scope, function Composition-Anonymous or Lambda Function, recursion -packages.

UNIT III	LISTS, TUPLES, DICTIONARIES AND STRINGS	5 Hrs

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value-Dictionaries- operations and methods;- advanced list processing - list comprehension - Strings: string slices; immutability, string functions and methods, string module.

LIST OF EXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Write a Python program to compute the +2 Cutoff mark, given the Mathematics, physics and Chemistry marks. A college has decided to admit the students with a cut off marks of180. Decide whether the student is eligible to get an admission in that college or not.
12. A university wishes to create and maintain the details of the students such as Rollno, Regno, Name, Dept, Batch, Contact_no, Nativity(Indian/NRI) as key value pairs. Do the following operations:
    (i) Display the complete student details on giving Rollno as input.
    (ii) Display the complete student details whose nativity belongs to NRI.
    (iii) Display the complete student details whose department is CSE.

13. Write a Python program to process the mark processing system (Record has the following fields: Name, Reg_no, Mark1, Mark2, Mark3, Mark4, Total, average). Print the student details and find the total and average mark.

TOTAL : 15+30=45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of Python Programming. **[Understand]**
- Solve mathematical expressions involving sequential logic, decision structure and looping constructs in python. **[Apply]**
- Analyze the given problem and write Programs using Python Programming. **[Analyze]**
- Develop programs using functions, packages and use recursion to reduce redundancy**. [Design]**
- Evaluate the given Complex Problem and write Program in Python. **[Evaluate]**
- Select and apply Program design to solve problem using Modern tool usage Pygame. **[Modern tool]**

TEXT BOOKS :

1. Ashok NamdevKamthane&Amit Ashok Kamthane, “Problem solving and python programming”, McGraw Hill Education, 2018 (copyright)
2. Anurag Gupta & G P Biswas, “Python Programming – Problem solving, packages and libraries”, McGraw Hill Education, 2020 (copyright).

REFERENCE BOOKS :

1. John V Guttag, “ Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, “Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, “ Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

19UCB407	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat c)File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC).

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Compare the performance of different transport layer protocols. **[Understand]**
- Use simulation tools to analyze the performance of various network protocols. **[Apply]**
- Analyze various routing algorithms. **[Analyze]**
- Design various protocols using TCP and UDP. **[Create]**
- Evaluate the simulation of Various Protocols**. [Evaluate**]
- Select and apply simulation tool to solve real time Problems using Modern tool usage. **[Modern Tool]**

19UCB408	DATA BASE MANAGEMENT LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to

- To understand data definitions and data manipulation commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of data bases
- To be familiar with the use of a front end tool
- To understand design and implementation of typical database applications

LIST OF EXPERIMENTS

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application
9. Database Connectivity with Front End Tools
10. Case Study using real life database applications

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of Database Systems and Applications. **[Understand]**
- Use the basics of SQL and construct queries using SQL in database creation and interaction. **[Apply]**
- Analyze and Select storage and recovery techniques of database system. **[Analyze]**
- Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system**. [Create]**
- Evaluate the given Complex Problem and solve using Data base Concepts. **[Evaluate]**
- Develop applications with database support using Modern Tool. **[Modern tool]**

19UGM431	GENDER EQUALITY	L	T	P	C
		1	0	0	P/F

COURSE OBJECTIVES :

- To introduce basic concepts relating to gender and to provide logical understanding of gender roles.

UNIT I	GENDER SENSITIZATION	5 Hrs

Definition of gender, Perspectives-Gender sensitive approach- Gender and sex- Social construction of gender and gender roles- Socialization- institutions of socialization- changing content and context of gender-need for re-socialization. Gender Stereotyping and Gender Discrimination.

UNIT II	GENDER EQUALITY AND CONSTITUTION	5 Hrs

Indian constitution related to equality - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation - cultural and educational rights - the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers- Internal Complaints Committee - Legal AID cells, Help line, State and National level Commission.

UNIT III	GENDER ROLES & EQUALITY	5 Hrs

Gender & Morality – Structural and functionalist views of Gender- Gender in the Classroom- Beyond access for girls and boys- Gender equality in schools- Gender equality and adult basic education- Developing capacity to achieve gender equality in education- Individuality and removal of gender stereotypes- Respect for each other's-Promote equal opportunity.

COURSE OUTCOMES:

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

- Describe the social construction of gender and sexuality and their influence in social context. **(Understand)**
- Analyze how the concepts of gender equality are created, maintained, and/or challenged. (**Analyze)**
- Apply concepts of gender roles and equality in classroom, school, disciplinary or interdisciplinary creative, scholarly, and/or activist project. **(Apply)**

REFERENCES:

1. Sheila Aikman and Elaine Unterhalter, "Practising Gender Equality in Education", Oxfam GB, 2007.
2. Pasadena and Hackensack, "Gender roles and Equality", Salem Press,2011.

19UGM432	BASICS OF BIOLOGY FOR ENGINEERING (For CSE, CSBS &Mech)	L	T	P	C
		2	0	0	P/F

COURSE OBJECTIVES :

- To explain the essentials of basic biological principles.
- To familiarize the different clinical and industrial applications of biology for solving societal problems with engineering tools.

UNIT I	INTRODUCTION AND CLASSIFICATION	5 Hrs

Characteristics of living organisms – Basic classification – Cell theory – Structure of prokaryotic and eukaryotic cell – Introduction to Bio-molecules: Definition – General classification and important functions of Carbohydrates – Lipids – Proteins – Nucleic acids, Vitamins and Enzymes – Genes and Chromosome.

UNIT II	BIODIVERSITY	5 Hrs

Plant System: Basic concepts of Plant growth – Nutrition – Photosynthesis and Nitrogen fixation – Animal System: Elementary study of Digestive, Respiratory, Circulatory, Excretory systems and their functions.

UNIT III	BASICS OF CELL AND MOLECULAR BIOLOGY	6 Hrs

Discovery of cell and Cell Theory – Comparison between plant and animal cells – Cell wall – Plasma membrane – Modification of plasma membrane and intracellular junctions – Stem cells and Tissue engineering.

UNIT IV	HUMAN DISEASES	7 Hrs

Infectious and Non-infectious diseases – Causative agents – Epidemiology – Pathogenicity, Control and prevention – Treatment of AIDS – Tuberculosis – Pathology of non-infectious and genetic diseases and disorders – Cancer, Diabetes mellitus, Cardiac diseases – Neurological disorders – Parkinson's disease.

UNIT V	BIOLOGY AND ITS INDUSTRIAL AND CLINICAL APPLICATIONS	9 Hrs

Transgenic plants and animals – Bioreactors – Bio-pharming – Recombinant vaccines – Cloning – Artificial memory and neural networks – Bioremediation – Biofertilizer – Biocontrol – Biofilters – Biosensors – Biopolymers – Bioenergy – Biochips.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

- Explain the fundamentals of living things, their classification, cell structure and biochemical constituents**.(Understand)**
- Apply the concept of plant, animal and microbial systems and growth in real life situations. **(Apply)**
- Analyze biological engineering principles, procedures needed to solve societal issues.(**Analyze)**

TEXT BOOKS:

1. Satyanarayana, U. “Biotechnology”, 4th Edition, Books and Allied Pvt. Ltd. Kolkata, 2007.
2. Carol D. Tamparo and Marcia A. “Diseases of the Human Body”, Lewis, F.A. Davis Company, 2011.
3. R. Khandpur, “Biomedical instrumentation - Technology and applications”, McGraw Hill Professional, 2004.

REFERENCE BOOKS

1. Lehninger A.L, Nelson D.L, Cox .M.M, Principles of Biochemistry”, CBS Publications 2017.
2. Arthur T. Johnson, “Biology for Engineers”, CRC Press, Taylor and Francis, 2nd Edition, 2019.
3. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, “Cell Biology and Genetics (Biology: The unity and diversity of life Volume I)”, Cengage Learning, 12th Edition, 2008.

B.D. Singh, “Biotechnology: Expanding horizon”, Kalyani Publishers,

Semester V

Course Code		Course Title	L	T	P	C
THEORY						
19UCB501	PC	Compiler Design	3	0	0	3
19UCB502	PC	Software Engineering	3	0	0	3
19UCB503	ES	Fundamentals of Management	2	0	0	2
19UCB504	PC	Mobile Applications Development & Services	2	0	3	3.5
	PE	Professional Elective – I	3	0	0	3
	OE	Open Elective – I	3	0	0	3
19UGS531	BS	Reasoning and Aptitude	1	0	0	1
PRACTICAL						
19UCB507	PW	Creative Thinking and Innovations	0	0	2	1
19UCB508	PC	Compiler design Laboratory	0	0	3	1.5
19UGS532	HS	Soft Skills Laboratory	0	0	3	1.5
		TOTAL	**17**	**0**	**11**	**22.5**
Total No. of Credits –22.5						

19UCB501	COMPILER DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To familiarize the components of computer system and instructions
- To discuss in detail the operation of the arithmetic unit.
- To design pipelining and parallel processing architecture
- To give knowledge on memory and I/O systems

UNIT I	INTRODUCTION	9 Hrs

Phases of compilation and overview - Lexical Analysis (scanner): Regular languages – Finite Automata - Regular expressions - Relating regular expressions and finite automata - Scanner generator (lex, flex).

UNIT II	SYNTAX ANALYSIS (Parser)	10 Hrs

Context-free languages and grammars- Push-down Automata - LL(1) grammars and top-down parsing - Operator grammars - LR(0) - SLR(1) - LR(1) - LALR(1) grammars and bottom-up parsing - Ambiguity and LR parsing - LALR(1) parser generator (yacc, bison)

UNIT III	SEMANTIC ANALYSIS and INTERMEDIATE CODE GENERATION	9 Hrs

Attribute grammars-Syntax directed definition - Evaluation and flow of attribute in a syntax tree. Intermediate Code Generation: Translation of different language features, different types of intermediate forms

UNIT IV	CODE IMPROVEMENT (OPTIMIZATION)	9 Hrs

Symbol Table: Basic structure - Symbol attributes and management. Run-time environment: Procedure activation - Parameter passing - Value return – Memory allocation - Scope. Code Improvement (optimization): Control-flow - Data-flow dependence - Local optimization - Global optimization - Loop optimization - Peep-hole optimization, etc

UNIT V	ARCHITECTURE DEPENDENT CODE IMPROVEMENT	8 Hrs

Instruction scheduling for pipeline - Loop optimization for cache memory etc. Register allocation and target code generation.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code and stack machines**. [Understand]**

- Apply parsing technique to parse strings, syntax directed translation rules for grammars and code generation algorithms. **[Apply]**
- Analyze the lexical, syntactic and code generation into meaningful phases for a compiler to undertake language translation. **[Analyze]**
- Design a simple compiler for customized programming statements**. [Design]**
- Ability to Evaluate the structure and techniques used in compiler construction**. [Evaluate]**
- Ability to conduct experiments of Computational using Modern Tool.- Lex **[Modern tool]**

TEXT BOOKS:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.

REFERENCE BOOKS:

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C‖, Prentice-Hall Software Series, 1993.

19UCB502	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To gain knowledge of basic SW engineering methods and practices, and their appropriate application.
- To describe software engineering layered technology and Process frame work.
- To identify software measurement and software risks.
- To describe the approaches to verification and validation using static and dynamic testing.
- To examine the good qualities of a software.

UNIT I	INTRODUCTION	9 Hrs

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.

UNIT II	SOFTWARE DESIGN	9 Hrs

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT III	SOFTWARE TESTING	9 Hrs

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 IV	PROJECT MANAGEMENT	9 Hrs

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan

UNIT V	AGILE SOFTWARE DEVELOPMENT	9 Hrs

Agile methods, Agile development techniques, agile project management, Scaling Agile methods. Project Management: Risk Management, Managing people, Teamwork. Project Planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of software engineering principles**. [Understand]**
- Ability to apply Software Engineering Design Techniques and practices for developing Software. **[Apply]**
- Ability to analyze the various requirements, design and Testing Techniques to select the appropriate techniques for the software system**. [Analyze]**
- Ability to Design Models for different phases of software development to solve real world problems. **[Design]**
- Ability to Evaluate Projects by Estimating cost and time required for developing the Software Product. **[Evaluate]**
- Demonstrate diagraming, requirement phases, test scenarios using suitable tools**. [Modern tool]**

TEXT BOOKS:

1. Roger S. Pressman, -Software Engineering – A Practitioner's Approachll, Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, *Software Engineering*, Pearson Education, 2016.

REFERENCE BOOKS:

1. Carlo Ghezzi, Jazayeri Mehdi and Mandrioli Dino, Fundamentals of Software Engineering, Pearson Education, 2002.
2. Michael Jackson, Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Addison-Wesley Professional, 1995.
3. Norman E Fenton and Shari Lawrence Pfleeger, Software Metrics: A Rigorous and Practical Approach, CRC Press, 2014.

Web References:

1. http://www.site.uottawa.ca/school/research/lloseng/weblinks.html
2. https://www.geeksforgeeks.org/software-engineering/
3. http://www.rspa.com/index.html

Online Resources:

1. https://nptel.ac.in/courses/106101061/
2. https://cosmolearning.org/courses/introduction-to-software-engineering/video-lectures/
3. http://www.nptel.ac.in/courses/Webcourse-contents/IITKharagpur/Soft Engg/New_index1.html

19UCB503	FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To familiarize the components of computer system and instructions
- To discuss in detail the operation of the arithmetic unit.
- To design pipelining and parallel processing architecture
- To give knowledge on memory and I/O systems

UNIT I	MANAGEMENT THEORIES	6 Hrs

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word).

UNIT II	FUNCTIONS OF MANAGEMENT & ORGANIZATION BEHAVIOR	6 Hrs

Planning, Organizing, Staffing, Directing, Controlling- Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

UNIT III	ORGANIZATIONAL DESIGN	6 Hrs

Attribute grammars-Syntax directed definition - Evaluation and flow of attribute in a syntax tree. Intermediate Code Generation: Translation of different language features, different types of intermediate forms

UNIT IV	MANAGERIAL ETHICS	6 Hrs

Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, Corporate Social Responsibility

UNIT V	LEADERSHIP	6 Hrs

Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid

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TOTAL:30 Periods

COURSE OUTCOMES:

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

- Understand the knowledge of fundamentals of Managements. **[Understand]**
- Apply a basic understanding of management and its history. **[Apply]**
- Analyze a basic understanding of the functions of management, to include planning, organizing, leading, and controlling. **[Analyze]**
- Design or Evaluate approaches to addressing issues of diversity. **[Design]**
- Evaluate the various management functional activities of an original business. **[Evaluate]**
- Determine the most effective action to take in specific situations using Modern Tool. **[Modern tool]**

TEXT BOOKS:

1. Richard L. Daft, Understanding the Theory and Design of Organizations, 11th edition, 2016.

REFERENCE BOOK:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior, 16th edition 2016

19UCB504	MOBILE APPLICATIONS DEVELOPMENT AND SERVICES	L	T	P	C
		2	0	3	3.5

COURSE OBJECTIVES:

- To understand fundamentals and identify need and scope for mobile applications.
- To learn the technologies and frameworks for designing and deploying mobile applications in Android and iPhone marketplace for distribution.
- To study and take into account technical constraints, communication interfaces and user interfaces.
- To explore emerging technologies and tools used to design and implement feature-rich mobile applications.

UNIT I	INTRODUCTION	6 **Hrs**

Need for mobile applications – Cost of Development – Importance of Mobile strategies in the Business world- Market and business drivers for mobile application- Requirements gathering and validation for mobile applications- –Mobile Myths, Third party framework – Publishing and delivery of Mobile Applications- Marketing. Factors in Developing Mobile Applications.

UNIT II	TECHNOLOGY AND ANDROID	6 **Hrs**

Establishing the development environment –Android architecture-Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment- Interaction with server side applications- Using Google Maps, GPS and Wifi–Integration with social media applications.

UNIT III	IOS	6 **Hrs**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi –iPhone marketplace.

UNIT IV	CROSS-PLATFORM FRAMEWORKS	6 **Hrs**

Introduction to titanium Appcelerator PhoneGap, Monotouch and Mono for android frameworks.

UNIT V	APPLICATIONS AND SERVICES	6 **Hrs**

Creating Consumable Web Services for Mobile Devices- Understanding web services-Using web service languages (formats)-Creating an example service-Debugging web services. Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture.

TOTAL: 30 Periods

Lab Experiments

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.

6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the basics of Android development framework and its functionalities. **[Understand]**
- Apply the knowledge of android user interfaces, menus, fragments and service for a given problem**. [Apply]**
- Analyze packages, project libraries and services to obtain a framework for solving problems in development of mobile applications**. [Analyze]**
- Design mobile Apps to provide solutions for real world problems in a team. **[Design]**
- Evaluate the services, emerging technologies and tools used to design and implement feature-rich mobile applications**. [Evaluate]**
- Demonstrate the real-world application in a team with standard documentation using Emulators- eclipse or android studio**. [Modern tool]**

TEXT BOOKS:

1. Bill Phillips, Chris Stewart,Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide”,3rd Edition,2017.
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
3. Wei-Meng Lee, “Beginning AndroidTM 4 Application Development”, John Wiley & Sons, 2012

REFERENCE BOOKS:

1. Charlie Collins, Michael Galpin, Matthias Kappler, “Android in Practice”, DreamTech, 2012.
2. James Dovey, Ash Furrow, “Beginning Objective C”, Apress, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche, Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106147/
2. https://www.coursera.org/learn/android-programming

ONLINE RESOURCES:

1. http://developer.android.com/develop/index.html.
2. https://www.google.com/search?client=firefox-b-d&q=ios+development+course

HARDWARE AND SOFTWARE REQUIRMENTS

- Standalone desktops with Windows, Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers.

19UEC507	CREATIVE THINKING AND INNOVATION	L	T	P	C
		0	0	2	1

PREAMBLE:

Creativity is vital in nearly every industry and occupation. Creativity and innovation are key to generation of new ideas and methods of improving goods and services for customer satisfaction. This course enhances the creative thinking and innovation skills of the students. Being creative helps one to be a better problem solver in all areas of life and work.

COURSE OBJECTIVES:

- To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.
- To transform innovative ideas into successful businesses
- To use a range of creative thinking tools to develop Out of the Box Ideas

Course Content

Introduction to Creativity and Innovation- Creative Techniques - Problem Identification through Brain Storming - Solution Identification through Creative Techniques - Presentation on the Innovative Idea - Market Analysis - Revenue and Business Model - Preparation of promotional aids - Customer Feedback Analysis.

List of Activities:

Duration	What does the Faculty do?	What do the students do?
Week 1	Explains creativity and innovation	Team Formation (Team Size: 3)
Week 2	Explains the Creative Techniques (Through Video / Presentation)	Discovering Consumer Need through Need Analysis (Customer Segment)
Week 3	Facilitates the brain storming	Problem Identification through brain storming
Week 4	Facilitates problem solving	Identify the solution for the chosen problem through creative techniques
Week 5	Evaluates the presentation	Presentation on the Innovative Idea and Value Proposition

Week 6	Evaluates the presentation	Presentation on the Innovative Idea and Value Proposition
Week 7	Explains about the Market Research / Competitor Analysis, Revenue Model and Business Model	Market Analysis after the explanation
Week 8	Facilitates the students work	Preparation of Innovation Development Plan, Business Development Plan and Financial Plan
Week 9	Facilitates the students work	Preparing product promotional material
Week 10	Facilitates the students work	Improvement through Feedback

Total Hours: 30 Periods

Assessment Pattern

1. Internal Assessment: Presentation on the Innovative Idea
2. End Semester Assessment:
    - Submission of Business Plan
    - Presentation on My Startup Idea (Evaluator : From Industry)

Course Outcomes:

After successful completion of the course students will be able to:

1. Demonstrate the ability to assess societal, health and safety issues and the consequent responsibilities relevant to the professional engineering practice (Valuing – Affective Domain)
2. Examine impact on environment and society in the proposed innovative idea and provide solutions for sustainable development (Organization – Affective Domain)
3. Adapt themselves to work in a group as a member or a leader for efficiently executing the given task (Organization – Affective Domain)

19UCB508	COMPILER DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- Study the working concepts of CPU scheduling
- Understand various file allocation strategy
- Learn various file organization techniques
- Understand the resource allocation concepts relevant to deadlock
- Implement page replacement algorithms
- Solve problem relevant to memory management

LIST OF EXPERIMENTS

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). The lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments.
2. Implement Lexical Analyzer using Lex/ flex Tool
3. Implement an Arithmetic Calculator using LEX and YACC
4. Implement Lex programs for the following:
   a. Count the number of characters, words and lines
   b. Check valid Mobile Number
   c. Accept valid email
5. Implementation of Shift Reduce Parsing Algorithm.
6. Program for computation of FIRST AND FOLLOW of non-terminals after the removal of left recursion
7. Implementation of Predictive Parsing Table Construction
8. Generate three address code for a simple program using LEX and YACC.
9. Implementation of Code Optimization techniques
10. Code generation for any specific architecture supported by open source compilers

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Comprehend the structure and techniques used in compiler construction. **[Understand]**
- Apply the different Phases of compiler using tools. **[Apply]**
- Analyze the control flow and data flow of a typical program**. [Analyze]**
- Generate an assembly language program equivalent to a source language program**. [Design]**
- Evaluate different Optimization Techniques and use the appropriate optimizer for a given program. **[Evaluate]**
- Ability to conduct experiments of Computational using Modern Tool.- Lex and YACC. **[Modern tool]**

HARDWARE AND SOFTWARE REQUIRMENTS

- Operating System: Linux (any flavor) / Windows
- Any C/C++ compiler compatible and Compiler writing tools LEX and YACC

Semester VI

Course Code		Course Title	L	T	P	C
THEORY						
19UCB601	ES	Marketing Research	2	0	0	2
19UCB602	ES	Business Strategy	2	0	0	2
19UCB603	PC	Artificial Intelligence	2	0	2	3
19UCB604	PC	Information Security	2	0	2	3
	PE	Professional Elective – II	3	0	0	3
	PE	Professional Elective III	3	0	0	3
	OE	Open Elective – II	3	0	0	3
PRACTICAL						
19UCB609	PW	Product Development Project	0	0	8	4
19UGS633	HS	Interpersonal Skills Laboratory	0	0	3	1.5
MANDATORY COURSES						
19UGM632	MC	Indian Constitution	1	0	0	0
		TOTAL	**18**	**0**	**15**	**24.5**
Total No. of Credits – 24.5						

19UCB601	MARKETING RESEARCH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To inculcate the students with a fair knowledge on Marketing Research, Product Research, Pricing Research, Advertising Research and Sales Research

UNIT I	MARKETING RESEARCH	6 Hrs

Marketing Research – Overview of MR process – Research Designs – Research Methods – Questionnaire Design – Scaling Techniques – Sampling Procedure- Data Collection techniques of MR – Consumer panel research – retail audit – TV audience measurement – other syndicated research services.

UNIT II	PRODUCT RESEARCH	6 Hrs

Product research- New product Development Process- Concept Testing- Test Marketing. Research for Identifying market segments.

UNIT III	PRICING RESEARCH	6 Hrs

Pricing Research. Distribution Research- Researching for number and location of sales representatives- Deciding on the number and location of retail outlets and warehouses Distributive cost analysis.

UNIT IV	ADVERTISING RESEARCH	6 Hrs

Advertising Research: Copy testing- Evaluating advertising effectiveness research- Before and after tests. Media Research- Media Selection and Scheduling- Media Audiences Measurements.

UNIT V	SALES RESEARCH	6 Hrs

Sales research – Methods for measuring market potential- Sales forecasting. Sales Analysis Sales analysis by territories- Sales Analysis by products- Sales Analysis by customers- Sales analysis by size of orders.

Total: 30 Hours

COURSE OUTCOMES:

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

- Understand the basic concept, principles, statistical tools of marketing research. [**Understand]**
- Apply Leverage marketing concepts for effective decision making**. [Apply]**
- Analyze the dynamics of marketing and analyze how its various components interact with each other in the real world. **[Analyze]**
- Design or Evaluate approaches to addressing issues of diversity. **[Design]**
- Evaluate various strategies of Internet Marketing**. [Evaluate]**

- Determine the most effective action to take in specific situations using Modern Tool. **[Modern tool]**

TEXT BOOKS:

1. Harper W Boyd Jr. Ralph Westfall and Stanley F stasch, Marketing Research: Text and Cases, Seventh Edition, All India Traveller Bookseller Publishers and Distributors, New Delhi 2002.
2. Rajendra Nagundkar Marketing Research: TEXT and Cases Second Edition, Tata Mcgraw Hill Publishing Company Ltd, New Delhi.
3. Ramanuj Majumdar, Marketing Research, Text Applications and Case studies. New Age International P Ltd. New Delhi 1996.

REFERENCE BOOKS:

1. Rajan Saxena, “Marketing Management” , McGraw Hill Education,6th edition,2019
2. S.A. Sherlekar, “Marketing Management”, Himalaya Publishing House,2014
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
7. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler

19UCB602	BUSINESS STRATEGY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To expose students to various perspectives and concepts in the field of Strategic Management
- The course would enable the students to understand the principles of strategy formulation, implementation and control in organizations.
- To help students develop skills for applying these concepts to the solution of business problems
- To help students master the analytical tools of strategic management

UNIT I	INTRODUCTION TO STRATEGIC MANAGEMENT	6 Hrs

Importance of Strategic Management - Vision and Objectives - Schools of thought in Strategic Management - Strategy Content, Process, and Practice - Fit Concept and Configuration Perspective in Strategic Management

UNIT II	INTERNAL ENVIRONMENT OF FIRM	6 Hrs

Recognizing a Firm's Intellectual Assets - Core Competence as the Root of Competitive Advantage - Sources of Sustained Competitive Advantage - Business Processes and Capabilities-based Approach to Strategy

UNIT III	EXTERNAL ENVIRONMENTS OF FIRM	6 Hrs

Competitive Strategy - Five Forces of Industry Attractiveness that Shape Strategy - The concept of Strategic Groups, and Industry Life Cycle - Generic Strategies - Generic Strategies and the Value Chain

UNIT IV	CORPORATE STRATEGY, AND GROWTH STRATEGIES	6 Hrs

The Motive for Diversification - Related and Unrelated Diversification - Business Portfolio Analysis - Expansion, Integration and Diversification - Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT V	STRATEGY IMPLEMENTATION	6 Hrs

Structure and Systems - The 7S Framework - Strategic Control and Corporate Governance

Total: 30 Hours

COURSE OUTCOMES:

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

- Understand the basic concepts and principles of strategic management. [**Understand]**
- Apply different strategic approaches to managing a business successfully in a global context. **[Apply]**
- Analyze the internal and external environment of business**. [Analyze]**
- Develop and prepare organizational strategies that will be effective for the current business environment**. [Design]**

- Evaluate the different strategical approaches and Corporate strategies and Growth strategies. **[Evaluate]**
- Ability to solve the real world Business oriented problems using Modern tool. **[Modern tool]**

TEXT BOOKS

1. Robert M. Grant. Contemporary Strategic Management, Blackwell, 7th Edition, 2012.

REFERENCE BOOKS

1. M.E. Porter, Competitive Strategy, 1980. M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters.
4. Exploring Corporate Strategy, Gerry Johnson, Kevan Scholes, Richard Whittington, 2009, Pearson Ed Ltd, United Kingdom, 2nd Ed.
5. Crafting and Executing Strategy Arthur A Thompson Jr, Strickland A.J., John E. Gamble and Arun K. Jain, McGraw Hill Education Private Limited, New Delhi.
6. Strategic Management Michael Hitt, Ireland, Hoskission, 2010, Cengage Learning, NewDelhi.
7. Strategic Management – Concepts and Cases, Fred R. David, 2010, PHI Learning, New Delhi.
8. Business Policy and Strategic Management (Text and Cases) , Subba Rao, P 2010,

19UCB603	ARTIFICIAL INTELLIGENCE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES :

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

UNIT I	INTRODUCTION AND OVERVIEW OF ARTIFICIAL INTELLIGENCE	6Hrs

Problems of AI- AI technique,-Tic - Tac - Toe problem-Intelligent Agents- Agents & environment- nature of environment- structure of agents- goal based agents- utility based agents- learning agents.

UNIT II	PROBLEM SOLVING, PROBLEMS, PROBLEM SPACE & SEARCH TECHNIQUES	5 Hrs

Defining the problem as state space search- production system- problem characteristics- issues in the design of search programs

UNIT III	SEARCH	7 Hrs

Problem solving agents- searching for solutions- uniform search strategies: breadth first search,- depth first search- depth limited search- bidirectional search-comparing uniform search strategies. Heuristic search strategies Greedy best-first search- A* search-AO* search- memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search- simulated annealing search- local beam search

UNIT IV	CONSTRAINT SATISFACTION PROBLEMS	6 Hrs

Local search for constraint satisfaction problems- Adversarial search- Games, optimal decisions & strategies in games- the minimax search procedure- alpha-beta pruning- additional refinements- iterative deepening. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition

UNIT V	KNOWLEDGE REPRESENTATION	6 Hrs

Knowledge representation issues- representation & mapping- approaches to knowledge representation. Using predicate logic- representing simple fact in logic- representing instant & ISA relationship- computable functions & predicates- resolution, natural deduction. Representing knowledge using rules- Procedural verses declarative knowledge- logic programming- forward verses backward reasoning- matching- control knowledge.

Total: 30 Hours

LIST OF EXPERIMENTS

1. Write a Program to Implement Breadth First Search using Python

2. Write a Program to Implement Depth First Search using Python
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python
5. Write a Program to Implement Water-Jug problem using Python
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python
9. Write a Program to Implement Missionaries-Cannibals Problems using Python
10. Write a Program to Implement N-Queens Problem using Python

COURSE OUTCOMES:

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

- Understand the concept of agents, environments, search strategies, reasoning, logic and probabilities. **[Understand]**
- Ability to apply knowledge of agent architecture, searching and reasoning techniques for different applications. **[Apply]**
- Ability to analyze procedural and declarative knowledge by applying agent-based rules.
- Ability to design a reasoning system for a given requirement. **[Design]**
- Evaluate the search algorithms and Use appropriate algorithms for any AI problem. **[Evaluate]**
- Ability to conduct practical experiments for demonstrating agents, searching and inferencing using Modern tool. **[Modern tool]**

TEXT BOOKS:

1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.

2 I. Bratko, —Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS:

1. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008

2. Nils J. Nilsson, —The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.

3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.

4. Gerhard Weiss, —Multi Agent Systems‖, Second Edition, MIT Press, 2013.

5. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

19UCB604	INFORMATION SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES :

- This course focusses on the models, tools, and techniques for enforcement of security with some emphasis on the use of cryptography. Students will learn security from multiple perspectives.

UNIT I	OVERVIEW OF SECURITY PARAMETERS	6 Hrs

Overview: Confidentiality, integrity and availability - Security violation and threats- Security policy and procedure- Assumptions and Trust- Security Assurance, Implementation and Operational Issues- Security Life Cycle.

UNIT II	ACCESS CONTROL MODELS AND SECURITY POLICIES	6 Hrs

Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.

UNIT III	SYSTEMS DESIGN	6 Hrs

Systems design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.

UNIT IV	LOGIC BASED SYSTEM	6 Hrs

Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

UNIT V	OPERATING SYSTEMS SECURITY AND DATABASE SECURITY	6 Hrs

Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing.

Total: 30 Peroids

LIST OF EXPERIMENTS

1. Analysis of security in Unix/Linux
2. Administration of users, password policies, privileges and roles
3. Perform encryption, decryption using any one substitution techniques
4. Perform encryption and decryption using any one transposition techniques
5. Implement the SIGNATURE SCHEME - Digital Signature Standard.
6. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
7. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

COURSE OUTCOMES:

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

- Understand the CIA triad of Confidentiality, Integrity and Availability. [**Understand]**
- Appreciate the difficulties that arise when valuable information needs to be shared. [**Apply]**
- Analyze what information is appreciating the value of information to the modern organization. **[Analyze]**
- Develop basic understanding of security, cryptography, system attacks and defenses against them. **[Design]**
- Evaluate the five leading-edge resources that have up-to-date information on information security**. [Evaluate]**
- Ability to solve the real world problems using modern tool- Wireshark **[Modern tool]**

TEXT BOOKS:

1. Principles of Information Security Paper back , Michael E Whitman , Herbert J Mattord, Fourth edition, Cengage learning, 2012.
2. Network security essentials, William Stallings, fourth edition, PHI, 2011.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1- 3 CRC Press LLC, 2004.
2. Security Engineering, Ross Anderson.
3. Computer Security: Art and Science, M. Bishop, Pearson Education.
4. Information Security: Principles and Practice, M. Stamp.
5. Security in Computing, C.P. Pfleeger, S.L. Pfleeger, J. Margulies.
6. Secure Programming HOWTO, David Wheeler.
7. Browser Security Handbook, Michael Zalewski.
8. Handbook of Database Security, M. Gertz, S. Jajodia.

WEB REFERENCES:

1. http://faculty.kfupm.edu.sa/COE/marwan/richfiles/misc/Network-security-essentials-4th editionwilliam-stallings.pdf
2. http://files.gu.edu.ge:8008/.../Principles%20of%20Information%20Security.
3. https://www.mooc-list.com/course/information-security-and-risk-management-context-coursera
4. https://www.coursera.org/learn/cyber-security-domain/lecture/FLyKS/information-securitygovernance-and-risk-management

19UCB609	PRODUCT DEVELOPMENT PROJECT	L	T	P	C
		0	0	8	4

COURSE OBJECTIVES:

- To develop a product for a specific problem right from its identification and literature review till the successful solution of the same
- To train the students in preparing project reports
- To prepare the students to face reviews and viva voice examination

PROJECT DESCRIPTION

- Eight periods per week shall be allotted in the timetable and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, and computer analysis of field work as assigned by the guide and also to presenting periodical seminars on the progress made in the project.
- The aim of the product development project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
- The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

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

- Understand the problem definition. [Understand]
- Apply their views in terms of preparing reports and presentation skills. [**Apply]**
- Identify and solve problems pertaining to Computer Science and Business Systems. [**Analyze]**
- Develop IT based solution for real world problems. **[Design]**
- Investigate the independent learning for effective implementation of the project. **[Investigate]**
- Build the project as a Team or as an individual using Modern tool. **[Modern tool]**

19UGM632	INDIAN CONSTITUTION	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES :

- The students will be exposed to fundamental rights & duties in Indian Constitution.
- The students will be given knowledge on the components of the parliamentary system to prepare for the process of their career development.
- The student will have knowledge on powers and functions of Local bodies and Indian polity to appear for various competitive exams such as UPSC, TNPSC and RRB…
- The student will know about the functions of judiciary and electoral process followed in the country.

UNIT I	INTRODUCTION ON INDIAN CONSTITUTION	6 Hrs

Marketing Research – Overview of MR process – Research Designs – Research Methods – Questionnaire Design – Scaling Techniques – Sampling Procedure- Data Collection techniques of MR – Consumer panel research – retail audit – TV audience measurement – other syndicated research services.

UNIT II	PARLIAMENTARY SYSTEM	6 Hrs

Product research- New product Development Process- Concept Testing- Test Marketing. Research for Identifying market segments.

UNIT III	JUDICIARY AND ELECTION COMMISSION	6 Hrs

Pricing Research. Distribution Research- Researching for number and location of sales representatives- Deciding on the number and location of retail outlets and warehouses Distributive cost analysis.

UNIT IV	LOCAL ADMINISTRATION	6 Hrs

Advertising Research: Copy testing- Evaluating advertising effectiveness research- Before and after tests. Media Research- Media Selection and Scheduling- Media Audiences Measurements.

Total: 30 Hours

COURSE OUTCOMES:

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

- Able to apply knowledge of the fundamental rights and duties prescribed by Indian Constitution to prepare for various competitive examinations.
- able to manage complex societal issues in society with the knowledge of judiciary and local administration.
- able to interpret the societal, health, safety, legal and cultural issues with

understanding of parliamentary system and electoral process through self-learning skills.

- able to understand the ethical responsibilities of municipalities, panchayats and co-operative societies.
- able to understand and distinguish the functioning of the parliamentary system followed in various countries.

TEXT BOOKS:

1. Shubham Singles, Charles E. Haries, et al., “Constitution of India and Professional Ethics” by Cengage Learning India Private Limited, 2018.
2. Subhash C. Kashyap,”Our Constitution: An Introduction to India’s Constitution and constitutional Law”, NBT, 2018.
3. Brij Kishore Sharma,“Introduction to the Constitution of India”, PHI Learning Pvt. Ltd.,
4. New Delhi, 2011.
5. M.V.Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.
6. Durga Das Basu, “Introduction to the Constitution on India”, Prentice Hall, 2001.

19UGS633	INTERPERSONAL SKILLS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES :

- The students will be exposed to fundamental rights & duties in Indian Constitution.
- The students will be given knowledge on the components of the parliamentary system to prepare for the process of their career development.
- The student will have knowledge on powers and functions of Local bodies and Indian polity to appear for various competitive exams such as UPSC, TNPSC and RRB…
- The student will know about the functions of judiciary and electoral process followed in the country.

List of Exercises

Part - A : Communication and Leadership Projects

I) Speech Projects

1. The Open up Speech (Prepared Speech)
2. Speech Organizing to the Point (Prepared Speech)
3. Table Topics Speech

II) Evaluation Projects

4. Speech Evaluation
5. TAG (Timer, Ah Counter and Grammarian) Evaluation

III) Leadership Roles

6. Speech Master of the Day
7. General Evaluator
8. Table Topics Master

Part - B : Problem-Solving and Decision- Making Project

IV) Quality Circle Project

Total: 45 Hours

COURSE OUTCOMES:

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

- Able to apply knowledge of the fundamental rights and duties prescribed by Indian Communicate orally with fluency and clarity in a given contextual situation (Responding - Affective Domain)
- Evaluate a speech and offer constructive evaluation of the speech (Evaluating - Cognitive Domain)
- Adapt themselves to work in a group as a member or a leader for efficiently executing the given task (Organization – Affective Domain)
- Analyze a problem and find appropriate solution (Analyze - Cognitive Domain)
- Take decision by organizing relevant information and defining alternatives (Create - Cognitive Domain)

Semester VII

Course Code		Course Title	L	T	P	C
THEORY						
19UCB701	ES	Financial Management	2	0	0	2
19UCB702	ES	Financial and Cost Accounting	2	0	0	2
19UCB703	ES	Human Resource Management	2	0	0	2
19UCB704	ES	IT Project Management	2	0	0	2
19UCB705	PC	Usability Design of Software Applications	3	0	0	3
	PE	Professional Elective IV	3	0	0	3
	OE	Open Elective – III	3	0	0	3
PRACTICAL						
19UCB707	PW	Summer Internship	0	0	0	1
19UCB708	PC	Usability Design of Software Applications Laboratory	0	0	3	1.5
19UCB709	PC	IT Workshop Scilab / Matlab	0	0	3	1.5
MANDATORY COURSES						
19UGM731	MC	Professional Ethics and Human values	2	0	0	0
		TOTAL	**19**	**0**	**6**	**21**
Total No. of Credits – 21						

19UCB701	FINANCIAL MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

The student should be made to:

- Understand basics of Financial Management and Time Value of Money
- Analyze the Securities Value and its Risk & Return
- Analyze the Long-Term and Short-Term Investment Decisions

UNIT I	INTRODUCTION	6

Introduction to Financial Management - Goals of the firm - Financial Environments. VALUE OF MONEY: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT II	VALUATION OF SECURITIES AND RISK AND RETURN	6

VALUATION OF SECURITIES: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. RISK AND 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 AND FINANCIAL LEVERAGE AND COST OF CAPITAL	6

OPERATING AND 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	6

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

UNIT V	WORKING CAPITAL MANAGEMENT, CASH AND ACCOUNTS RECEIVABLE MANAGEMENT	6

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. 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 and Collection Policies,

Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.

Total: 30 Hours

COURSE OUTCOMES:

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

- Understand the concept of fundamental financial concepts, especially time value of money. [**Understand]**
- Apply capital budgeting projects using traditional methods. **[Apply]**
- Analyze he main ways of raising capital and their respective advantages and disadvantages in different circumstances. [**Analyze]**
- Integrate the concept and apply the financial concepts to calculate ratios and do the capital budgeting. **[Evaluate]**

TEXT BOOKS:

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill. References Books : 1. Srivastava, Misra: Financial Management, OUP, 2011.
2. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.2008

19UCB702	FINANCIAL AND COST ACCOUNTING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

The student should be made to:

- To provide an in depth study of the Generally Accepted Cost Accounting Principles and Techniques for identification, analysis and classification of cost components to facilitate managerial decision making.
- To understand the concepts of Financial Management and its application for managerial decision making.

UNIT I	INTRODUCTION	6

ACCOUNTING CONCEPT- Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements

UNIT II	ACCOUNTING PROCESS	6

Book Keeping and Record Maintenance - Fundamental Principles and Double Entry - Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts - Cash Book and Subsidiary Books - Rectification of Errors

UNIT III	FINANCIAL STATEMENTS	6

FINANCIAL STATEMENTS Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them

UNIT IV	COSTING SYSTEMS	6

COSTING SYSTEMS -Elements of Cost - Cost Behavior, Cost Allocation, OH Allocation - Unit Costing, Process Costing, Job Costing - Absorption Costing, Marginal Costing, Cost Volume Profit Analysis – Budgets - ABC Analysis Class Discussion: Application of costing concepts in the Service Sector

UNIT V	COMPANY ACCOUNTS AND ANNUAL REPORTS	6

COMPANY ACCOUNTS AND ANNUAL REPORTS Audit Reports and Statutory Requirements - Directors Report - Notes to Accounts – Pitfalls

Total: 30 Periods

COURSE OUTCOMES:

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

- Ability to define, understand and explain concepts in Financial and Cost Accounting. **[Remember/Understand]**
- Apply concept of Financing and accounting in real world problem**. [Apply]**
- Analyze the given real time problem and manage Financial, Cost Accounting in company. **[Analyze]**
- Design costing and Audit reports for the given Scenario. **[Design]**
- Ability to Evaluate and compare Financial and Cost Management in the given Scenario. **[Evaluate]**
- Select and apply the concept of Financial and cost Accounting using QuickBooks**.[Modern Tool]**

TEXT BOOKS:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, Accounting: Texts and Cases, McGraw-Hill, 13th edition,2013.

19UCB703	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

The student should be made to:

- To familiarize the students about the different aspects of managing people in the organizations from the stage of acquisition to development and retention.

UNIT I	INTRODUCTION	6

Conceptual foundations; Human aspect of management; Human resource management- concept, scope and importance; Competencies of HR manager- employer branding and competency mapping; Changing role of HRM- workforce diversity, technological change, restructuring and rightsizing, empowerment; TQM; Management of ethics.

UNIT II	HUMAN RESOURCE PLANNING, JOB ANALYSIS, AND JOB DESIGN	6

H: Assessing human resource requirements; Human resource forecasting; Work load analysis; Job analysis; Job description and specifications; Job design; Job characteristic approach to job design.

UNIT III	RECRUITMENT, SELECTION, TRAINING, AND DEVELOPMENT	6

Factors affecting recruitment; Sources of recruitment (internal and external); Basic selection model; Psychological tests for selection; Interviewing; Placement and induction; Job changes- Transfers, Promotions, and Separations; An overview of training and development; Emerging trends in recruitment, selection, and development

UNIT IV	COMPENSATION MANAGEMENT, PERFORMANCE APPRAISAL, AND AUDIT	6

Compensation management- Job evaluation, base compensation and supplementary compensation; Innovations in compensation management- Pay band system, ESOP; Performance appraisal- concept, traditional and modern methods- MBO, 360 degree appraisal, 720 degree appraisal, behaviourally anchored rating scale, balanced scorecard; Potential appraisal.

UNIT V	EMERGING HORIZONS OF HRM	6

International HRM, challenges of international HR managers; Green HRM; E-HRM; HRIS (Human Resource Information System); Human resource audit; Contemporary issues in human resource management- moonlighting phenomenon, employee engagement, flexi timing, psychological contract, managing protean career, layoffs.

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- understand HRM and the role of HRM in effective business administration. **[Understand]**

- Ability to Apply Various strategies in Human resource and integrate the knowledge of HR concepts to take correct business decisions **[Apply]**
- Analyse the strategic issues and strategies required to select and develop manpower resources. **[Analyze]**
- develop necessary skill set for application of various HR issues. **[Create]**
- Ability to investigate the new techniques adopted in HRM. **[Investigation]**

REFERENCE BOOKS:

1. D' Cenzo, David A., Stephen P. Robbins & Susan L. Verhulst (2012). Human Resource Management.New Delhi: John Wiley and Sons.

2. Dessler, Garry (2012). Human Resource Management. Prentice Hall of India.

3. Dowling, Peter J., Festing M., & Engle A.D. (2013). International Human Resource Management. Cengage Learning.

4. Gooderham, P. N., Nordhaug, O. & Ringdal, K. (1999). Institutional and rational determinants of organizational practices: Human resource management in European firms. Administrative Science Quarterly, 44(3), 507-531.

5. Ian, Beardwell, Len, Holden & Tim Claydon (2004). Human Resource Management: A Contemporary Approach. Prentice Hall.

19UCB704	IT PROJECT MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

The student should be made to:

- obtain practical project management skills and competencies , establishment of project communications, managing project changes and managing distributed software teams and projects based on the Project Management Body of Knowledge (PMBOK) as a framework.

UNIT I	PROJECT INITIATION PHASE	6

Scoring Matrix – Project Charter – Role of charter – Creation of charter – Role of stakeholder – Identification of stakeholders– Stakeholders register and management strategy – Ranking the Stakeholder

UNIT II	PROJECT PLANNING PHASE	6

Requirement Process Collection – Project Scope – Work break down structure– Define activities – Milestones Estimate activity resources – Activity durations Plan risk management – Identify and rank risks –Risk response plan – Risk contingency plan – Plan quality management –Quality roles and responsibilities – Define project quality – Measure project quality – Quality control – Quality management plan – Human resource plan-Communication management plan

UNIT III	PROJECT COST ESTIMATION	6

Analogous estimation – Parametric – Three point method – WBS method – Project Management Tools & Strategies – PERT, CPM and GANNT

UNIT IV	PROJECT EXECUTION PHASE	6

Project staffing assignment – Project Manager Team assessment – Team feedback– Task distribution – Create issue logs

UNIT V	PROJECT MONITORING, CONTROLLING AND CLOSING PHASE	6

Pr Cost and Schedule variance Analysis –Work Performance Results – Change control – Quality Control – Risk register update – Lesson Learned

TOTAL:30 Periods

COURSE OUTCOMES:

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

- Explain the key components of a project plan. **[Understand]**
- Apply appropriate project planning and tracking tools. **[Apply]**
- Analyze and Apply suitable software project management technique for the given software project scenario. **[Analyze]**
- Develop a project plan for the applications on Internet of Things, Society and Environment. **[Design]**

- Interpret how to identify the lessons learned in a project closeout and review session. **[Evaluate]**

REFERENCE BOOKS:

1. Warburton. R &Kanabar. V, The Art and Science of Project Management, RW Press, RI, Second Edition, 2016.
2. Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill, Third Edition, 2011.
3. Kanabar. V and Warburton, R, Fundamentals Project Management, Kaplan Press, New York, 2008.
4. Walker Royce, Software Project Management A Unified Framework, Pearson Education, 2004

19UCB705	USABILTY DESIGN OF SOFTWARE APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Understand contemporary user interfaces, including the basics of human-computer interaction, the user interface design/evaluation process, and thearchitectures within which user interfaces are developed.

UNIT I	FOUNDATIONS AND GOALS OF HUMAN COMPUTER INTERACTION	9

human capabilities – computer interaction design - Relationship between HCI, User Experience design, human factors engineering, and psychology - Relevance of HCI to domains like healthcare, education, and Business - HCI technology including virtual reality, augmented reality, and robotics

UNIT II	HUMAN ABILITIES AND COMPUTER INTERACTION	9

Senses, Information Processing and Motor Systems – Physiological Fundamentals – perceptual, cognitive and motor memory - Memory Characteristics and Process –Cognitive Modelling Human Processor(MHP) & GOMS Model

UNIT III	DESIGN PROCESS	9

Interaction Models – Ergonomics – Context of Interaction – Experience – Engagement and fun - Design for Users with Disabilities(physical and cognitive) – Software Engineering aspects of HCI

UNIT IV	PRINCIPLES OF UNIVERSAL DESIGN	9

Design Process – - Information Visualization – Task Analysis – Task Models –Norman's Seven Principles – DOET(Design of Everyday Things) - Prototyping – Dimensions – Terminology – Descriptions – storyboarding –User Interface Toolkits – Seeheim model – Model View Controller

UNIT V	EVALUATION AND DESIGN ISSUES	9

Nielsen's Ten Heuristic Principles for evaluation- Expert Reviews – Usability testing – Survey instruments – acceptance tests – evaluation during active use – controlled psychologically oriented experiments - Frustrating experiences–Error Messages - Non anthromorphic design – Evaluation of spastic devices interaction panels

Total: 45 Periods

COURSE OUTCOMES:

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

- Explain the fundamental concepts and needs for human computer interaction, User interface design, understanding human psychology and applications of HCI in various fields

[**Remember/Understand]**

- Apply the Universal design principles with standards Norman, Seeheim model and DOET Principles with tools **[Apply]**
- Analyze the design issues with Nielsen's principles, experts, controlled psychological experiments and errors **[Analyze]**
- Design a Protype for the given Scenario **[Design]**
- Ability to Evaluate Various Solution for given problem. **[Evaluate]**
- Demonstrate the working of devices for normal, physical and cognitive impaired people along with case studies **[Modern Tool]**

REFERENCE BOOK:

1. Don Norman, " The Design of Everyday Things" First Edition, Basic Books, 2013.
2. Alan Dix, Janet E.Finlay, Gregory D.Abowd, Russell Beale , " Human- Computer Interaction" (3rd Edition) , Prentice-Hall, Inc, 2009, ISBN : 0130461091
3. B. Shneiderman; Designing the User Interface, Addison Wesley, 5th Edition, 2014.

WEB REFERNCES:

1. https://www.cc.gatech.edu/~stasko/6750
2. http://iitg.ac.in/uelab/courses.html

19UCB707	SUMMER INTERNSHIP	L	T	P	C
		0	0	0	1

COURSE OBJECTIVES:

The student should be made to:

- Apply knowledge gained in the Internship to real-world challenges
- Develop and enact a compelling professional vision that values diversity and inclusion in the workplace.

The duration of internship will be One/Two weeks. It will be after completion of 7th Semester and before the commencement of Semester VIII.

Following five options can be opted by the students:

1. Offline internship in industry - Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by Government and written consent of the student and parents. Student is supposed to produce joining letter and relieving letter once the internship is over in case of Offline internship in anyindustry.
2. Online internship in industry / other agencies
3. Seminar by student under mentorship of a faculty. The topic shall be as per UG Syllabus topics
4. Preparation of consolidated report on survey of materials used in the respective branch of the student. The work should include the study of catalogues, price list specifications, properties, usage notes and other technical details and drawings etc, Work shall be carried out under the guidance of faculty. A detailed report shall be submitted. It shall be done by only one student. It is to be completed individually.
5. A Mini Project- on some suitable topic related to respective branch. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc depending on the branch of the student. Preferably a single student should do it.

Other guidelines:

- Student has to prepare detailed report and submit to his/her college. A copy of report can be kept in the departments for record.
- Each student must be assigned a faculty as a mentor from the college and an Industry expert as co- mentor.
- The evaluation of the work done by students will be carried out after 1/2 weeks by the internal and external examiner.

- The presentation by student in the presence of all student is desirable.

Student should produce successful completion certificate in case of offline / online internship in industry.

COURSE OUTCOMES:

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

- Apply knowledge gained in the classroom (or major) to real-world challenges in an internship environment.
- Develop and enact a compelling professional vision that values diversity and inclusion in the workplace.
- Engage in responsible conduct while working as an intern and allow decisions to be informed by a value-centered life.

19UCB708	USABILTY DESIGN OF SOFTWARE APPLICATIONS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- To design the user interface with required ethical standards and principles.
- To be competent in storyboarding the design and doing usability testing.
- To visualize the data acquired during research visit in the specific real world domains.

LIST OF EXPERIMENTS

1. Gather useful information about users and activities through asking, looking, learning, and trying
2. Organize information about users into useful summaries with affinity diagrams – Chart , Software
3. User research findings with personas and scenarios
4. Sketching as a process for user experience design – Chart, Software
5. Give and accept critiques of design ideas in a constructive manner – Peer Review
6. Visualize the data visualization tool. Gathere through any information
7. Demonstrate skills for low-fidelity prototyping and describe the strengths and weaknesses of a variety of prototyping methods – Software
8. Appreciate the process of user experience design as a- cyclical, iterative process Understand the differences between usability and user experience.
9. Analyze an interaction design problem and propose a user- centered process, justifying the process and identifying them trade-offs
10. Development of accessible, Gesture and user-adapted interfaces for people with sensory, motor/physical and

TOTAL : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able t

- Understand the given Scenario and solve using user interface design . **[Understand]**
- Use interface with story boarding and interaction modelconsidering the context, ergonomics, experience and engagement**. [Apply]**
- Analyze the design issues with user experience and usability testing **[Analyze]**
- Develop the prototype for the chosen problem. **[Design]**
- Examine the societal, economic influences for the given problem. **[Evaluate]**
- Report all the research findings with genuine design anddevelopment.. **[modern tool]**

19UCB709	IT WORKSHOP SCILAB / MATLAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The student should be made to:

- To Study Scilab includes hundreds of mathematical functions with the possibility to add interactively programs from various languages (C, C++, Java...).
- To Familiarise with sophisticated data structures (including lists, polynomials, rational functions, linear systems...), an interpreter and a high level programming language.

LIST OF EXPERIMENTS

1. Study of basic scilab commands
2. Matrix constructors and operations
3. Matrix bitwise, relational & logical operations
4. Control structures (if-else, if-elseif –else, select)
5. Control structures (for, while, break and continue)
6. Graphics - 2d plots
7. Scilab – civil application program (1)
8. Scilab – civil application program (2)
9. Scilab – electronics application program (1)
10. scilab – electronics application program (2)

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Understand the need for simulation/implementation for the verification of mathematical functions. **[Understand]**
- Understand and Apply the main features of the MATLAB/SCILAB program development environment to enable their usage in the higher learning**. [Apply]**
- Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB/SCILAB tools**. [Analyze]**
- Implement simple mathematical functions/equations in numerical computing environment such as MATLAB/SCILAB. **[Design]**
- Interpret and visualize simple mathematical functions and operations thereon using plots/display. **[Evaluate]**
- Select and apply appropriate tool to solve real world problem. **[Modern Tool Usage**]

Semester VIII

Course Code		Course Title	L	T	P	C
THEORY						
	PE	Professional Elective V	3	0	0	3
	PE	Professional Elective VI	3	0	0	3
	OE	Open Elective – IV	3	0	0	3
PRACTICAL						
19UCB801	PW	Project Work	0	0	16	8
		TOTAL	**9**	**0**	**16**	**17**
Total No. of Credits – 17						

19UCB801	PROJECT WORK	L	T	P	C
		0	0	16	8

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same
- To train the students in preparing project reports
- To prepare the students to face reviews and viva voice examination

PROJECT DESCRIPTION

- Sixteen periods per week shall be allotted in the timetable and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, and computer analysis of field work as assigned by the guide and also to presenting periodical seminars on the progress made in the project.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
- The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

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

- Understand the problem definition. [Understand]
- Apply their views in terms of preparing reports and presentation skills. [**Apply]**
- Identify and solve problems pertaining to Computer Science and Business Systems. [**Analyze]**
- Develop IT based solution for real world problems. **[Design]**
- Investigate the independent learning for effective implementation of the project. **[Investigate]**
- Build the project as a Team or as an individual using Modern tool. **[Modern tool]**

PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	L	T	P	C
COMPUTER SCIENCE					
19UCB901	Introduction to IoT	3	0	0	3
19UCB902	Data Mining Techniques	3	0	0	3
19UCB903	Robotics and Embedded Systems	3	0	0	3
19UCB904	Cloud Micro Services and Application	3	0	0	3
19UCB905	Quantum Computing and Applications	3	0	0	3
19UCB906	Cognitive Science and Analytics	3	0	0	3
19UCB907	Deep Learning for Computer Vision	3	0	0	3
19UCB908	Introduction to Block chain Technology and Application	3	0	0	3
19UCB909	Introduction to Industry 4.0	3	0	0	3
19UCB910	Advanced Social, Text and Media Analytics	3	0	0	3
19UCB911	Data Science for Engineering	3	0	0	3
19UCB912	Cryptology	3	0	0	3
19UCB913	Graph Theory and Applications	3	0	0	3
19UCB914	Software Quality Management	3	0	0	3
19UCB915	Introduction to Parallel and Distributed Algorithms	3	0	0	3
19UCB916	Fault Tolerant Computing Systems	3	0	0	3
19UCB917	Introduction to Ad Hoc and Sensor Networks	3	0	0	3
19UCB918	Computer Graphics and Multimedia	3	0	0	3
19UCB919	Information Retrieval Techniques	3	0	0	3
19UCB920	Information Storage Management concepts	3	0	0	3
19UCB921	Introduction to Mobile and Pervasive computing	3	0	0	3
19UCB922	Introduction to Human Computer Interaction	3	0	0	3

19UCB923	Software Project Management	3	0	0	3
19UCB924	Augmented Reality	3	0	0	3
19UCB925	Introduction to Data Analytics	3	0	0	3
19UCB926	Java Programming	3	0	0	3
19UCB927	Speech and Natural Language Processing concepts	3	0	0	3
19UIT911	Building Enterprise Applications	3	0	0	3
19UIT912	Software Testing	3	0	0	3
BUSINESS SYSTEMS					
19UCB928	Management Accounting	3	0	0	3
19UCB929	Strategic Management	3	0	0	3
19UCB930	Business Intelligence	3	0	0	3
19UCB931	Behavioral Economics	3	0	0	3
19UCB932	Enterprise Resource Planning	3	0	0	3
19UCB933	Total Quality Management	3	0	0	3

19UCB901	INTRODUCTION TO IoT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I	FUNDAMENTALS OF IoT	9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II	IoT PROTOCOLS	9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III	DESIGN AND DEVELOPMENT	9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming

UNIT IV	DATA ANALYTICS AND SUPPORTING SERVICES	9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning– No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V	CASE STUDIES/INDUSTRIAL APPLICATIONS	9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concept of IoT [**Understand]**
- Apply data analytics and use cloud offerings related to IoT **[Apply]**
- Analyze various protocols for IoT. [**Analyze]**
- Design a PoC of an IoT system using Rasperry Pi/Arduino **[Design]**

- Evaluate the Quality using different Quality systems**[Evaluate]**
- Solve the given real time Scenario using Modern tool**[Modern tool]**

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things‖, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

19UCB902	DATA MINING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- emphasis on data processing techniques, rule mining, classification, clustering and in the development of prediction models.
- ITo interpret the real world problems by examining with appropriate mining tools.

UNIT I	DATA MINING AND PRE-PROCESSING	9

Data Mining: Types of Data - Process Stages – Techniques - Knowledge Representation Methods - Role of machine learning and statistics - Issues and challenges in Data Mining.
Data Pre-processing: Data Cleaning - Data Integration and Transformation - Data Reduction and Data Discretization - Concept hierarchy Generation - Outlier Analysis through statistical techniques - Data Similarity Measures for mixed attribute. .

UNIT II	ASSOCIATION RULE MINING	9

Frequent Item set Mining Methods- Apriori, Frequent Pattern (FP) Tree - Mining Various Kinds of Association rules - Association Mining to Correlation Analysis - Constraint-Based Association Mining.

UNIT III	CLASSIFICATION	9

Classification by Decision Tree – ID3, C4.5, CART - Bayesian Classification, Laplacian Correction in Bayesian algorithm - Rule Based Classification - Support Vector Machines - Neural Network - Lazy learners - Evaluating the Accuracy of a Classifier- Ensemble Methods

UNIT IV	PREDICTION	9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V	CLUSTERING	9

Partitioning Method – K-Means, K-Medoids - Hierarchical Method- AGNES, Density Based Method- DBSCAN - Model based Method – COBWEB Algorithm - Outlier Techniques - Performance Evaluation - Case Study.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the fundamental concepts of data mining [**Understand]**
- Apply appropriate data pre-processing techniques for the given dataset **[Apply]**
- Analyze Association rules using algorithms like Apriori and Frequent Pattern tree for the given problem [**Analyze]**
- Demonstrate the performance of different Classification algorithms (decision tree algorithms, naïve bayes., support vector machines and Neural Networks) and prediction algorithms (Linear Models and Logistic Regression) to solve the real world problem. **[Design]**
- Illustrate various clustering and outlier techniques for grouping the given

data**[Evaluate]**

- Experiment various data pre-processing and mining techniques for the given application using Python, R, Weka and Rapid Miner etc **[Modern tool]**

TEXT BOOK:

1. Jiawei Han, Micheline Kamper, Jian Pei, “Data Mining: Concepts and Techniques”, Morgan Kaufman, Third Edition, 2011.
2. Parteek Bhatia , “Data Mining and Data Warehousing: Principles and Practical Techniques”, Cambridge University Press, First Edition, 2019.
3. ArunK.Pujari, “Data Mining Techniques”, Universities Press, Third Edition, 2013.
4. Ian H.Witten, Eibe Frank, Mark.A. Hall, “Data Mining Practical Machine Learning Tools and Techniques”, Elsevier, Fourth Edition, 2016.
5. AdelchiAzzalini, Bruno Scarpa, “Data Analysis and Data Mining: An Introduction”, Oxford University Press, Third Edition, 2012.
6. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall India Learning Private Limited, Second edition, 2011.

ONLINE RESOURCE

1. https://nptel.ac.in/courses/106/105/106105174/ - Data Mining by Prof. Pabitra Mitra, IIT Kharagpur.

19UCB903	ROBOTICS AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To study the applications of Robotics in industries
- To work with variety of sensors in Robotic systems

UNIT I	INTRODUCTION TO SENSORS FOR ROBOTIC APPLICATIONS	9

Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer, Digital Camera

UNIT II	ROBOTICS CONTROL ELEMENTS	9

Actuators - DC Motors, H-Bridge, Pulse Width Modulation, Stepper Motors, Servos. Control - OnOff Control, PID Control, Velocity Control and Position Control

UNIT III	EMBEDDED CONTROLLERS FOR ROBOTS	9

Embedded Controllers, Interfaces, Operating System - Industrial Robots

UNIT IV	ROBOT KINEMATICS	9

Evolution of robotics, Robot anatomy, Design and control issues, Manipulation and Control. Direct Kinematic Model - Denavit-Hartenberg Notation, Kinematic Relationship between adjacent links, Manipulator Transformation Matrix; Inverse Kinematic Model

UNIT V	MOBILE ROBOTS	9

Concepts of Localization and path planning - Autonomous robots - Robot Operating System.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the fundamental concepts of Robotics [**Understand]**
- Apply appropriate Techniques to solve complex Problem. **[Apply]**
- Analyze different Sensors in Robotic System [**Analyze]**
- Demonstrate the performance of different Sensors in Robotics and Embedded System.. **[Design]**
- Illustrate various Mobile Robots used in clustering and outlier techniques for grouping the given data**[Evaluate]**
- Experiment various data pre-processing and mining techniques for the given application using Python, R, Weka and Rapid Miner etc **[Modern tool]**

TEXT BOOKS

1. AnisKoubaa, "Robot Operating System (ROS) The Complete Reference", First Volume, Springer, 2016 2 Thomas Bräunl, "Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems", Third Edition, Springer-Verlag Berlin Heidelberg, 2008.
2. R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2003

REFERENCE BOOKS

1. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics: Control, Sensing, Vision, and Intelligence", McGraw-Hill, New York, 1987.

19UCB904	CLOUD MICRO SERVICES AND APPLICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To study the applications of Micro Services.

UNIT I	INTRODUCTION TO MICRO SERVICES	9

Motivation for Micro services, What is monolithic application? Domain Driven Design, Edge Service, Dealing with complexity, Micro services Security, API management and gateways, the future of Micro services, Micro services Governance, Summary of Micro services.

UNIT II	WEB APP DEVELOPMENT USING NODEJS	9

Introduction to NodeJs, Getting Started with NodeJs, Project Structure, Basic Routing, File system, View templates Serving static content, Handling HTTP and HTTPS, Connecting to database, Mongo DB Installation and Database, Node Js Mongo driver, Performing CRUD operations, Connecting Pooling, Connecting Pooling using NodeJS mongo driver, Performing CRUD operations, Connecting Pooling, Connecting Pooling using NodeJS mongo driver.

UNIT III	CONTAINERS AND DOCKERS	9

Containers and Dockers, Basic Docker commands, Dev versus Ops, The Twelve-Factor App, Docker mission, Docker Adoption, Docker basic concept, Docker architecture, Docker typical workflow, Docker shared and layered file systems technology, container ecosystem and orchestration.

UNIT IV	KUBERNATES	9

what is kubernates strength and architecture, Master & worker node component, kubernate building blocks, Deploying Applications on kubernates, Helm, Application center components, PoD health checking, Health check and kubectl example, Cloud application component architecture, Benefits of using Kubernetes with IBM container.

UNIT V	CASE STUDY	9

The Journey from Monolith Architecture to Micro services; Refactoring A Monolith application Into A Cloud-Native App..

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the transformation journey from Monolithic application to micro services.
- Develop understanding of connecting database using Mongo DB.

- Develop understanding of Container and docker.
- Develop understanding of Kubernates.
- Understanding cloud application Kubernates architecture.

TEXT BOOKS:

1.IBM Career Education – “Microservices Architecture and Implementation”

2.Sam Newman, “Building Microservices”, O'reilly Publication.

19UCB905	QUANTUM COMPUTING AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- .study the applications of Quantum Computing

UNIT I	INTRODUCTION TO QUANTUM COMPUTATION	9

Quantum bits, Bloch sphere representation of a qubit, multiple qubits. **Background Mathematics and Physics:** Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

UNIT II	QUANTUM CIRCUITS	9

single qubit gates, multiple qubit gates, design of quantum circuits.

UNIT III	QUANTUM INFORMATION AND CRYPTOGRAPHY	9

Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

UNIT IV	QUANTUM ALGORITHMS	9

Classical computation on quantumcomputers. Relationship between quantum and classical complexity classes. Deutsch'salgorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

UNIT V	NOISE AND ERROR CORRECTION	9

Graph states and codes, Quantum error correction, fault-tolerant computation, Applications

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concepts of Quantum computing.
- Apply the quantum algorithm to real time scenario.
- Design the Applications using Quantum algorithms.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.2002
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific,2004
3. Pittenger A. O., **An Introduction to Quantum Computing Algorithms,2000**

19UCB906	COGNITIVE SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- study the concepts of cognitive science and analytics.

UNIT I	INTRODUCTION	9

Introduction to the study of cognitive sciences. A brief history of cognitive science. Methodological concerns in philosophy, artificial intelligence and psychology. Structure and constituents of the brain; Brief history of neuroscience; Mathematical models; Looking at brain signals; Processing of sensory information in the brain.

UNIT II	NEURAL NETWORK MODELS	9

Neural Network Models; Processing of sensory information in the brain; motor and sensory areas; Brain Imaging, fMRI, MEG, PET, EEG; Multisensory integration in cortex; information fusion; from sensation to cognition, cybernetics; From physics to meaning; Analog vs. Digital: Code duality.

UNIT III	LINGUISTIC KNOWLEDGE	9

What is language?; Linguistic knowledge: Syntax, semantics, (and pragmatics); Generative linguistics; Brain and language; Language disorders; Lateralization; The great past tense debate; Cognitivist and emergent standpoints ; A robotic perspective.

UNIT IV	ROBOTICS	9

Affordances, direct perception, Ecological Psychology, affordance learning in robotics; Development, child and robotic development; Attention and related concepts; Human visual attention; Computational models of attention; Applications of computational models of attentional.

UNIT V	MACHINE LEARNING AND ANALYTICS	9

Categories and concepts; Concept learning; Logic ; Machine learning; Constructing memories; Explicit vs. implicit memory; Information processing (three-boxes) model of memory; Sensory memory; Short term memory; Long term memory; Rationality; Bounded rationality; Prospect theory ; Heuristics and biases; Reasoning in computers; Key points in social cognition; Context and social judgment; Schemas; Social signals, Analytics.

TOTAL:45 Periods

COURSE OUTCOMES:

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

Know Introduction to Cognitive Science, Psychology, Nervous system and brain

- Understand Brain and sensory motor information, Representation of sensory information

- Analyze From Sensation to Cognition; Roots of Cognitive Science
- Develop Language and Embodiment
- Implement Affordances in biological and artificial systems, Cognitive Development
- Make Attention, Learning, Memory, Reasoning, Social Cognition.

TEXT BOOKS:

1. Gardner, Howard E. The mind's new science: A history of the cognitive revolution. 2nd Edition.

2. Bermúdez, José Luis. Cognitive science: An introduction to the science of the mind. Cambridge University Press, 2014.

REFERENCE BOOKS:

1. McCulloch, Warren S., and Walter Pitts. "A logical calculus of the ideas immanent in nervous activity." The bulletin of mathematical biophysics 5.4 (1943): 115-133.

2. Imaging: Brain Mapping Methods, John C. Mazziotta, Richard S. J. Frackowiak, Elsevier Science Publication.

3. Fromkin, Rodman, and Hyams. An Introduction to Language, Boston, MA: Thomson Wadsworth, 9th edition, 2011.

19UCB907	DEEP LEARNING FOR COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- study the concepts of Deep Learning.
- Study the concepts of computer vision

UNIT I		9

Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks. Feedforward neural networks: Pattern classification using perceprton, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders

UNIT II		9

Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layerwise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)

UNIT III		9

Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.

UNIT IV		9

Recurrent neural networks (RNNs): Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture

UNIT V		9

Generative models: Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Belief nets, Learning sigmoid belief nets, Deep belief nets

Applications: Applications in vision

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of Deep Learning.
- Analyze the Deep Learning algorithms For Computer Vision

- Develop a application using Deep Learning concepts
- Create a application for given real time problem

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, In preparation for MIT Press, Available online: http://www.deeplearningbook.org, 2016

REFERENCE BOOKS:

1. S. Haykin, Neural Networks and Learning Machines , Prentice Hall of India, 2010

2. Satish Kumar, Neural Networks - A Class Room Approach, Second Edition, Tata McGraw-Hill, 2013 3. B. Yegnanarayana, Artificial Neural Networks, Prentice- Hall of India, 1999 4. C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006

19UCB908	INTRODUCTION TO BLOCK CHAIN TECHNOLOGY AND APPLICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Study the concepts of Block chain Technology and Applications.

UNIT I		9

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II		9

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III		9

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT IV		9

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT V		9

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of Block Chain Technologies and its Applications.
- Analyze the Block chain Algorithms.
- Develop a application using Block Chain Technologies concepts

- Create a application for given real time problem

TEXT BOOKS:

1.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

REFERENCE BOOKS:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

19UCB909	INTRODUCTION TO INDUSTRY 4.0	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- This course is designed to offer learners an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world.
- Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

UNIT I	INTRODUCTION	8 Hrs

Introduction, core idea, origin concept of industry 4.0,Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0

UNIT II	A CONCEPTUAL FRAMEWORK	9 Hrs

Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0.

UNIT III	TECHNOLOGY ROADMAP	9 Hrs

Introduction, Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.

UNIT IV	ADVANCES IN ROBOTICS IN THE ERA OF INDUSTRY 4.0	9 Hrs

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly

UNIT V	THE ROLE OF AUGMENTED REALITY & OBSTACLES AND FRAMEWORK CONDITIONS FOR INDUSTRY 4.0	10 Hrs

Introduction, AR Hardware and Software Technology, Industrial Applications of AR, Lack of A Digital Strategy alongside Resource Scarcity, Lack of standards and poor data security, Financing conditions, availability of skilled workers, comprehensive broadband infra- structure, state support, legal framework, protection of corporate data, liability, handling personal data

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to define, understand the bassic concepts of Industry 4.0. **[Remember/Understand]**
- Apply the concepts of Industry 4.0 and scope for Indian Industry. **[Apply]**
- Analyze the given real time problem/s and develop complete solution/s after carefully selecting one or more of Industry 4.0 technique/s. **[Analyze]**
- Design the conceptual framework and road map of Industry 4.0. **[Design]**
- Investigate the Robotic technology and Augmented reality for Industry 4.0. **[Investigate]**
- Demonstrate obstacle and framework conditions for Industry 4.0 using Modern tool. **[Modern Tool]**

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".

REFERENCE BOOKS:

1. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
2. Klaus Schwab,"The Fourth Industrial Revolution".
3. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/106/105/106105195/

19UCB910	ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Understand the role of social media data and analytics in helping organizations achieve their goals and understand their publics;
- Identify and select key performance indicators to accurately measure the success of social media efforts;
- Analyze social media data using native analytics
- Examine the ethical and legal implications of leveraging social media data;

UNIT I	INTRODUCTION	9

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas

UNIT II	NETWORK FUNDAMENTALS AND MODELS	9

The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization

UNIT III	MAKING CONNECTIONS AND WEB ANALYTICS TOOLS AND TECHNIQUES	9

Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools and techniques: Click stream analysis, A/B testing, online surveys, Use of Google Analytics; Web crawling and Indexing; Natural Language Processing Techniques for Micro-text Analysis

UNIT IV	FACEBOOK ANALYTICS	9

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Postperformance on FB, Use of Facebook Business Manager; Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc

UNIT V	PROCESSING AND VISUALIZING	9

Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification. Applications in Advertising and Game Analytics (Use of tools like Unity30 / PyCharm). Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Explain and discuss the importance of Social Media Analytics. [Remember/Understand]
- Apply appropriate analytic tools to a range of social media data sources. [Apply]
- Analyze unstructured data primarily textual comments - for sentiments expressed in them. [Analyze]
- Design and Present a compelling argument for investment in social media in

marketing budgets for a given plan. [Design]

- Evaluate effectiveness of different social media campaigns using various analytical tools**. [Evaluate]**
- conduct experiments and implement SMA for given application using modern tool. **[Modern Tool]**

TEXT BOOKS:

1. Mathew Ganis, Avinash Koihrkar," Social Media Analytics", IBM Press,1st 2015
2. Jim Sterne," Social Media Metrics", Wiley,2019
3. Oliver Blanchard," Social Media ROI", Que Publishing,2019

REFERENCE BOOKS:

1. Marshall Sponder, Gorah F. Khan," Digital Analytics for Marketing", Routledge, 1st 2017
2. Marshall Sponder," Social Media Analytics", McGraw Hill,2019
3. Tracy L. Tuten, Michael R. Solomon," Social Media Marketing", V3rd 2018
4. Gohar F. Khan, " Creating Value With Social Media Analytics", CreateSpace Independent Publishing,1st 2018.
5. Alex Gonsalves," Social Media Analytics Strategy", Appress,1st 2017.

ONLINE RESOURCES:

1. https://searchbusinessanalytics.techtarget.com/definition/social-media-analytics
2. https://analytics.facebook.com
3. https://gameanalytics.com/blog/best-tools-for-mobile-game-developers.html
4. https://www.jetbrains.com/pycharm/features/scientific_tools.html

19UCB911	DATA SCIENCE FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Understand the mathematical foundations required for data science.
- Understand the data science algorithms, data analytics problem solving framework.
- Construct use cases to validate approach and identify modifications required.

UNIT I	INTRODUCTION	9

Data Analysis Life Cycle Overview. Data analysis Discovery, Framing Problem, Developing Initial Hypothesis, Sources of Data, Process for Making Sense of Data, Data Preparation, Performing ETLT, Data Conditioning, Survey and Visualize, Common tools for Data Preparation Phase, Data Exploration and Variable Selection, Common tools for the Model Planning and Building Phase, Communicate Results, Operationalize

UNIT II	DESCRIBING DATA	9

Observations and Variables, Types of Variables, Central Tendency, Distribution of the Data, Confidence Intervals, Hypothesis Tests, Student t-test.

UNIT III	PREPARING DATA TABLES	9

Cleaning the Data, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data

UNIT IV	UNDERSTANDING and IDENTIFYING RELATIONSHIPS	9

Visualizing Relationships Between Variables, Calculating Metrics About Relationships. IDENTIFYING AND UNDERSTANDING GROUPS: Clustering, K-means, Association Rules, Apriori Algorithm and Applications of Association Rules

UNIT V	BUILDING MODELS FROM DATA	9

Linear Regression, Logistic Regression, Bayes Theorem, Naive Bayes Classifier, k-Nearest Neighbours, Learning Decision Trees from Data.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concepts of mathematical foundations required for data science. **[Understand]**
- Apply the concept of Data Science to various applications. **[Apply]**
- Analyze the usage of appropriate Data analytics technique for a given application. **[Analyze]**
- Design and develop a data analytics method for different applications. **[Design]**
- Evaluate the solution approach **[Evaluation]**
- Construct use cases to validate approach and identify modifications required **[Create].**

TEXT BOOKS:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, Glenn J. Myatt, 2 nd Edition, Wiley 2014.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education services 2015.

REFERENCES BOOKS:

1. Python Data Science Handbook, Jake VanderPla s, 1 st Edition, O'Reilly, 2017.

WEB REFERENCES:

1. https://www.onlineprog rammingbooks.com/pyt hon-data-sciencehandbook/
2. https://www.coursera.org/learn/datascience-methodology
3. https://www.edx.org/course/foundationsof-data-science

19UCB912	CRYPTOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- **an overview of basic cryptographic concepts and methods**.
- **a good knowledge of some commonly used cryptographic primitives and protocols**.
- **understanding of theory and implementation**, as well as limitations and vulnerabilities.

UNIT I	INTRODUCTION	9

Introduction Caeser cipher, Modular arithmetic, shift cipher, Affine Cipher, Vigenere Cipher, Prefect secrecy, Application of Shift Cipher, Problem Discussion on Affine cipher and Perfect Secrecy

UNIT II	CIPHER AND CRYPTANALYSIS	9

Product Cipher, Block Cipher, Modes of Operation for Block Cipher, Substitution Permutation network, Fiestel Cipher, S-Box Theory, Cryptanalysis and its Variants, Linear Attack, Problem Discussion

UNIT III	CRYPTOSYSTEM AND ALGORITHMS	9

Public Key Cryptology Introduction RSA Cryptosystem, Complexity analysis of Euclidian Algorithm and RSA Cryptosystem square and multiply algorithm,

UNIT IV	PRIMALITY TESTING ALGORITHMS	9

Miler-Rabin Algorithm, Legendre Symbol and Jacobi Symbol, Efficien Computation of Jacobi Symbol, Solovay-Stassen Algorithm, Problem Discussion on Jacobi Symbol Calculation and RSA Cryptosystem

UNIT V	CRYPTOGRAPHIC HASH FUNCTION	9

Introduction, Random Oracle model, Security of hash functions, Randomized Algorithm and its application on Preimage resistance and collision resistance, Iterated Hash Functions, Problem Discussion

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the basic concepts of Cryptology. **[Understand]**
- Apply the concept of Cryptology to solving security problems. **[Apply]**
- Analyze the cryptographic protocols, including the basic number theory. **[Analyze]**
- Design a model for given scenario using variety of protocols and algorithms. **[Design]**
- Evaluate the variety of protocols for providing security in digital systems **[Evaluation]**
- solve the real-world problem using the modern tools **[Modern tool]**

TEXTBOOK:

1. Stinson D., “Cryptography Theory and Practice”, 3rd;edition, Chapman & Hall / CRC,3rd edition,2017

REFERENCES BOOKS:

1. Das A. and Venimadhavan C.E., “Public-Key Cryptography-Theory and Practice”, Pearson Education Inc, 2009
2. Koblitz N., “A Course in Number Theory and Cryptography”, 2nd edition,Springer (Indian Reprint),1987
3. Buchman J., “Introduction to Cryptography”, 2nd edition,Springer (Indian Reprint),2019.

WEB REFERENCES:

1. https://drive.google.com/file/d/1x3OwEAmJ1HsiFsnwQEFOZfxondLUi6cB/view

19UCB913	GRAPH THEORY AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Be familiar with the most fundamental Graph Theory topics and results.
- Be exposed to the techniques of proofs and analysis.

UNIT I	INTRODUCTION	9

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT II	TREES, CONNECTIVITY & PLANARITY	9

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.

UNIT III	MATRICES, COLOURING AND DIRECTED GRAPH	9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

UNIT IV	PERMUTATIONS & COMBINATIONS	9

Fundamental principles of counting – Permutations and combinations – Binomial theorem – combinations with repetition – Combinatorial numbers – Principle of inclusion and exclusion – Derangement – Arrangements with forbidden positions.

UNIT V	GENERATING FUNCTIONS	9

Generating functions – Partitions of integers – Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concepts of Graph Theory and its Applications. [**Understand]**
- Identify spanning trees, cut sets, isomorphism and different representations of a planar graph. **[Apply]**
- Analyze the difference between planar and non-planar graphs and solve problems. [**Analyze]**
- **Design and** develop efficient algorithms for graph related problems in different domains of engineering and science. **[Design]**
- Evaluate and select the appropriate Theory to solve the problem. **[Evaluate]**
- Solve the given real time Scenario using Modern tools. **[Modern tool]**

TEXTBOOK:

1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Prentice Hall of India, 2003.
2. Grimaldi R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, Addison Wesley, 1994..

REFERENCES:

1. Clark J. and Holton D.A, “A First Look at Graph Theory”, Allied Publishers, 1995
2. Mott J.L., Kandel A. and Baker T.P. “Discrete Mathematics for Computer Scientists and Mathematicians” , Prentice Hall of India, 1996
3. Liu C.L., “Elements of Discrete Mathematics”, Mc Graw Hill, 1985
4. Rosen K.H., “Discrete Mathematics and Its Applications”, Mc Graw Hill, 2007.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111/106/111106102/

19UCB914	SOFTWARE QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Understand the quality assurance context
- Understand SQA projects, management, standards and management organization.
- To develop awareness regarding the theoretical and methodological issues related to software project management.
- To develop software projects based on current technologies.
- Demonstrate critical thinking, integrative reasoning, & communication skills

UNIT I	INTRODUCTION	9

Concepts and Overview: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software

UNIT II	SOFTWARE QUALITY ASSURANCE	9

Software Quality Assurance: The Philosophy of Assurance, The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques. Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.

UNIT III	EVALUATION AND CONFIGURATION MANAGEMENT	9

Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations. Configuration Management: Maintaining Product Integrity, Change Management, Version Control, Metrics, Configuration Management Planning.

UNIT IV	ERROR REPORTING AND TREND ANALYSIS	9

Error Reporting: Identification of Defect, Analysis of Defect, Correction of Defect, Implementation of Correction, Regression Testing, Categorization of Defect, Relationship of Development Phases. Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

UNIT V	CORRECTIVE ACTION AS TO CAUSE	9

Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken. Traceability, Records, Software Quality Program Planning, Social Factors: Accuracy, Authority, Benefit, Communication, Consistency, and Retaliation.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the process of Software Project Management. [**Understand]**
- Conduct project planning activities that accurately forecast project costs. **[Apply]**
- Analyze the skills required for managing projects, project teams, and stakeholders. [**Analyze]**
- Design and manage the software project using Handle tools. **[Design]**
- Select and use project management frameworks that ensure successful outcomes. **[Evaluate]**
- Solve the given real time Scenario using Modern tools. **[Modern tool]**

TEXTBOOK:

1. Robert Dunn, “Software Quality Concepts and Plans”, Prentice-Hall, 1990.
2. Alan Gillies, “Software Quality, Theory and Management”, Chapman and Hall, 1992.

REFERENCES:

1. Michael Dyer, “The Cleanroom approach to Quality Software Engineering”, Wiley & Sons, 1992.
2. Daniel Freedman, Gerald Weinberg, “Handbook of Walkthroughts, Inspections and Technical Reviews”, Dorset House Publishing, 1990.
3. Tom Gilb, “Principles of Software Engineering Management”, Addison-Wesley, 1988.
4. Tom Gilb, Dorothy Graham, “Software Inspection” Addison-Wesley, 1993.
5. Watts Humphrey, “Managing the Software Process”, Addison-Wesley, 1990.
6. Watts Humphrey, “A Discipline for Software Engineering”, Addison-Wesley, 1995.
7. Arthur Lowell, “Improving Software Quality An Insiders guide to TQM”, 1993, Wiley & Sons.

WEB REFERENCES:

1. http://www2.cis.gsu.edu/cis/news/newandnoteworthy2.asp Access from the GSU online library:
2. http://www.library.gsu.edu/ebooks/;
3. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
4. http://www.cl.cam.ac.uk/~lp15/papers/Notes/SE-I.pdf 3 http://archive.mu.ac.in/myweb_test/MCA
5. https://teaching.csse.uwa.edu.au/units/CITS3220/lectures/09projManIntro.pdf
6. https://mrcet.com/downloads/digital_notes/CSE/IV%20Year/SOFTWARE%20PROJECT%20MANAGEMENT.pdf

19UCB915	INTRODUCTION TO PARALLEL AND DISTRIBUTED ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand different parallel and Distributed architectures and models of computation.
- To introduce the various classes of parallel algorithms and Distributed Algorithm.
- To study parallel and Distributed algorithms for basic problems.

UNIT I	INTRODUCTION	9 Hrs

Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

UNIT II	PRAM ALGORITHMS	9 Hrs

Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching.

UNIT III	SIMD ALGORITHMS -I	9 Hrs

2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication

UNIT IV	DISTRUBUTED ALGORITHM-MODELS	9 Hrs

Basic concepts. Models of computation: shared memory and message passing systems, synchronous and asynchronous systems. Logical time and event ordering. Global state and snapshot algorithms, clock synchronization.

UNIT V	DISTRIBUTED OPERATING SYSTEMS	9 Hrs

Distributed Operating Systems: Mutual exclusion, deadlock detection Classical Algorithms: Leader election, termination detection, distributed graph algorithms.

COURSE OUTCOMES:

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

- Ability to Identify the basic concepts in Parallel and Distributed Algorithm**. [Understand]**
- Ability to Apply Various Parallel and Distributed Algorithm in real world problems**. [Apply]**
- Analyze efficiency of different parallel algorithms. **[Analyze]**
- Develop parallel and Distributed algorithms for standard problems and applications. **[Create]**
- Ability to investigate different Algorithm models. **[Investigation]**

TEXT BOOKS:

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.

4. Nancy Lynch, Distributed Algorithms, Morgan Kaufmann.
5. Andrew S. Tanenbaum, Distributed Operating Systems, ACM Press.

REFERENCE BOOKS:

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

19UCB916	FAULT TOLERANT COMPUTING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To create understanding of the fundamental concepts of fault tolerance systems
- To learn basic techniques for achieving fault tolerance in hardware
- To have in-depth understanding in software fault tolerance systems
- To gain knowledge in design & testing of fault tolerance systems
- To develop skills in modelling and evaluating fault tolerant architectures in Real time systems

UNIT I	INTRODUCTION	9 Hrs

Faults, Errors and Failures - Levels of Fault tolerance - Dependability measures - Dependability evaluation - Fault Tolerant techniques - Hardware redundancy - Information redundancy - Software redundancy- Time redundancy -Software reliability.

UNIT II	HARDWARE FAULT TOLERANCE	9 Hrs

Passive hardware redundancy - Triple/N modular redundancy - Voting techniques - Active hardware redundancy - Hybrid techniques - Fault tolerance at processor level - Byzantine failures - Network topologies and their resilience.

UNIT III	SOFTWARE FAULT TOLERANCE	9 Hrs

Evolution of Recovery block concept – N Version programming - Stochastic Reward Nets - Approaches to software Fault tolerance - Analysis of software fault tolerance - Exception handling in Hierarchical Modular Programs- Check pointing in Modular programs-Random Check pointing - Issues in fault tolerance implementation.

UNIT IV	DESIGN DIVERSITY & TESTING	9 Hrs

Memory Technologies - Basics of Caches - Measuring and Improving Cache Performance - dependable memory hierarchy - Virtual Machines - Virtual Memory - Using FSM to Control a Simple Cache - Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks - Advanced Material: Implementing Cache Controllers.

UNIT V	FAULT TOLERANCE IN REAL TIME SYSTEMS	9 Hrs

Time- Space tradeoff - Fault tolerant scheduling algorithms - Fault tolerant ATM switches - Fault tolerant Routing and sparing Techniques - Yield and reliability enhancement for VLSI/WSI array processors. Case studies: Non-stop systems, Stratus systems, Cassini command and data sub system, IBM G5, Itanium

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the need for fault tolerance systems. [Understand]
- Ability to apply the concepts and Work in the internal technologies of fault tolerance in hardware. [Apply]

- Ability to analyze the the behavior of various software faults [Analyze]
- Ability to design & testing various fault tolerance systems. [Design]
- Ability to Model and evaluate fault tolerant architectures in Real time systems
- . [Investigation]
- Ability to solve the real-world problem using the modern tools. [Modern tool]

REFERENCE BOOKS:

1. E.Dubrova, —Fault-Tolerant Design‖, Springer, 2013, ISBN 978-1-4614-2112-2
2. I. Korenand, M.Krishna, —Fault Tolerant Systems‖, Morgan Kaufmann, 2007, SanFransisco, CA
3. Kjetil Norvag, —An Introduction to fault tolerant systems‖, IDI Technical report, July 2000, ISSN 0802-6394
4. Micheal R.Lyu, —Software fault tolerance‖, John Wiley & Sons Ltd.,

19UCB917	INTRODUCTION TO AD HOC AND SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand the basic hardware and software issues of computer organization
- To understand the representation of data at machine level
- To understand how computations are performed at machine level
- To understand the memory hierarchies, cache memories and virtual memories
- To learn the different ways of communication with I/O devices

UNIT I	ADHOC AND SENSORS NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS	9 Hrs

Wireless Sensor Networks (WSNs): concepts and architectures - Applications of Ad Hoc and Sensor Networks - Design Challenges in Ad hoc and Sensor Networks. Wireless Networks, Issues in Ad hoc wireless networks, Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).:

UNIT II	WSN NETWORKING CONCEPT AND MAC PROTOCOLS	9 Hrs

Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks - Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, MAC Protocols for wireless sensors Networks, Low duty cycle Protocols and Wakeup concepts, Classification of MAC Protocols , S-MAC, Contention based protocols -PAMAS schedule based protocols –LEACH, IEEE 802.15.4. MAC protocols , Energy efficient routing challenges and issues in transport layer

UNIT III	ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS:	9 Hrs

Routing Protocol: Issues in designing a routing protocol for Ad hoc networks - Classification-proactive routing - reactive routing (on-demand) - hybrid routing - Transport Layer protocol for Ad hoc networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks - Classification of Transport Layer solutions-TCP over Ad hoc wireless

UNIT IV	SENSOR NETWORKS INTRODUCTION AND ARCHITECTURES	9 Hrs

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations.

UNIT V	SENSOR NETWORK SECURITY	9 Hrs

Security in Ad Hoc Wireless Networks - Network Security Requirements. Network Security requirements issues and Challenges in security provisioning Network, Security Attacks. Layer wise attack in wireless sensor networks, possible solutions for Jamming, tampering black hole attack, Flooding attack, Key distribution and Management, Secure Routing -SPINS reliability requirements

in sensors Networks. Sensor Network Platforms and Tools

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the Fundamental Concepts and applications of ad hoc and wireless sensor networks and apply this knowledge to identify the suitable routing algorithm based on the network. **[Understand]**
- Apply the knowledge to identify appropriate physical and MAC layer protocols **[Apply]**
- Ability to analyze the Routing Prorocols ,Architecture and Security issues in Sensor Network.. **[Analyze]**
- Ability to design routing protocols for ad hoc wireless networks with respect to TCP design issues. **[Design]**
- Ability to investigate the challenges in security provisioning ,Security Attacks and security issues possible in Adhoc and Sensors Networks**. [Investigation]**
- Ability to solve the real-world problem using the modern tools NS2 Simulator. **[Modern tool]**

TEXT BOOKS:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Pearson Education, 2008.
2. Labiod. H, “Wireless Adhoc and Sensor Networks”, Wiley, 2008.
3. Li, X, “Wireless ad -hoc and sensor Networks: theory and applications”, Cambridge University Press, 2008.

REFERENCE BOOKS :

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, world Scientific Publishing Company, 2nd edition, 2011.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005 (soft copy available) .
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley, 2007. (soft copyavailable).
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.(soft copy available)

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1. www.wirelessnetworksonline.com
2. www.securityinwireless.com
3. www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf Practice Aspects 1. NS2 Simulator tool

19UCB918	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

UNIT I	ILLUMINATION AND COLOR MODELS	9

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

UNIT II	TWO-DIMENSIONAL GRAPHICS	9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms

UNIT III	THREE-DIMENSIONAL GRAPHICS	9

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV	MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING	9

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies

UNIT V	HYPERMEDIA	9

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to understand the Concepts in Graphics and Multimedia. [**Understand]**
- Ability to Apply two dimensional transformations and three Dimensional Tranformational to solve Practical Problems. R programming for manipulation of datasets. **[Apply]**
- Ability to Analyze various two Dimensional and Three Dimensional Transformation R. [**Analyze]**
- Ability to design 2D ,3D and apply various Illumination and Color model. **[Design]**
- Ability to Investigate various clipping techniques t and understand Multimedia File format. **[Investigation]**
- Ability to conduct experiments of Grpahics using Modern Tool. [**Modern tool]**

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT I – III]
2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design‖, PHI, 2003. [UNIT IV,V]

REFERENCE BOOKS:

1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications‖, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice‖, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, —Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics‖, CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, —Principles of Interactive Computer Graphics‖, Mc Graw Hill1978. https://www.blender.org/support/tutorials

19UCB919	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

UNIT I	INTRODUCTION	9

Information Retrieval – Early Developments – The IR Problem – The User_s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II	MODELING AND RETRIEVAL EVALUATION	9

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III	TEXT CLASSIFICATION AND CLUSTERING	9

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT IV	WEB RETRIEVAL AND WEB CRAWLING	9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures– Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V	RECOMMENDER SYSTEM	9

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand concepts in Information Retrieval [**Understand]**
- Apply appropriate method of classification or clustering. **[Apply]**
- Analyze open source search engine framework and explore its capabilities [**Analyze]**
- Design and implement implement a recommender system. innovative features in a search engine **[Design]**
- Evaluate existing andIllustrate various clustering and outlier techniques for grouping the given data**[Evaluate]**

TEXT BOOKS:

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbookǁ, First Edition, 2011.

REFERENCE BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

19UCB920	INFORMATION STORAGE MANAGEMENT CONCEPTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To emphasize the need for Information storage, provides an in depth coverage of technologies in the various phases of designing, building and sustaining an Information Storage System
- To provide an overview of various management techniques.

UNIT I	STORAGE NETWORKING TECHNOLOGIES	9

Fibre Channel SAN - SAN-based virtualization – VSAN - IP SAN - Storage access over IP network - Network Attached Storage – File level virtualization in NAS – Integration of NAS and SAN - CAS – Object based storage - Unified Storage platform.

UNIT II	BUSINESS CONTINUITY	9

Information availability and Business Continuity - Business Continuity terminologies - Business Continuity Planning – Solutions - Clustering and Multipathing architecture - Single Points of Failure - Backup and Recovery - Methods, targets and topologies - Data Deduplication and backup in virtualized environment - Fixed Content and Data Archive – Replication - Local Replication - Remote Replication - Three-Site Remote Replication - Continuous Data Protection

UNIT III	MONITORING AND MANAGEMENT	9

Monitoring and managing storage infrastructure components in classic and virtual environments - Information lifecycle management (ILM) and Storage Tiering - Cloud service management

UNIT IV	SECURITY	9

Storage Security (Importance of Information security, elements and attributes of security), Developing a storage security model (Restricting Access Path, Vulnerability Management, Understanding Vulnerabilities), Securing Data Storage (Storage Security domains, Risk assessment Methodology, Security elements, threats against applications, Controlling user access to data, threats again backup , recovery and archive)

UNIT V	VIRTUALIZATION	9

Virtualization (Define virtualization, types of virtualization), Storage Virtualization (Storage functionality, Virtual storage, Comparison of virtualization architectures, challenges of storage virtualization), Block level virtualization, File level virtualization.

COURSE OUTCOMES:

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

- Ability to understand the components and functions of Information Storage System. [**Understand]**
- Apply Investigate the common issues in Storage Infrastructure. **[Apply]**
- Ability to Analyze the working of Information Storage Systems . [**Analyze]**
- Ability to design storage system for the given scenario. **[Design]**
- Ability to Investigate various storage system **[Investigation]**

- Ability to conduct experiment using Modern Tool. [**Modern tool]**

TEXT BOOKS:

1. Information Storage and Management, Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, EMC Educational Services, Wiley 2012.

REFERENCE BOOKS:

1. Designing Storage Area Networks, Tom Clark, Addison-Wesley Professional, edition, 2003.
2. Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs, Richard Barker, Paul Massiglia, Wiley, 2001
3. Storage Networks: The Complete Reference, Robert Spalding,Tata McGraw Hill, 2003.
4. Disaster Recovery and Business Continuity, Thejendra BS, Shroff Publishers, 2006
5. Information Storage and Management, Wiley Publication ISBN: 978-81-265-2147-0
6. Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill
7. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill.

19UCB921	INTRODUCTION TO MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To learn the basic architecture and concepts till Third Generation Communication systems.
- To understand the latest 4G Telecommunication System Principles.
- To introduce the broad perspective of pervasive concepts and management
- To explore the HCI in Pervasive environment
- To apply the pervasive concepts in mobile environment

UNIT I	INTRODUCTION	9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT II	OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM	9

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA.

UNIT III	PERVASIVE CONCEPTS AND ELEMENTS	9

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction - Pervasive Transaction Processing - Infrastructure and Devices -

UNIT IV	HCI IN PERVASIVE COMPUTING	9

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - Context- Driven HCI Service Selection - Interaction Service Selection Overview

UNIT V	PERVASIVE MOBILE TRANSACTIONS	9

Pervasive Mobile Transactions - Introduction to Pervasive Transactions - Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework – Context-Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism

TOTAL:45Periods

COURSE OUTCOMES:

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

- Ability to Obtain a through understanding of Basic architecture and concepts of till Third Generation Communication systems [**Understand]**
- Ability to Explain the latest 4G Telecommunication System Principles **[Apply]**
- Ability to Incorporate the pervasive concepts. [**Analyze]**
- Ability to Implement the HCI in Pervasive environment **[Design]**
- Ability to Work on the pervasive concepts in mobile environment. **[Investigation]**

TEXT BOOKS:

1. Alan Colman, Jun Han, and Muhammad AshadKabir, Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications, Springer, 2016

2. J.Schiller, —Mobile Communication‖, Addison Wesley, 2000.
   JuhaKorhonen, —Introduction to 4G Mobile Communications‖ ,Artech House Publishers, 2014

REFERENCE BOOKS:

1. Kolomvatsos, Kostas, Intelligent Technologies and Techniques for Pervasive Computing, IGI Global, 2013
2. M. Bala Krishna, Jaime LloretMauri, —Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks‖, CRC 2016
3. MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, — Pervasive Computing: Concepts, Technologies and Applications ‖ CRC Press, 2016

19UCB922	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT I	FOUNDATIONS OF HCI	9 Hrs

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT II	DESIGN & SOFTWARE PROCESS	9 Hrs

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering –Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III	MODELS AND THEORIES	9 Hrs

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia

UNIT IV	MOBILE HCI	9 Hrs

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0,Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT V	WEB INTERFACE DESIGN	9 Hrs

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to identify the basic concepts and design issues of Computer Organization and Architecture**. [Understand]**
- Ability to apply the concepts of basic functional units to demonstrate the working of computational system**. [Apply]**
- Ability to assess the importance of user feedback. **[Analyze]**
- Ability to Design effective dialog for HCI. **[Design]**
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites**.**

[Investigation]

- Ability to Develop meaningful user interface ATL CSIM **[Modern tool]**

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction‖, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)

2. Brian Fling, —Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV).

REFERENCE BOOKS

1. Bill Scott and Theresa Neil, —Designing Web Interfaces‖, First Edition, O'Reilly, 2009.

19UCB923	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to

- Understand the Software Project Planning and Evaluation techniques.
- Plan and manage projects at each stage of the software development life cycle (SDLC).
- Learn about the activity planning and risk management principles.
- Manage software projects and control software deliverables.
- Develop skills to manage the various phases involved in project management and people management.
- Deliver successful software projects that support organization‘s strategic goals.

UNIT I	PROJECT EVALUATION AND PROJECT PLANNING	9

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION	9

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT III	ACTIVITY PLANNING AND RISK MANAGEMENT	9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV	PROJECT MANAGEMENT AND CONTROL	9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management

UNIT V	STAFFING IN SOFTWARE PROJECTS	9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams–Communicationsgenres–Communicationplans–Leadership.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand Project Management principles while developing software. **[Understand]**
- Gain extensive knowledge about the basic project management concepts, framework and the process models. **[Apply]**
- Obtain adequate knowledge about software process models and software effort estimation techniques. **[Analyze]**
- Estimate the risks involved in various project activities. **[Design]**
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles. **[Evaluate]**
- Learn staff selection process and the issues related to people management**.** **[Modern tool]**

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCE

1. Robert K. Wysocki ―Effective Software Project Management‖ – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management‖- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.

19UCB924	AUGMENTED REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To introduce the relevance of this course to the existing technology through demonstrations,
  case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering
  applications
- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I	AUGMENTED REALITY FUNDAMENTALS	9 Hrs

Definition – Components and Platforms of AR – Ingredients of AR – Working of AR - Difference between AR and other systems – Challenges with AR

UNIT II	AR HARDWARE	9 Hrs

Sensors – Hardware Sensors, Processors- DisplaysAR -Displays Input device characteristics- Desktop input devices- Tracking Devices- 3D Mice-Special Purpose Input Devices- Direct Human Input- Home Brewed Input Devices- Choosing Input Devices for 3D Interfaces

UNIT III	AR SOFTWARE	9 Hrs

AR Software Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers , Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market

UNIT IV	CONTENT AND INTERACTION IN AR	9 Hrs

Creating visual content – creating audio content – creating content for other senses – Manipulation – Navigation -Reality applications and interaction in projected AR environments – Subjective vs. Objective point of view

UNIT V	MOBILE AR, AR APPLICATIONS	9 Hrs

Mobile AR, Advantages and Disadvantages – Architecture of mobile AR – Applications: Industry and Construction, Maintenance and Training, Medicine, Personal Information Display, Navigation, Television, Advertising, Games

TOTAL:45 Periods

COURSE OUTCOMES:

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

- To understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR. **[Understand]**
- To understand geometric modeling and Virtual environment. **[Understand]**

- To relate and differentiate VR/AR technology (**Analyze**)
- To use various types of Hardware and software in virtual Reality systems (**Apply**)
- To implement Virtual/Augmented Reality applications. (**Apply**)

TEXT BOOKS:

1. Dieter Schmalstieg, Tobias Hollerer - Augmented Reality: Principles and Practice – Pearson,(Addison Wesley Professional), India – 2015 – ISBN: 9789332578494
2. Greg Kipper, Joseph Rampolla - Augmented Reality: An Emerging Technologies Guide to AR – Syngress (Elsevier) – 2013 – ISBN: 9781597497336.

REFERENCE BOOKS:

1. Alan B. Craig - Understanding Augmented Reality: Concepts and Applications – Morgan Kaufmann (Elsevier) – 2013 – ISBN: 9780240824086

19UCB925	INTRODUCTION TO DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Gain an in-depth knowledge on managing, handling and analysing structured or unstructured data.
- Explore the concepts, methods, principles, techniques, tools applicable to any technology environment and establishes a baseline that can be enhanced by practice and additional real-world experience.

UNIT I	INTRODUCTION TO BIG DATA	9

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Introduction: Big Data - Characteristics of Big Data - Big data management architecture - Examining Big Data Types - Big Data Technology Components - Big data analytics - Big data analytics examples - Web Data Overview - Web Data in Action.

UNIT II	HADOOP	9

Introduction: History of Hadoop - Hadoop Ecosystem - Analyzing data with Hadoop - Hadoop Distributed File System - Design - HDFS concepts - Hadoop file system - Data flow - Hadoop I / O - Data integrity - Serialization - Setting up a Hadoop cluster - Cluster specification - cluster setup and installation - YARN.

UNIT III	MAPREDUCE	9

Introduction: Understanding Map Reduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures - Shuffle and sort - Map Reduce types and formats - features - counters - sorting - MapReduce Applications – Configuring and setting the environment - Unit test with MR unit - local test.

UNIT IV	SPARK	9

Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators - built-in control structures – functions and closures - inheritance.

UNIT V	NOSQL DATABASES	9

Introduction to NoSQL - MongoDB: Introduction - Data types - Creating - Updating and deleing documents -Querying - Introduction to indexing - Capped collections - Hbase: Concepts - Hbase Vs RDBMS – Creating records - Accessing data - Updating and deleting data - Modifying data - exporting and importing data. USE CASES: Call detail log analysis - Credit fraud alert - Weather forecast..

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the characteristics of big data and concepts of Hadoop ecosystem. [**Understand]**

- Apply Mapreduce programming model to process big data**. [Apply]**
- Analyze Spark and its uses for big data processing. [**Analyze]**
- Design programs for big data applications using Hadoop components. **[Design]**
- Illustrate the use of survival analytics models, measurements and its evaluation to real time applications. **[Evaluate]**

TEXT BOOKS

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2015.

2. Simon Walkowiak, “Big Data Analytics with R”, PackT Publishers, 2016.

REFERENCE BOOKS

1. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools,

Techniques, No SQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013.

2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.

3. Kim H. Pries, Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers”, CRC Press, 2015.

19UCB926	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To teach principles of object oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism.
- To impart fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification;
- To familiarize the concepts of packages and interfaces.
- To facilitate students in handling exceptions.
- To demonstrate the concept of event handling used in GUI.

UNIT I	JAVA BASICS	9

Review of Object oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.:

UNIT II	INHERITANCE AND POLYMORPHISM	9

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.

UNIT III	PACKAGES AND INTERFACES	9

Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces. I / O STREAMS: Concepts of streams, Stream classes-Byte and Character stream, Reading console Input and Writing Console output, File Handling.

UNIT IV	EXCEPTION HANDLING	9

Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes.MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.

UNIT V	AWT CONTROLS	9

The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar. Working with Frame class, Colour, Fonts and layout managers. EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events, Adapter classes, Inner classes.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concept in Object Oriented Programming [**Understand]**
- Apply the concepts to solve Complex Problem. **[Apply]**
- Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP like encapsulation, Inheritance and Polymorphism [**Analyze]**
- Design and develop java programs, analyze, and interpret object oriented data and report results. **[Design]**
- Solve the given real time Scenario using Modern tool**[Modern tool]**

TEXT BOOKS:

1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi

REFERENCE BOOKS:

1. T.Budd(2009),An Introduction to Object Oriented Programming, 3rd edition, PearsonEducation, India.
2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.

19UCB927	SPEECH AND NATURAL LANGUAGE PROCESSING CONCEPTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand the use of CFG and PCFG in Natural language processing
- To learn the fundamentals of natural language processing
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

UNIT I	INTRODUCTION	9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II	WORD LEVEL ANALYSIS	9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models

UNIT III	SYNTACTIC ANALYSIS	9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV	SEMANTICS AND PRAGMATICS	9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V	DISCOURSE ANALYSIS AND LEXICAL RESOURCES	9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the To tag a given text with basic Language features [Understand]
- To design an innovative application using NLP components [Apply]
- To implement a rule based system to tackle morphology/syntax of a language

[Analyze]

- To design a tag set to be used for statistical processing for real-time applications. [Design]
- To compare and contrast the use of different statistical approaches for different types of NLP applications. [Evaluate]

TEXT BOOKS

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.

REFERENCE BOOKS

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

19UCB928	MANAGEMENT ACCOUNTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand concepts of Finance and Accounting
- To know how to use Accounts in Computerized Environment

UNIT I	FINANCIAL ACCOUNTING	9

Introduction to Financial, Cost and Management Accounting- Generally accepted accounting principles, Conventions and Concepts-Balance sheet and related concepts- Profit and Loss account and related concepts - Introduction to inflation accounting- Introduction to human resources accounting.

UNIT II	COMPANY ACCOUNTS	9

Meaning of Company -Maintenance of Books of Account-Statutory Books- Profit or Loss Prior to incorporation- Final Accounts of Company- Alteration of share capital- Preferential allotment, Employees stock option- Buy back of securities.

UNIT III	ANALYSIS OF FINANCIAL STATEMENTS	9

Analysis of financial statements – Financial ratio analysis, cash flow (as per Accounting Standard 3) and funds flow statement analysis.

UNIT IV	COST ACCOUNTING	9

Cost Accounts - Classification of manufacturing costs - Accounting for manufacturing costs. Cost Accounting Systems: Job order costing - Process costing- Activity Based Costing- Costing and the value chain- Target costing- Marginal costing including decision making- Budgetary Control & Variance Analysis - Standard cost system.

UNIT V	ACCOUNTING IN COMPUTERISED ENVIRONMENT	9

Significance of Computerised Accounting System- Codification and Grouping of Accounts- Maintaining the hierarchy of ledgers- Prepackaged Accounting software.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Study and use basic fundamental concepts in Financial and cost Accounting
- Implement Financial and cost accounting in Computerised Environment.

- Explore the scenario in Cost Accounting.
- Study about Company accounts and Financial accounting.

TEXT BOOKS

1. M.Y.Khan & P.K.Jain, Management Accounting, Tata McGraw Hill, 2004.
2. R.Narayanaswamy, Financial Accounting – A managerial perspective, PHI Learning, New Delhi, 2008.

REFERENCE BOOKS

1. Jan Williams, Financial and Managerial Accounting – The basis for business Decisions, 13th edition, Tata McGraw Hill Publishers, 2005.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, Introduction to Management Accounting, PHI Learning, 2008.
3. Stice & Stice, Financial Accounting Reporting and Analysis, 7th edition, Cengage Learning, 2008.
4. Singhvi Bodhanwala, Management Accounting -Text and cases, PHI Learning, 2008.
5. Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2007

19UCB929	STRATEGIC MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand about Strategic Management, Globalisation, Competitive Advantage, Implementation Strategies, Evaluation and Issues of Non-Profit Organisations.

UNIT I	STRATEGY AND PROCESS	9

Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business – Vision, Mission and Purpose – Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.

UNIT II	COMPETITIVE ADVANTAGE	9

External Environment - Porter's Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution- Globalisation and Industry Structure - National Context and Competitive advantage Resources- Capabilities and competencies–core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies-Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

UNIT III	STRATEGIES	9

The generic strategic alternatives – Stability, Expansion, Retrenchment and Combination strategies - Business level strategy- Strategy in the Global Environment-Corporate Strategy-Vertical Integration-Diversification and Strategic Alliances- Building and Restructuring the corporation-Strategic analysis and choice - Environmental Threat and Opportunity Profile (ETOP) - Organizational Capability Profile - Strategic Advantage Profile - Corporate Portfolio Analysis - SWOT Analysis - GAP Analysis - Mc Kinsey's 7s Framework - GE 9 Cell Model - Distinctive competitiveness - Selection of matrix - Balance Score Card-case study.

UNIT IV	STRATEGY IMPLEMENTATION & EVALUATION	9

The implementation process, Resource allocation, Designing organisational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic change-Politics-Power and Conflict-Techniques of strategic evaluation & control-case study.

UNIT V	OTHER STRATEGIC ISSUES	9

Managing Technology and Innovation- Strategic issues for Non Profit organisations. New Business Models and strategies for Internet Economy-case study

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand Enhanced strategy formulations, Strategy implementations, evaluation procedures, New Business Models Industrial Finance and Corporate Ethics [**Understand]**
- Apply business ideas in real world problems **[Apply]**
- Analyze and explore Financial decision, and Corporate ideas[**Analyze]**
- Design and Formulate Business goals to be followed in Industries **[Design]**
- Evaluate and identify Financial decision that can be applied in day-to-day life **[Investigation]**

TEXT BOOKS:

1. Thomas L. Wheelen, J.David Hunger and Krish Rangarajan, Strategic Management and Business policy, Pearson Education., 11th edition, 2007
2. Charles W.L.Hill & Gareth R.Jones, Strategic Management Theory, An Integrated approach, Biztantra, Wiley India,6th edition, 2007.
3. Azhar Kazmi, Strategic Management & Business Policy, Tata McGraw Hill, Third Edition, 2008.

19UCB930	BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To provide an integrative foundation in the field of business intelligence at the operational, tactical, and strategic levels.
- Ability to communicate one's analyses and recommendations to decision-makers

UNIT I	Introduction to Business Intelligence	9

Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, Setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management

UNIT II	Elements of Business Intelligence Solutions	9

Reports & ad hoc queries; Analyse OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications.

UNIT III	Building the BI Project	9

Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success,Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.

UNIT IV	Reporting authoring	9

Building reports with relational vs Multidimensional data models ; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.

UNIT V	BI Deployment, Administration & Security	9

Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the concepts in Business Intelligence.
- Gain extensive knowledge about the BI Development and Security
- Build Business Projects.
- Apply the concept of Business Intelligence in real world.

TEXT BOOKS

1. Business Intelligence (IBM ICE Publication).

REFERENCE BOOKS

1. http://en.wikipedia.org/wiki/Business_intelligence.
2. http://www.webopedia.com/TERM/B/Business_Intelligence.html.
3. Http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions.

19UCB931	BEHAVIORAL ECONOMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To Familiarise with the discipline behavioural economics.
- To understand about strategic interaction& behavioural game theory

UNIT I	INTRODUCTION	9

What is behavioural economics? - History and evolution- relation with other disciplines- objectives, and scope- themes and methodology of behavioural economics (theory, evidence, consilience) – application

UNIT II	FOUNDATION	9

Values, preferences and choice- believes- heuristic and biases- state dependent preferences (such as habit formation and addiction)- mis-prediction and projection bias-anticipation and information avoidance-decision making under risk and uncertainty- prospect theory- the role of reference-dependent preference in both risky (loss aversion) and risk free (endowment) choices-mental accounting- applications

UNIT III	INTER TEMPORAL CHOICE	9

The discounted utility model (origin, features, methodology, anomalies with discounted utility models)- alternative inter temporal choice models (time preferences, time inconsistent preferences-hyperbolic discounting- modifying the instantaneous functions)- applications

UNIT IV	STRATEGIC INTERACTION	9

Behavioural game theory (nature, equilibrium, mixed strategies, bargaining, iterated games, signalling, learning)- application

Modelling of social preferences –nature and factors affecting social preferences- distributional social preferences based on altruism, inequality aversion models- reciprocity models, evidence and policy implications

UNIT V	MOTIVATION AND PERSONALITY	9

Motivation and personality in economic behaviour- need for achievement- locus of control- sensation seeking and risk attitude- altruism- time preference- cognitive style-life style

COURSE OUTCOMES:

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

- Ability to understand basic concepts in behavioral economics. [**Understand]**
- Ability to Apply and understand Risk in Economics **[Apply]**
- Ability to Analyze the effects of Strategic Interaction. [**Analyze]**
- Ability to design various Modelling of social preferences. **[Design]**
- Ability to Evaluate various concepts in behavioral economics. **[Investigation]**

REFERENCE BOOKS:

1.An introduction to Behavioural economics by Wilkinson and Klaes, Palgrave McMillan

Behavioural Economics and Finance, by Michelle Beddeley, Rutledge, 2019

2.Behaviour economics and business ethics- interrelation and application by Alexander Rajko, Rutledge, London, 2012

3.Philosophical problems of behavioural economics by Steffan Heidel, Routlege, 1996

4.Psychology in Economics and business, Gerrit Ando Antonides, Springer Science Business Media, 1991

5.Economic Psychology (ed) Rob Rinyard, Wiley, 2018, chapter 16

19UCB932	ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology
- To focus on a strong emphasis upon practice of theory in Applications and Practical-oriented approach
- To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth
- To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

UNIT I	INTRODUCTION	9

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II	ERP SOLUTIONS AND FUNCTIONAL MODULES	9

Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

UNIT III	ERP IMPLEMENTATION	9

Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation,Methodology and Frame work- Training – Data Migration. People Organization in implementation-Consultants, Vendors and Employees

UNIT IV	POST IMPLEMENTATION	9

Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation

UNIT V	EMERGING TRENDS ON ER	9

Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics- Future trends in ERP systems-web enabled, Wireless technologies, cloud computing

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Make basic use of Enterprise software, and its role in integrating business

functions [Understand]

- Awareness of core and extended modules of ERP [Understand]
- Analyze the strategic options for ERP identification and adoption. [Analyze]
- To design a tag set to be used for statistical processing for real-time applications. [Design]
- To design an innovative application using NLP components [Design]
- Create reengineered business processes for successful ERP implementation. [Evaluate]

TEXT BOOKS

1. Alexis Leon, Enterprise Resource Planning, third edition, Tata McGraw-Hill, 2014..
2. mahadeo Jaiswal and Ganesh Vanapalli, first edition,ERP Macmillan India, 2013

REFERENCE Books

3. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
4. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
5. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
6. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

19UCB933	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To facilitate the understanding of Quality Management principles and process.
- To train them with various tools and techniques of Quality Management.
- To inculcate the importance of Quality in an organization.

UNIT I	INTRODUCTION	9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II	TQM PRINCIPLES	9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III	TQM TOOLS AND TECHNIQUES I	9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV	TQM TOOLS AND TECHNIQUES II	9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V	QUALITY SYSTEMS	9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Describe the dimensional barrier regarding Quality [**Understand]**
- Apply the various quality systems in implementation of Total quality management **[Apply]**
- Analyze the various types of techniques used to measure quality [**Analyze]**

- Discover the new decision principle in real time projects. **[Design]**
- Evaluate the Quality using different Quality systems. **[Investigation]**
- Solve the given real time problem with Pathmaker software**. [Modern tool]**

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, —Total Quality Managementll, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
19UCB971	Corporate Finance	3	0	0	3
19UCB972	R Programming	3	0	0	3
19UCB973	Computational Finance and Modeling	3	0	0	3
19UCB974	Machine Learning	3	0	0	3
19UCB975	Entrepreneurship Development	3	0	0	3
19UCB976	Business Analysis and DM Modeling using R	3	0	0	3
19UCB977	Perl Programming	3	0	0	3
19UCB978	Social Network Analysis	3	0	0	3
19UCB979	Introduction to Digital Marketing	3	0	0	3

19UCB971	CORPORATE FINANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- Understand ideas involved in short term corporate financing
- Gain Good ethical practices

UNIT I	INDUSTRIAL FINANCE	9

Indian Capital Market – Basic problem of Industrial Finance in India. Equity –Debenture financing – Guidelines from SEBI, advantages and disadvantages and cost of various sources of Finance - Finance from international sources, financing of exports – role of EXIM bank and commercial banks.– Finance for rehabilitation of sick units.

UNIT II	SHORT TERM-WORKING CAPITAL FINANCE	9

Estimating working capital requirements – Approach adopted by Commercial banks, Commercial paper- Public deposits and inter corporate investments.

UNIT III	ADVANCED FINANCIAL MANAGEMENT	9

Appraisal of Risky Investments, certainty equivalent of cash flows and risk adjusted discount rate, risk analysis in the context of DCF methods using Probability information, nature of cash flows, Sensitivity analysis; Simulation and investment decision, Decision tree approach in investment decisions

UNIT IV	FINANCING DECISION	9

Simulation and financing decision - cash inadequacy and cash insolvency- determining the probability of cash insolvency- Financing decision in the Context of option pricing model and agency costs- Inter-dependence of investment- financing and Dividend decisions.

UNIT V	CORPORATE GOVERNANCE	9

Corporate Governance - SEBI Guidelines- Corporate Disasters and Ethics- Corporate Social Responsibility- Stakeholders and Ethics- Ethics, Managers and Professionalism.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand Industrial Finance and Corporate Ethics [**Understand]**
- Apply business ideas in real world problems **[Apply]**
- Analyse and explore Financial decision,and Corporate ideas [**Analyze]**
- Design and Formulate Business goals to be followed in Industries **[Apply]**
- Evaluate and identifyFinancial decision that can be applied in day-to-day life **[Investigation]**

TEXT BOOKS

1. Richard A.Brealey, Stewat C.Myers and Mohanthy, Principles of Corporate Finance, Tata McGraw Hill, 9th Edition, 2011
2. I.M.Pandey, Financial Management, Vikas Publishing House Pvt., Ltd., 12th Edition, 2012.

REFERENCE BOOKS

1. Brigham and Ehrhardt, Corporate Finance - A focused Approach, Cengage Learning, 2nd Edition, 2011.
2. M.Y Khan, Indian Financial System, Tata McGraw Hill, 6th Edition, 2011
3. Smart, Megginson, and Gitman, Corporate Finance, 2nd Edition, 2011.
4. Krishnamurthy and Viswanathan, Advanced Corporate Finance, PHI Learning, 2011.

19UCB972	R PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand and able to use basic programming concepts
- To automate data analysis, working collaboratively and openly on code
- To know how to generate dynamic documents
- To use a continuous test driven development approach

UNIT I	INTRODUCTION TO R	9

Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R,Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers,Factors, Logical operations

UNIT II	CONTROL STRUCTURES AND VECTORS	9

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, ClassesVectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors,Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining theLength of a Vector, Matrices and Arrays as Vectors ,Vector Arithmetic andLogical Operations, Vector Indexing, Common Vector Operations

UNIT III	LISTS	9

Lists: Creating Lists, General List Operations, List Indexing Adding andDeleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, OtherMatrix-Like Operations

UNIT IV	FACTORS AND TABLES	9

Factors and Levels, Common Functions Used with Factors, Working withTables, Matrix/Array-Like Operations on Tables , Extracting a Sub table,Finding the Largest Cells in a Table, Math Functions, Calculating a Probability,Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT V	DATA VISUALIZATION	9

Graphics, Creating Graphs, Customizing Graphs, lattice library- Visualization, Box plot, Histogram, Pareto charts, Pie graph, Line chart, Scatterplot,visualization tool-word cloud.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Ability to understand basic fundamental concepts in R programming language [**Understand]**
- Ability to Apply R programming for manipulation of datasets. **[Apply]**

- Ability to Analyze various operators, control statements and scoping rules in R. [**Analyze]**
- Ability to design and implement the program using data frame ,list to provide the
- solution for various problem. **[Design]**
- Ability to Investigate various dataset using Statistical Tools available in R. **[Investigation]**
- Ability to conduct experiments of Computational using Modern Tool. [**Modern tool]**

TEXT BOOKS:

1. Roger D. Peng," R Programming for Data Science ", 2012
2. Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011

REFERENCES:

1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2. Venables , W.N.,and Ripley,"S programming", Springer, 2000.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ma33/preview
2. https://data-flair.training/blogs/object-oriented-programming-in-r/
3. http://www.r-tutor.com/elementary-statistics
4. https://www.tutorialspoint.com/r/

ONLINE RESOURCES:

1. https://www.r-tutor.com/elemntary-statstics
2. https://www.edx.org/learn/r-programming
3. https://www.javatpoint.com/r-tutorial

19UCB973	COMPUTATIONAL FINANCE AND MODELING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To build financial models by including various fields of study viz financial management and derivatives.
- To design and construct useful and robust financial modelling applications
- To recognize efficient financial budgeting and forecasting techniques
- To develop various portfolio models

UNIT I	INTRODUCTION TO FINANCIAL MODELLING & BUILT IN FUNCTIONS USING SPREAD SHEETS	9

Introduction to Financial Modelling- Need for Financial Modelling- Steps for effective financial modelling-Introduction to Time value of money & Lookup array functions :FV,PV,PMT,RATE,NPER, Vlookup, Hlookup ,if, countifetc - Time value of Money Models: EMI with Single & Two Interest rates –Loan amortisation modelling-Debenture redemption modelling

UNIT II	BOND & EQUITY SHARE VALUATION MODELLING	9

Alt Man Z score Bankruptcy Modelling-Indifference point modelling – Financial Break even modelling -Corporate valuation modelling(Two stage growth)- Business Modelling for capital budgeting evaluation: Payback period ,NPV ,IRR and MIRR.

UNIT III	CORPORATE FINANCIAL MODELLING	9

Appraisal of Risky Investments, certainty equivalent of cash flows and risk adjusted discount rate, risk analysis in the context of DCF methods using Probability information, nature of cash flows, Sensitivity analysis; Simulation and investment decision, Decision tree approach in investment decisions

UNIT IV	PORTFOLIO MODELLING	9

Risk ,Beta and Annualised Return –Security Market Line Modelling –Portfolio risk calculation (Equal Proportions)-Portfolio risk optimisation (varying proportions)-Portfolio construction modelling.

UNIT V	DERIVATIVE MODELLING	9

Option pay off modelling: Long and Short Call & Put options -Option pricing modelling (B-S Model)-Optimal Hedge Contract modelling.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Develop fast, efficient and accurate excel skills
- Design and construct useful and robust financial modelling applications
- Recognize efficient financial budgeting and forecasting techniques

- Familiarise the students with the valuation modelling of securities • Develop various portfolio models
-
- Understand Industrial Finance and Corporate Ethics [**Understand]**
- Apply business ideas in real world problems **[Apply]**
- Analyse and explore Financial decision,and Corporate ideas [**Analyze]**
- Design and Formulate Business goals to be followed in Industries **[Apply]**
- Evaluate and identifyFinancial decision that can be applied in day-to-day life **[Investigation]**

TEXT BOOKS

1. John C. Hull, Options, Futures, and Other Derviatives Prentice Hall, Tenth Edition Ruey S. Tsay, Analysis of Financial Time Series John Wiley, 2020

REFERENCE BOOKS

1. Wayne L Winston," Microsoft Excel 2016-Data Analysis and Business Modelling ",PHI publications, (Microsoft Press),New Delhi,2017.
2. Chandan Sen Gupta, "Financial analysis and Modelling –Using Excel and VBA" , Wiley Publishing House ,2014'
3. Craig W Holden,"Excel Modelling in Investments" Pearson Prentice Hall, Pearson Inc,New Jersey,5th Edition 2015
4. Ruzhbeh J Bodanwala , "Financial management using excel spread sheet",Taxman Allied services Pvt Ltd, New Delhi,3rd Edition 2015.

19UCB974	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

UNIT I	INTRODUCTION	9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II	NEURAL NETWORKS AND GENETIC ALGORITHMS	9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III	BAYESIAN AND COMPUTATIONAL LEARNING	9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV	INSTANT BASED LEARNING	9

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V	ADVANCED LEARNING	9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand concepts of supervised, unsupervised, semi-supervised machine learning approaches. [**Understand]**

- Apply the back propagation algorithm and genetic algorithms to various problems **[Apply]**
- Analyze and suggest appropriate machine learning approaches for various types of problems [**Analyze]**
- Discuss the decision tree algorithm and indentity and overcome the problem of overfitting **[Apply]**
- Evaluate Machine learning Algorithm applied to real world Problem **[Evaluate]**
- **Solve the given real time problem with Colab and PyTorch [Modern tool]**

TEXT BOOK:

1. Tom M. Mitchell, -Machine Learning‖, McGraw-Hill Education(India) Private Limited, 2013 .

REFERENCES:

1. Ethem Alpaydin, –Introduction to Machine Learning (Adaptive Computation and Machine Learning)‖, The MIT Press 2004.
2. Stephen Marsland, -Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009.

19UCB975	ENTERPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To develop and strengthen entrepreneurial quality and motivation in students and
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I	ENTREPRENEURSHIP	9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II	MOTIVATION	9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives

UNIT III	BUSINESS	9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies

UNIT IV	FINANCING AND ACCOUNTING	9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax

UNIT V	SUPPORT TO ENTREPRENEURS	9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, CorrectiveMeasures-Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Understand the nature of entrepreneurship. [**Understand]**
- Apply business ideas in real world problems **[Apply]**
- Analyze and explore entrepreneurial leadership and management [**Analyze]**
- Design and Formulate Business goals to be followed in Industries **[Apply]**

- Evaluate and identify personal attributes that enable best use of entrepreneurial opportunities **[Evaluate]**

TEXT BOOKS :

1. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi,2013.
2. Donald F Kuratko, “Entreprenuership – Theory, Process and Practice”, 9th Edition, Cengage Learning, 2014.

REFERENCE BOOKS :

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

19UCB976	BUSINESS ANALYSIS AND DM MODELING USING R	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

Students should be able

1. To impart the knowledge of Business and understand Data Profiling.
2. To Acquire the knowledge of the Data Instruction and Modeling

UNIT I	UNDERSTANDING YOUR BUSINESS	9 Hrs

Identify business value - Determine how business and corporate drivers impact the strategic direction of the business - Analyze different project processes used in working with data - Compare different types of data

UNIT II	DATA PROFILING & CLENSING	9 Hrs

Data Profiling: Identify core data profiling tasks - Identify outliers - Use tools for data profiling - Data Cleansing: Identify core data cleansing tasks - Use tools for cleansing

UNIT III	ETL (EXTRACT, TRANSFORM, AND LOAD)	9 Hrs

Data Quality and MDM: Identify role of data quality in organization - Identify role of MDM in organization - Use tools for data quality and MDM - ETL Tools: Distinguish between ETL processes - Use Talend Data Integration - Use MSSQL SSIS

UNIT IV	DATA MODELING	9 Hrs

UNDERSTANDING DATA: Overview: Identify data roles in the organization - Determine how data moves through the data lifecycle - Data Modeling: Identify the role of data modeling in the organization - Analyze data modeling techniques - Use tools for data modeling

UNIT V	R BASICS	9 Hrs

Introduction, History and overview of R, elements and data structures, Sessions and Functions, Variables, Data Types, Vectors, Scalars, Conclusion, Data Frames, Lists, Matrices, Arrays, Classes, Data input/output, Data storage formats, Subsetting objects, Vectorization

Dealing with Incorrect Entries-Missing Value Treatment-Encoding Categorical Labels-Handling Outliers-Logarithmic Transformation-Standardization-Converting Column Types

COURSE OUTCOMES:

- Ability to understand the concepts of Business. [**Understand]**
- Ability to Apply Data Extraction and Modeling to solve real time problem. **[Apply]**
- Ability to Analyze various Data Modeling in Business [**Analyze]**
- Ability to design various Data Modeling in Business **[Design]**
- Ability to Investigate various dataset using Statistical Tools available in R. **[Investigation]**
- Ability to conduct experiments in Data Modeling using Modern Tool. [**Modern tool]**

REFERENCES:

1. Data Analytics Modeling Certificate; AICPA
2. Fundamentals of Business Analytics, 2nd Edition; R N Prasad, SeemaAcharya; Wiley
3. Business Analysis with Microsoft Excel and Power BI, 5th edition; Conrad G. Carlberg; Pearson
4. Data Analytics with R; BhartiMotwani; Wiley Norman Matloff, The Art of R Programming, Cengage Learning,ISBN: 9781593273842, No Starch Press, US-Publisher,2017
5. Larry Pace, Joshua Wiley, Beginning R -An Introduction to Statistical Programming, 2nd Edition, Apress, ISBN: 9781484203743, 2015

19UCB977	PERL PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand the basic Perl language features.
- To understand Perl language as a tool for convenient text, data storage and file processing.
- Execute programs from Perl environment and process their result

UNIT I	INTRODUCTION TO PERL	9

An overview of Perl Getting started, Scalar data – Numbers – Strings – Built-in warnings - Operators – Variables – Output with print – Control structures – Getting user input – More control structures.

UNIT II	LISTS AND HASHES	9

Introduction to lists, Simple lists, Complex lists, Accessing list values, List slices, Ranges, Combining ranges and Slices. Arrays – Accessing single and Multiple elements from an array – Interpolating Arrays into Strings – For Control Structure – Array functions (pop, push, shift, unshift, and sort) – Array manipulations; Introduction to Hashes – Hash element access – Hash functions – Typical use of hash

UNIT III	FILES AND DATA INPUT/OUTPUT	9

Files and Data Input from standard input – Diamond operator – Invocation Arguments – Standard Output – Formatted Output using printf – File Handles – Opening a file handle – Fatal errors – Using file handle – Reopening a standard file handle – Output with say – File handles in a scalar

UNIT IV	SUBROUTINES	9

Introduction to subroutines – Defining – Invoking – Return Values – Arguments – Private variables – Variable length parameter list – Lexical variables – Use strict pragma – Return operator – Non-scalar return values – Perl Unit – Finding and Installing Unit – Using simple Unit- CGI.

UNIT V	REGULAR EXPRESSIONS	9

Introduction to regular expressions- Simple patterns – Character classes – Matching with regular expression Processing text with regular expression – Substitutions – Split operator – Join function.

COURSE OUTCOMES:

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

- Ability to understand basic programming concepts of Perl. [**Understand]**
- Ability to Apply R programming to solve Complex Problem. **[Apply]**
- Ability to Analyze the effects of using Perl structures that implement decisions, loops, and store arrays. [**Analyze]**
- Ability to Design Perl programs that make use of various directories and use several files linked together. **[Design]**
- Ability to Investigate various concepts in Subroutines and files. **[Investigation]**
- Ability to conduct experiments on Perl Programming using Modern Tool. [**Modern tool]**

TEXT BOOKS :

1. Stephen Spainhour, Ellen Siever, Nathan Patwardhan," Perl in a Nutshell", O'Reilly Media Publications,1998. 2. Simon Cozens, Peter Wain Wrigth, "Beginning Perl", Wrox press, 1st edition, 2000.

REFERENCE BOOKS :

1. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, "Programming Perl", O'Reilly Media, 4th edition, 2012.

2. Randal L. Schwartz, Brian D Foy, Tom Phoenix, "Learning Perl", O'Reilly Media, 6th edition, 2011. 3. Ellie Quigley, "Perl by Example", Prentice Hall, 5th edition, 2014.

19UCB978	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

UNIT I	INTRODUCTION	9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks

UNIT II	MODELING AND VISUALIZATION	9

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III	MINING COMMUNITIES	9

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT IV	POST IMPLEMENTATION	9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V	Approaches in Social networking environment	9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic

Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Work on the internals components of the social network [Understand]
- Model and visualize the social network [Understand]
- Mine the behaviour of the users in the social network. [Analyze]
- Predict the possible next outcome of the social network.[Analyze]
- Apply social network in real time applications [Apply]

TEXT BOOKS

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advances‖, Springer, 2012
2. Borko Furht, —Handbook of Social Network Technologies and Applications‖, Springer, 1 st edition, 2011
3. Charu C. Aggarwal, —Social Network Data Analytics‖, Springer; 2014
4. Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis‖, Springer, 2010.
5. Guandong Xu , Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications‖, Springer, 1st edition, 2012

REFERENCE BOOKS

1. Peter Mika, —Social Networks and the Semantic Web‖, Springer, 1st edition, 2007.
2. Przemyslaw Kazienko, Nitesh Chawla,‖Applications of Social Media and Social Network Analysis‖, Springer,2015

19UCB979	INTRODUCTION TO DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

- To understand, design and implement online marketing tools.
- Translate some of the key marketing and business models
- Review the history of digital marketing
- Explain the key digital marketing activities needed for competitive success

UNIT I	INTRODUCTION	9

Digital Environment - Digital transformation, Programmatic marketing, Artificial intelligence, Virtual and augmented reality; Digital Customers - Online buying behaviour, Privacy; Non-marketers in digital marketing, Personalization, viral marketing, paid, earned, owned, content marketing, Influencers, Affiliate marketing, Attribution, Public relations and Reputation management, Integrated marketing communications, Gaming, Legal considerations, Strategic digital marketing, Digital marketing objectives.

UNIT II	E-COMMERCE AND DIGITAL MARKETING METRICS	9

E-Commerce - Multi-channel retailing, Fulfilment, Comparison shopping engines, e-marketplaces and third-party shopping websites, e-commerce website; Metrics and Analytics – Introduction, Analytics presentation and use.

UNIT III	WEBSITE CONTENT DEVELOPMENT	9

Introduction, Web presence ownership, management and development, Usability, Content development, B2Bwebsite, global web presence.

UNIT IV	SEARCH ENGINE OPTIMIZATION AND EMAIL MARKETING	9

Search Engine Optimization – Workings of search engines, Keyword selection, On-site optimization, Off-site optimization, Strategic search engine optimization, Third-party search engine ranking; Email Marketing - Email as a medium for direct marketing, Email as medium for marketing messages, Email newsletters.

UNIT V	ADVERTISING ONLINE AND SOCIAL MEDIA MARKETING	9

Advertising Online - Programmatic advertising , Objectives and management, Online ad formats, Search advertising, Network advertising, Landing pages; Marketing on Social Media – Blogging, Consumer reviews and ratings, Social networking, Social sharing, Social service and support, Strategic marketing on social media, Measuring and monitoring social media marketing.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Summarize the Digital Marketing Environment [**Understand**]
- Analyse the Dynamics of online selling and related metrics [**Understand**]
- Evaluate the managerial implication in Website Development. [**Analyze**]
- Demonstrate the Search Engine Optimization and Email Marketing.[**Analyze**]
- Develop the Advertising Online and Social Media Marketing strategies [**Apply**]

TEXT BOOKS:

1. Alan Charlesworth (2018), Digital Marketing - A Practical Approach, 3rd Ed, Routledge - Taylor & Francis Group.

2. Chaffey, Meyer, Fiona Ellis-Chadwick: “Digital Marketing-strategy implementation and practice”, (5th ed.),Prentice-Hall, 2012.

REFERENCE BOOKS:

1. Vandana Ahuja, 2015, “Digital marketing”, (1sted.), Oxford University Press,

2. Damian Ryan 2014., “Understanding Digital Marketing”, Kogan Page Limit,

3. Richard Gay, Alan Charlesworth, Rita Esen, “Online Marketing: A customer led approach”, Oxford University Press, 2007.

4. Judy Strauss, 2013 Reymond Frost, “E-Marketing”, (7th ed.), Pearson education.

5. Mohammed, Fisher, Jaworski and Cahill, 2010: “Internet Marketing: building advantage in a networked economy”, (2nd ed.), Tata McGraw-Hill

LIST OF ONE CREDIT COURSES

Course Code	Course Title	L	T	P	C
19UCB861	Web Designing	1	0	1	1
19UCB862	Big Data Computing	1	0	0	1
19UCB863	Animation Graphics	0	0	2	1
19UCB864	Soft Computing	1	0	1	1
19UCB865	Visualization using Tableau	1	0	1	1
19UCB866	Wordpress Applications	0	0	2	1
19UCB867	Multimedia Technology	1	0	1	1
19UCB868	Adobe Illustrator	0	0	2	1
19UCB869	Software Testing Tools-TestRail	1	0	1	1
19UCB870	Mongo DB Atlas Database	0	0	2	1
19UCB871	Game Development	0	0	2	1
19UCB872	Drone Technology	0	0	2	1
19UCB873	Data processing with PySpark	0	0	2	1
19UCB874	Scala	0	0	2	1
19UCB875	Data Analysis using SQL	1	0	1	1
19UCB876	Node js	1	0	1	1