GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)
Coimbatore - 641 013

Curriculum and Syllabi For
B.E. (COMPUTER SCIENCE AND ENGINEERING)
(Full Time)

2016
Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE - 641 013

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VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

- To achieve academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship.
- To improve the research competence to address societal needs.
- To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society.

VISION AND MISSION OF THE DEPARTMENT

VISION

To be in the frontier of Computer Science and Engineering and to produce globally competent graduates with moral values committed to build a vibrant nation.

MISSION

- To strengthen the core competence in Computer Science and Engineering through analytical learning.
- To produce successful graduates with personal and professional responsibilities and committed to lifelong learning.
- To uplift innovative research in Computer Science and Engineering to serve the needs of Industry, Government and Society.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12**. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Theoretical Computer Science: Students at the time of graduation will be able to apply fundamental knowledge of theoretical computer science and critically analyze problems to provide computer based solutions for engineering applications.

Hardware and software systems: Students at the time of graduation will be able to design cost effective hardware/software systems and components for engineering/social applications using the knowledge of hardware and/or software architecture, programming and development.

Technology: Students at the time of graduation will be able to apply appropriate technology to find solutions for complex problems.

Research Capability: Students at the time of graduation will be able to apply domain knowledge and expertise for enhancing research capability to transform innovative ideas into reality

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will be in computing profession as experts in solving hardware/software engineering problems by their depth of understanding in core computing knowledge or will have completed or will be pursuing research leading to higher degrees.

PEO2: Graduates will have sufficient breadth of understanding to enable continued professional development and lifelong learning throughout their career.

PEO3: Graduates will demonstrate creativity in their engineering practices including entrepreneurial and collaborative ventures with strategic thinking, planning and execution.

PEO4: Graduates will communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practise their profession with high regard to legal and ethical responsibilities.

B.E.COMPUTER SCIENCE AND ENGINEERING
CBCS 2016 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SHS1Z1	Communication Skills in English	HS	50	50	100	2	2	0	3
2	16SBS1Z2	Engineering Mathematics I	BS	50	50	100	3	2	0	4
3	16SBS103	Engineering Physics	BS	50	50	100	3	0	0	3
4	16SBS104	Applied Chemistry	BS	50	50	100	3	0	0	3
5	16SES105	Fundamentals of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
PRACTICAL										
6	16SBS106	Chemistry Lab	BS	50	50	100	0	0	4	2
7	16SES107	Workshop Practice	ES	50	50	100	0	0	4	2
		TOTAL		350	350	700				20

SECOND SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SHS2Z1	Technical English	HS	50	50	100	2	2	0	3
2	16SBS2Z2	Engineering Mathematics II	BS	50	50	100	3	2	0	4
3	16SBS2Z3	Materials Science	BS	50	50	100	3	0	0	3
4	16SHS2Z4	Environmental Science and Engineering	HS	50	50	100	3	0	0	3
5	16SES2Z5	Programming in C	ES	50	50	100	3	0	0	3
PRACTICAL										
6	16SBS206	Physics Lab	BS	50	50	100	0	0	4	2
7	16SES207	Engineering Graphics	ES	50	50	100	2	0	4	4
8	16SES2Z8	Programming in C Lab	ES	50	50	100	0	0	4	2
		TOTAL		400	400	800				24

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SBS3Z1	Engineering Mathematics III	BS	50	50	100	3	2	0	4
2	16SES302	Engineering Mechanics	ES	50	50	100	3	2	0	4
3	16SES303	Digital Systems	ES	50	50	100	3	0	0	3
4	16SES304	Analog and Digital Communication	ES	50	50	100	3	0	0	3
5	16SPC305	Data Structures	PC	50	50	100	3	0	0	3
6	16SBS306	Discrete Structures	BS	50	50	100	3	0	0	3
PRACTICAL										
7	16SES307	Digital Systems Laboratory	ES	50	50	100	0	0	4	2
8	16SPC308	Data Structures Laboratory	PC	50	50	100	0	0	4	2
9	16SEE309	Business Communication Skills	EEC	50	50	100	0	0	4	2
		TOTAL		450	450	**900**	18	4	12	**26**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SBS401	Probability, Random Processes and Queueing Theory	BS	50	50	100	3	2	0	4
2	16SPC402	Theory of Computation	PC	50	50	100	3	2	0	4
3	16SPC403	Computer Architecture	PC	50	50	100	3	0	0	3
4	16SPC404	Database Management Systems	PC	50	50	100	3	0	0	3
5	16SPC405	Principles of Operating Systems	PC	50	50	100	3	0	0	3
6	16SPC406	Design and Analysis of Algorithms	PC	50	50	100	2	0	2	3
PRACTICAL										
7	16SPC407	Database Management Systems Laboratory	PC	50	50	100	0	0	4	2
8	16SPC408	Operating Systems Laboratory	PC	50	50	100	0	0	4	2
9	16SEE409	Hardware Troubleshooting Skills	EEC	50	50	100	0	0	4	2
		TOTAL		**450**	**450**	**900**	17	4	14	**26**

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SPC501	Embedded Computing Systems	PC	50	50	100	3	0	0	3
2	16SES502	Science of Programming	ES	50	50	100	3	0	0	3
3	16SPC503	Computer Networks	PC	50	50	100	3	0	0	3
4	16SPC504	Software Engineering Methodologies	PC	50	50	100	3	0	0	3
5	16SPC505	Digital Signal Processing and Applications	PC	50	50	100	2	2	0	3
6	16SOE5xx	Open Elective-I	OE	50	50	100	3	0	0	3
PRACTICAL										
7	16SPC507	Embedded Computing Systems Laboratory	PC	50	50	100	0	0	4	2
8	16SPC508	Computer Networks Laboratory	PC	50	50	100	0	0	4	2
9	16SEE509	Applications Development Skills	EEC	50	50	100	0	0	4	2
		TOTAL		**450**	**450**	**900**	**17**	**4**	**12**	**24**

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	L	T	P	C
THEORY										
1	16SPC601	Distributed Computing	PC	50	50	100	3	0	0	3
2	16SPC602	Computer Graphics and Visualizations	PC	50	50	100	3	0	0	3
3	16SPC603	Compiler Design	PC	50	50	100	2	2	0	3
4	16SPC604	Wireless Communication and Networks	PC	50	50	100	3	0	0	3
5	16SOE6xx	Open Elective-II	OE	50	50	100	3	0	0	3
6	16SPE6xx	Professional Elective-I	PE	50	50	100	3	0	0	3
PRACTICAL										
7	16SPC607	Compiler Design Laboratory	PC	50	50	100	0	0	4	2
8	16SEE608	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL		400	400	**800**	17	2	12	**24**

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16SPC701	Industrial Management	HS	50	50	100	3	0	0	3
2	16SPC702	Machine Learning	PC	50	50	100	3	0	0	3
3	16SOE7xx	Open Elective-III	OE	50	50	100	3	0	0	3
4	16SPE7xx	Professional Elective-II	PE	50	50	100	3	0	0	3
5	16SPE7xx	Professional Elective-III	PE	50	50	100	3	0	0	3
6	16SPE7xx	Professional Elective-IV	PE	50	50	100	3	0	0	3
PRACTICAL										
7	16SPC707	Machine Learning Laboratory	PC	50	50	100	0	0	4	2
8	16SEE708	Open Source Usage Skills	EEC	50	50	100	0	0	4	2
		TOTAL		400	400	**800**	18	0	8	**22**

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	CAT	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
THEORY										
1	16SPE8xx	Professional Elective-V	PE	50	50	100	3	0	0	3
2	16SPE8xx	Professional Elective-VI	PE	50	50	100	3	0	0	3
PRACTICAL										
3	16SEE803	Project Work	EEC	50	50	100	0	0	16	8
		TOTAL		150	150	**300**	6	0	16	**14**

L- Lecture; T-Tutorial; P-Practical; C-Credits; INT-Internal; EXT-External; BS-Basic Science; HS- Humanities and Social Science; ES- Engineering Sciences; PC- Professional Core; PE- Professional Elective; OE- Open Elective; EEC- Employability Enhancement Course;

LIST OF PROFESSIONAL ELECTIVES

S.No	Course Code	Course Title
1	16SPEx01	Introduction to Web Technology
2	16SPEx02	Simulation and Modeling
3	16SPEx03	Pattern Recognition
4	16SPEx04	Artificial Intelligence
5	16SPEx05	Digital Image Processing
6	16SPEx06	Cryptography
7	16SPEx07	Real Time Systems
8	16SPEx08	Software Defined Networks
9	16SPEx09	Cloud Engineering
10	16SPEx10	Computer Vision
11	16SPEx11	Parallel Computing
12	16SPEx12	Graph Theory
13	16SPEx13	Object Oriented Analysis and Design
14	16SPEx14	Fuzzy Logic and Neural Networks
15	16SPEx15	Advanced Data Structures and Applications
16	16SPEx16	Multimedia Systems
17	16SPEx17	Internet of Things
18	16SPEx18	Big Data Analytics
19	16SPEx19	Adhoc Networks
20	16SPEx20	Information Security

LIST OF OPEN ELECTIVES

S.No	Course Code	Course Title
1	16AOEx01	NanoScience and Technology
2	16AOEx02	Material Characterizations
3	16AOEx03	Electrochemical Technology
4	16AOEx04	Polymer Technology
5	16COEx05	Disaster Management and Mitigation
6	16COEx06	Environmental Management
7	16COEx07	Town Planning and Architecture
8	16MOEx08	Total Quality Management for Engineers
9	16MOEx09	Composite Materials
10	16MOEx10	Automobile Engineering
11	16EOEx11	Renewable Energy Sources and Technology
12	16EOEx12	Smart Grid Technology
13	16LOEx13	Principles of Communication
14	16LOEx14	Microcontrollers and its Applications
15	16NOEx15	Industrial Automation Systems
16	16NOEx16	Measurements and Instrumentation
17	16SOEx17	Enterprise Java
18	16SOEx18	Cyber Security
19	16SOEx19	Network Essentials
20	16IOEx20	Programming in Python
21	16IOEx21	Big Data Science
22	16IOEx22	Object Oriented Programming Using C++
23	16BOEx23	Computational Biology
24	16BOEx24	Biology for Engineers
25	16BOEx25	Fundamentals of BioEngineering

LIST OF ONE-CREDIT COURSES

Sl. No.	Course Code	Course Title	CAT	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
1	16SOC1Z1	Human Values I	OC	100	-	100	1	0	0	1
2	16SOCx02	Human Values and Professional Ethics	OC	100	-	100	1	0	0	1
3	16SOCx03	Yoga for Youth Empowerment	OC	100	-	100	1	0	0	1

COURSE-CATEGORY DISTRIBUTION

CATEGORY	CREDITS	PERCENTAGE	SUGGESTED PERCENTAGE
HS	12	6.67%	5-10%
BS	32	17.78%	15-20%
ES	29	16.11%	15-20%
PC	60	33.33%	30-40%
PE	18	10.00%	10-15%
OE	9	5.00%	5-10%
EEC	20	11.11%	10-15%
Total	180	100%	

BS-Basic Science; HS- Humanities and Social Science; ES- Engineering Sciences; PC-Professional Core; PE- Professional Elective; OE- Open Elective; EEC- Employability Enhancement Course;

16SHS1Z1   **COMMUNICATION SKILLS IN ENGLISH**   **CATEGORY : HS**
(Common to all Branches)   L T P C
                                                             2 2 0 3

PREREQUISITES: Nil

Course Objectives:
- o To make the learners understand the usage of basic grammar in English.
- o To enhance the learner's speaking skills through appropriate listening practice.
- o To instill reading habits to practice communicative tasks and comprehension
- o To improve the learner's writing skills through various means
- o To enrich the vocabulary of learners for speaking and writing

UNIT I   **6+6 Periods**

Listening - Listening to practice basic pronunciation at phonemic and word level, Listening to informal conversations of exchanging greetings and introducing oneself/others;   **Speaking**-Introducing oneself, one's family / friend, speaking about one's place; **Reading**-Reading to practice stress and pause; **Writing**-Autobiographical writing, Letter to seek permission, Letter to issue certificates; **Grammar**- Use of Auxiliary Verbs, Adjectives and Adverbs; **Vocabulary**-Word formation, Synonyms and Antonyms of High frequency words.

UNIT II   **6+6 Periods**
Listening-Listening to Telephone Conversations for taking and leaving messages, making enquiries; **Speaking**—Role-play activities based on real life situations, Narrating daily routines; **Reading**– skimming and scanning, Reading for comprehension with exercises; **Writing**-Advertisements and slogan writing, Imperative instructions, Definitions; **Grammar** – Tenses, Prepositions; **Vocabulary**- Commonly confused words.

UNIT III   **6+6 Periods**
Listening -Listening to give instructions, Making requests and responding to requests, Thanking someone and responding to thanks; **Speaking** -Group Discussion on chosen topics, Describing a simple process; **Reading**-Reading and interpreting visual material, Critical reading; **Writing** – Letter to the Editor of a Newspaper, Recommendations; **Grammar**- Impersonal Passive, Subject-verb agreement; **Vocabulary**- Collocation, Word Association.

UNIT IV   **6+6 Periods**
Listening-Listening to accept/refuse invitation, Listening to apologize, Listening to congratulate; **Speaking** – Debates on current social affairs; **Reading** –Reading to make inference, Paraphrasing; **Writing-** Personal letter (Inviting your friend to a function, congratulating someone on his / her success, thanking one's friends / relatives); **Grammar** – 'Wh'-questions, Modal verbs; **Vocabulary** -Single word substitutes -Use of abbreviations & acronyms.

UNIT V   **6+6 Periods**

Listening -Video Listening to different accents, Viewing Speeches, Viewing English songs, Viewing short films; **Speaking** -Giving impromptu talks, Making presentations on given topics; **Reading** –Extensive reading;   **Writing** –Writing General Article, Writing Short Stories; **Grammar** - Common Errors in English; **Vocabulary** –Word Pairs with Repetitive meaning.

CONTACT PERIODS:
Lecture: 30 periods   Tutorial: 30 periods   Practical: 0 periods   Total: 60 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Department of English, Anna University. Mindscapes	*English for Technologists and Engineers*	*Orient Blackswan, Chennai. 2012*
Sadanand, Kamlesh & Punitha, Susheela	*Spoken English: A Foundation Course (Part 1)*	*Orient Blackswan, Hyderabad. 2014*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Raman, Meenakshi & Sangeetha Sharma	*Technical Communication: Principles and Practice*	*Oxford University Press, New Delhi. 2011*
Vijay, Anbazhagan.J, & Jaishree.N	*Technical English-I*	*Global Publishers, Chennai, 2016*
Rizvi, Ashraf. M.	*Effective Technical Communication*	*Tata McGraw-Hill, New Delhi. 2005*
Rutherford, Andrea. J Basic	*Communication Skills for Technology*	*Pearson, New Delhi. 2001*
Redston, Chris, Cunningham, Gillie	*Face 2 Face: Elementary Student's Book*	*Cambridge University Press, New Delhi. 2009*

EXTENSIVE READING (Not for Examination)
Kalam, Abdul. A.P.J. Wings of Fire. Universities Press, Hyderabad. 1999.

Websites
1. http://www.usingenglish.com
2. http://www.uefap.com

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: The learner will be able to understand basic grammar and the learner will have sufficient command over language by training his tongue and tuning his ear through apt listening tasks.
CO2: Reading tasks will enable the learner practice phonological and linguistic aspect of learning, help comprehend and create interest in extensive reading.
CO3: The learner shall be able to write appropriately for a given context and use the right word at the right place.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1										H						L
CO2										H						L
CO3										H						L
16SHS1Z1										H						L

L-Low, M-Moderate(Medium), H-High

16SBS1Z2   **ENGINEERING MATHEMATICS I**   **CATEGORY : BS**
                          (Common to all Branches)   L T P C
                                                                            3 2 0 4

PREREQUISITES: Nil
Course Objectives:

- o To familiarize techniques of matrix algebra including properties of eigen values and eigen vectors.
- o To gain the knowledge of hyperbolic functions and application problems in differential calculus.
- o To familiarize with functions of several variables and Functions of two variables including extremum problems, Jacobian and Leibnitz rule of integration.
- o To perform double and triple integration with relevant to surface area and volume of solid.

UNIT I   MATRICES   **9+6 Periods**

Eigen values and Eigen vectors of a real matrix-Characteristic equation-Properties of Eigen values and eigen vectors-Cayley Hamilton theorem - Diagonalization of matrices-Reduction of a quadratic form to canonical form by orthogonal transformation-Nature of quadratic forms

UNIT II   HYPERBOLIC FUNCTIONS AND DIFFERENTIAL   **9+6 Periods**
**   CALCULUS**

Hyperbolic and Inverse Hyperbolic functions-Identities- Real and Imaginary parts-Solving Problems using Hyperbolic functions.
Curvature and radius of curvature-Cartesian and polar coordinates- center of curvature and Evolutes- Envelopes and Evolute as envelope of normal.

UNIT III   FUNCTIONS OF SEVERAL VARIABLES   **9+6 Periods**

Functions of two variables- Taylor's theorem (statement only) and expansions-Maxima and Minima-Constrained extremum by Lagrange's multiplier method-Jacobians-Differentiation under integral sign

UNIT IV   INTEGRAL CALCULUS   **9+6 Periods**

Definite and Indefinite integrals-Substitution rule-Techniques of Integration-Integration by parts-Trigonometric substitutions-Integration of rational function by partial fractions-Integration of irrational functions-Improper integrals.

UNIT V   MULTIPLE INTEGRALS   **9+6 Periods**

Beta and Gamma integrals and properties. Double Integrals-Change of order of integration-Double integrals in polar coordinates-Area enclosed by plane curves-Triple integrals-Volume as a triple integral-Transformation to Polar, Cylindrical and Spherical polar coordinates.

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 30 periods   Practical: 0 periods   Total: 75 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER,YEAR OF PUBLICATION
Veerarajan T	*Engineering Mathematics for Semesters I and II*	*Tata McGraw Hill Publishing Co., New Delhi, 2015.*
Kandasamy P, ThilagavathyK and Gunavathy K	*Engineering Mathematics for I year B.E/B.Tech.*	*S.Chand& Co, Ramnagar, New Delhi, Reprint2013.*
S. Narayanan and Manicavachagom Pillai T.K.	*Calculus, Vol.I , II and III,*	*S. Viswanathan, Printers and Publishers Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Erwin Kreyszig	*Advanced Engineering Mathematics*	*Wiley & sons (Asia) Ltd, 10th Edition, 2015.*
Ray Wylie.C and Louis Barrett	*Advanced Engineering Mathematics*	*Tata McGraw Hill Company, New Delhi, 2004.*
Grewal B. S	*Higher Engineering Mathematics*	*Khanna Publishers, New Delhi, 43rd Edition, 2014.*
Ramana B V	*Higher Engineering Mathematics*	*Tata McGraw Hill Co. Ltd, NewDelhi, 11th Print, 2010.*
Bali N., Goyal M and Watkins C	*Advanced Engineering Mathematics*	*Firewall Media (An Imprint of Laxmi Publications Pvt Ltd), New Delhi, 7th Edition, 2009.*
Bali N.P and Goyal M	*A text book of Engineering Mathematics*	*University Science Press (An Imprint of Laxmi Publications Pvt Ltd), New Delhi,2014*

COURSE OUTCOMES:

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

CO1: Acquire knowledge of eigen values and eigen vectors including properties through matrix theory.

CO2: Understand the hyperbolic functions and applications of differential calculus.

CO3: Acquire fluency in partial differentiation and solving problems related to maxima and minima for more independent variables.

CO4: Understand the standard types of integration and solution to various integrals.

CO5: Understand the multiple integrals and their applications to engineering problems.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M						H	M	M	H	M	M	M
CO2	H	M	M							M			H	H	M	M
CO3	H	H	H							L			H	M	M	L
CO4	H	H	M	M						M	L	M	M	M	L	L
CO5	H	M	M							L	L	M	M	L	L	M
16SBS1Z2	H	H	M	M						M	L	M	H	M	M	M

L-Low, M-Moderate(Medium), H-High

16SBS103   **ENGINEERING PHYSICS**   CATEGORY : BS
              (Common to EEE, ECE, EIE, CSE & IT Branches)   L T P C
                                                                    3 0 0 3

PREREQUISITES: Nil

Course Objectives:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with:
   o Concepts, types of lasers and its applications, fibre optic principles and its applications.
   o Basics of properties of matter & thermal physics
   o Origin of quantum physics, Schrödinger's equation and applications.
   o Principles of acoustics, ultrasonics and their industrial applications.
   o Fundamentals of crystal Physics and its packing factor calculations.

UNIT I LASERS AND FIBRE OPTICS   **9 Periods**

Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein's coefficients - population inversion – methods of achieving population inversion –Optical Resonator -Types of Lasers – Principle, construction and working of Nd-YAG, CO_2, Semiconductor laser - applications of laser-Hologram
Introduction – Basic Principles involved in fiber optics- Total internal reflection – Structure of optical fiber –Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on materials, refractive index profile and Modes - Fiber optical communication links-Fiber optic sensors-displacement.

UNIT II PROPERTIES OF MATTER & THERMAL PHYSICS   **9 Periods**

Elasticity- Hooke's law- stress-strain diagram - Factors affecting elasticity - Bending moment - Depression of a cantilever - Young's modulus by uniform bending - I shaped girders.
Thermal expansion - thermal stress - thermal conductivity - heat conduction in solids - flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment.

UNIT III QUANTUM PHYSICS AND APPLICATIONS   **9 Periods**

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy and temperature –Heisenberg's Uncertainty principle – verification – physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations –- Particle in a one dimensional potential well– Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).

UNIT IV ACOUSTICS AND ULTRASONICS   **9 Periods**
Classification of sound - loudness and intensity - Weber-Fechner law - standard intensity and intensity level - decibel - reverberation - reverberation time - sound absorbing materials - Determination of absorption coefficient - factors affecting acoustics of buildings.
Introduction - properties of ultrasonic waves - production of ultrasonic waves; Magnetostriction effect- Magnetostriction generator- Piezoelectric effect- Piezoelectric generator- Acoustic grating - Determination of wavelength and velocity of ultrasonics-cavitation - applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing-Pulse echo system.
UNIT V CRYSTAL PHYSICS   **9 Periods**
Introduction – Crystalline and amorphous materials –Lattice – Unit Cell –Crystal system - Bravais lattices – 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 defects – Point, line and surface defects.

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 0 periods   Practical: 0 periods   Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Arumugam M	*Engineering Physics*	*Anuradha Publishers, 2010. (Unit I , Unit III &Unit IV)*
P.K.Palanisamy	*EngineeringPhysics*	*Scitech Publications(India)Pvt.Ltd,2015(UnitII&UnitV)*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Avadhanulu M N and Kshirsagar P G	*A Textbook of Engineering Physics*	*S.Chand and Company Ltd, New Delhi, 2010.*
Gaur R.K. and Gupta S.L	*Engineering Physics*	*Dhanpat Rai Publishers, 2009.*
K.Rajagopal	*Engineering Physics*	*PHI Learning Private Ltd, NewDelhi, 2015.*

COURSE OUTCOMES:

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

CO1: Analyze the construction and working of Nd-YAG, CO_2, Semiconductor lasers. Explain fiber optics and classify fibers based on index profiles and modes. [Familiarity]

CO2: Acquire knowledge in properties of matter and thermal physics [Application]

CO3: Analyze the dual nature of matter using Heisenberg's Uncertainty principle, Schrodinger's time independent and dependent wave equations.[Assessment]

CO4: Apply piezoelectric detector method for industrial applications. [Usage and Assessment]

CO5: Compare crystalline and non-crystalline materials and describe the lattice structure, coordination number and packing factor for crystals.[Usage and Assessment]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	L	L	L	L	L	L				L	L				L
CO2	L	L			L	L	L				L	L				L
CO3	L	L			L	L	L				L	L				L
CO4	L	L	L	L	L	L	L				L	L				L
CO5	L	L	L	L	L	L	L				L	L				L
16SBS103	L	L	L	L	L	L	L				L	L				L

L-Low, M-Moderate(Medium), H-High

16SBS104   **APPLIED CHEMISTRY**   **CATEGORY : BS**
              (Common to EEE, ECE, EIE, CSE & IT Branches)   **L T P C**
                                                                    3 0 0 3

PREREQUISITES: Nil

Course Objectives:
   o The course is aimed at inculcating knowledge of applied chemistry topics which would be useful for students to understand Chemistry relevant to circuitry Engineering subjects.

UNIT I ELECTROCHEMICAL CELLS   **9 Periods**

Galvanic cells – redox reactions- electrodes - metal and metal ion, hydrogen electrode and calomel electrode – electrode potentials – standard oxidation and reduction potentials - Nernst equation and problems - EMF series and significance – Application of EMF measurements – equilibrium constant, solubility of sparingly soluble salt, potentiometric titration of a redox system (Fe^{2+} Vs Cr^{6+}), pH measurement using glass electrode and fluoride measurement by ISE.

UNIT II BATTERIES   **9 Periods**

Batteries - components, characteristics - voltage, current, current capacity, power density, energy density, cycle life, shelf life and self - discharge. Types of batteries - Primary - Zn/MnO_2 , Zn/HgO, Zn/Ag_2O, $Li/SOCl_2$ - construction, function and performance comparison – Secondary- Pb/ acid, Ni/Cd, and Lithium ion battery - construction, function and performance comparison.

UNIT III CORROSION   **9 Periods**

Corrosion - Spontaneity - Chemical corrosion- mechanism, nature of oxides – Pilling Bedworth rule - electrochemical corrosion – mechanism - types – galvanic and differential aeration – Galvanic series and importance – Prevention methods - design of materials, cathodic protection techniques (sacrificial anode and impressed current cathode), Inhibitors - Protective coatings - Inorganic coating - electroplating – surface preparation and plating method applied to Cr and Ni and galvanising – Organic coating- paints - constituents and functions.

UNIT IV POLYMER TECHNOLOGY   **9 Periods**

Polymers - definitions of monomer, polymer, functionality, degree of polymerisation – Free radical mechanism -Individual polymers - PVC, PMMA, Teflon, polyamide, poly carbonate, epoxy, polyurethane - preparation, properties and their end users - compounding of plastics - components and functions - fabrication techniques - compression, injection, extrusion and blow moulding - Conducting polymers - structures of polypyrrole, polyaniline and poly acetylene - conduction mechanism of polyacetylene only - Biodegradable polymers – polylactide, starch and cellulose.

UNIT V SILICON WAFER TECHNOLOGY   **9 Periods**

Silicon for IC chips - single crystal – preparation by Czechralsky and float zone processes - wafer preparation, P-N junction formation – Ion implantation, Diffusion and epitaxial growth techniques - Insulator layer by oxidation - Printing of circuits by photolithography – masking and electron beam methods - etching by chemical and electrochemical methods - metal coatings.

CONTACT PERIODS:

Lecture: 45 periods   Tutorial: 0 periods   Practical: 0 periods   Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Vairam S, Subha Ramesh	*Engineering Chemistry*	*Wiley India, 2015.*
Jain. P.C. and Monica Jain	*Engineering Chemistry*	*Dhanpat Rai Publications Pvt Ltd, New Delhi, 16th Edition, 2004.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Dara. S.S, Umarae	*Text book of Engineering Chemistry*	*S. Chand Publications, 2004.*
M.S.Tyagi	*Introduction to semiconductor materials and devices*	*Wiley India, 2011.*
Kuriakose, J.C., and Rajaram J	*"Chemistry in Engineering and Technology", Vol.1 &II*	*Tata Mc Graw Hill Publishing company, Pvt.Ltd, New Delhi, 2001.*
P. Aggarwal, Avinash Aggarwal	*Engineering Chemistry*	*Khanna Publishers, 2010.*
David Linden and Thomas Reddy	*Hand book of batteries and fuel cells", Vol.1 &II*	*Tata Mc Graw Hill, 2001.*

COURSE OUTCOMES:

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

CO1: Understand the principles of electrochemical principles such as EMF measurements, electrode potentials and apply them in experimental techniques useful for electrochemical instrumentation.

CO2: Know the knowledge about different types of batteries with the functions which find use in their society including engineering fields.

CO3: Be familiar with corrosion of the instruments and equipment they use in their field and also to learn the mechanisms and the preventive measures by various techniques.

CO4: Know about the different types of polymeric materials, properties and fabrication which match the specific applications.

CO5: Gain the knowledge about the silicon chips and their fabrication methods and to apply in preparation of in electrical and electronic instruments.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	L	L	M	L	L	L	L	M	L	M	M	L	L	L
CO2	H	M	L	L	M	L	L	L	L	M	L	M	M	L	L	L
CO3	H	M	L	L	H	L	L	L	L	M	L	M	M	L	L	L
CO4	H	M	L	L	H	L	L	L	L	M	L	M	M	L	L	L
CO5	H	M	L	L	H	L	L	L	L	M	L	M	M	L	L	L
16SBS104	H	M	L	L	H	L	L	L	L	M	L	M	M	L	L	L

L-Low, M-Moderate(Medium), H-High

16SES105   **FUNDAMENTALS OF ELECTRICAL AND**   **CATEGORY : ES**
                      ELECTRONICS ENGINEERING   L   T   P   C
                      (Common to CSE & IT Branches)   3   0   0   3

PREREQUISITES: Nil

Course Objectives:
   o Analysing simple circuits and networks
   o Principles of transformers, ac and dc machines
   o Basic concepts of semiconductors, amplifiers and linear integrated circuits
   o Inverters and electronic measurements

UNIT I ELECTRICAL PRINCIPLES AND DC CIRCUITS   **9 Periods**

Introduction to Electrical Systems – Simple DC Circuits – Network Theorems: Kirchoff's Laws,
Mesh analysis, Nodal analysis, Superposition, Thevenin's, Norton and Maximum Power Transfer
Theorems, Delta-Star and Star-Delta Transformations.

UNIT II AC CIRCUITS AND POWER ENGINEERING   **9 Periods**

Alternating Voltage and Current – Single phase series circuits and Parallel networks – Power in AC
Circuits – Resonance in AC Circuits - Multiphase Systems – Transformers – AC Synchronous
Machines – Induction Motors – DC Machines – DC Motors.

UNIT III BASIC ELECTRONIC SYSTEMS   **9 Periods**

Basic Electronic Systems – Passive filters – Amplifier Equivalent Circuits – Semiconductor
Materials – Rectifiers – Junction Transistor Amplifiers – FET Amplifiers.

UNIT IV INTEGRATED CIRCUITS AND APPLICATIONS   **9 Periods**

Operational Amplifiers – Inverting, Non-inverting, Summing and Differential Amplifiers –
Common Mode Rejection Ratio – Digital and Analog Systems – Linear ICs Applications: Voltage
Regulators, Timers and Phase Locked Loops.

UNIT V POWER ELECTRONICS AND MEASUREMENTS   **9 Periods**

Thyristor-ac/dc converter-ac/dc inversion-switching devices in inverters- Electronic Measuring
Instruments – Digital voltmeters, Ammeters and wattmeters-Graphical Display Devices – Cathode
Ray Oscilloscope

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 0 periods   Practical: 0 periods   Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Edward Hughes	*Electrical and Electronics Technology*	*Revised by John Hiley, Keith Brown and Ian McKenzie Smith, 12th Edition, Pearson Education Ltd., 2016.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Vincent Del Toro	*Electrical Engineering Fundamentals*	*Second Edition, PHI, 2011.*
Robert L. Boylestad and Louis Nashelsky	*Electronic Devices and Circuit Theory*	*Eleventh Edition, Pearson Education, 2013.*

COURSE OUTCOMES:

Upon completion of this course, students will be able to

CO1: Analyse and solve DC and AC circuits

CO2: Appraise the significance of transformers in electric circuits

CO3: Investigate the operational principles of motors and generators

CO4: Use amplifier equivalent circuits to estimate operating and performance characteristics

CO5: Assess the significance of D/A and A/D converters

CO6: Describe the working principles of Electronic measuring instruments.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H		L					M		L	M	M	L
CO2	H	H	H	H		M								M	M	M
CO3	H	M	H	H		M							L	M	M	H
CO4	M	M	M	H	L						M	M	L	M	M	H
CO5	H	M	M	M										M	M	M
CO6	M	M	M	L	L	M	M				M	M		M	M	M
16SES105	H	M	H	H	L	M	M				M	M	L	M	M	M

L-Low, M-Moderate(Medium), H-High

16SBS106 **CHEMISTRY LAB** **CATEGORY : BS**
(Common to EEE, ECE, EIE, CSE & IT Branches) L T P C
                                                    0   0   4 2

PREREQUISITES: Nil

Course Objectives:
o The course is aimed at imparting knowledge of experimental techniques which would be useful for students to apply the practical principles relevant conventional engineering field.

LIST OF EXPERIMENTS
1. Estimation of hardness by EDTA method
2. Estimation of chloride by Argentometric method
3. Determination of dissolved oxygen by Winkler's method
4. Conductometric titration of mixture of strong acid and weak acid using strong base
5. Potentiometric titration of ferrous iron by dichromate
6. Estimation of copper in brass by EDTA method
7. Estimation of Iron by Spectrophotometry
8. Estimation of HCl by pH titration.

CONTACT PERIODS:

Lecture: 0 periods   Tutorial: 0 periods   Practical: 60 periods   Total: 60 periods

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
A.O. Thomas	*Practical Chemistry*	*Scientific Book Centre, Cannanore, 2003.*
Jeffery G H, Basset J. Menthom J, Denney R.C.	*Vogel's Text book of quantitative analysis, 5th Edition*	*EBS, 1988.*

COURSE OUTCOMES:
Upon completion of this practical classes, the students will be able to
  CO1: Understand the nature of hardness, chloride level, pollution level using dissolved oxygen content, iron present in water and analyse them in water.
  CO2: Apply the EMF and conductometric measurements in quantitative analysis of substances.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	L	L	M	L	L	L	L	M	L	M	M	L	L	L
CO2	H	M	L	L	M	L	L	L	L	M	L	M	M	L	L	L
16SBS106	H	M	L	L	M	L	L	L	L	M	L	M	M	L	L	L

L-Low, M-Moderate(Medium), H-High

16SES107 **WORKSHOP PRACTICE** CATEGORY : ES
(Common to EEE, ECE, EIE, CSE & IT Branches) L T P C
0 0 4 2

PREREQUISITES: Nil
Course Objectives:
- o To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint and Cross-Lap joint.
- o To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.

LIST OF EXPERIMENTS
1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap Joint and Dovetail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal
7. Electrical wiring – simple house wiring
8. Plumbing

CONTACT PERIODS:
Lecture: 0 periods   Tutorial: 0 periods   Practical: 60 periods   Total: 60 periods

COURSE OUTCOMES:
Upon completion of this practical classes, the students will be able to
CO 1: Use tools and equipments used in Carpentry, Welding, Foundry and Sheet metal.
CO 2: Make half lap joint and dovetail joint in carpentry.
CO 3: Make welded lap joint, butt joint and T-joint.
CO 4: Prepare sand mould for cube, conical bush, pipes and V pulley.
CO 5: Fabricate parts like tray, frustum of cone and square box in sheet metal
CO 6: Carry out minor works/repair related to electrical wiring and plumbing.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M					M	M		M	L		M	M	M	L	L
CO2	M	H				M	L		M	L		M	M	M	L	L
CO3	M	H				M	L		M	L		M	M	M	L	L
CO4	M	H				M	L		M	L		M	M	M	L	L
CO5	M	H				M	L		M	L		M	M	M	L	L
CO6	M	H				M	L		M	L		M	M	M	L	L
16SES107	M	H				M	L		M	L		M	M	M	L	L

L-Low, M-Moderate(Medium), H-High

16SHS2Z1   **TECHNICAL ENGLISH**   **CATEGORY : HS**
                                  (Common to all Branches)   **L T P C**
                                                                                  2 2 0 3

PRE REQUISITES: Nil
Course Objectives:
   o To make learners acquire guided listening and speaking skills in both formal and
      informal contexts.
   o To help them develop reading skills by familiarizing them with different types of
      reading tasks and strategies
   o To make them understand advance level of grammar and equip them with writing skills
      needed for academic as well as workplace contexts.
   o To explore the learner to Technical English and Technical Vocabulary.

UNIT I   **6+6 Periods**
Listening - Listening to ask for/ give opinions, Listening to persuade/dissuade people,
Listening to make complaints, Listening to transfer information; **Speaking** –Role play
activities on a formal/corporate context, Delivering Welcome Address- **Reading** – Reading to
infer lexical and contextual meaning; **Writing** - Effective use of SMS on Whatsapp/ Hike/
Messenger, Writing E-mails on a business context, Technical style; **Grammar** – Use of
relative / reflexive pronouns, Discourse Markers; **Vocabulary**- Homonyms and Homophones

UNIT II   **6+6 Periods**
Listening - Listening to express regrets/sympathy/condolences, Listening and Note-taking;
Speaking – Addressing at an official meeting to deal with problems/ sensitive issues,
Discussion on a movie with a poignant social message/ or on a recently read book; **Reading** -
Reading a short story or an article from newspaper; **Writing** - Writing a review of a
book/movie/music   concert/sports   event,   Graph   Description;   **Grammar**   –
Noun/Adjective/Adverbial phrases,   Cause and effect expressions; **Vocabulary** - Using
phrasal verbs in sentences, Jargon

UNIT III   **6+6 Periods**
Listening - Listening to a talk about using quantities, Listening to describe manner and
frequency, Listening to expressions of assumptions/inference, Listening to make comparisons;
Speaking –Making conversation to practice stress, pause, pronunciation and intonation,
Introducing the chief-guest; **Reading -** Speed reading – reading passages with time limit -
Writing – Notice, Agenda and Minutes of meetings; - Elements of Writing Technical articles
–**Grammar** - Numerical expressions, Conditional clauses; **Vocabulary** - Same word used as
different parts of speech, Register

UNIT IV   **6+6 Periods**
Listening - Listening to talks about future events/plans, Listening to a talk about making
arrangements, Listening to language of reporting, Viewing a model discussion; **Speaking** –
Discussion on a formal/corporate context, Proposing vote of thanks; **Reading** - Reading the
job advertisements and the profile of the company concerned; **Writing** - Process Description,
Applying for a job with résumé; **Grammar** - Direct and indirect speech; **Vocabulary** –
Idioms.

UNIT V   **6+6 Periods**
Listening – Listening to expressions of possibility, Listening to expressions of obligations,
Listening to expressions of ability, Viewing model interviews; **Speaking** - Mock interview;
Reading - Note making, Intensive reading; **Writing** – Checklist, - Feasibility / Project report;
Grammar – Time Statements and Contracted Time Statements; **Vocabulary** – Nominal
Compounds.

 CONTACT PERIODS:
 Lecture: 30 periods   Tutorial: 30 periods   Practical: 0 periods   Total: 60 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Department of English, Anna University. Mindscapes	*English for Technologists and Engineers.*	*Orient Blackswan, Chennai. 2012*
Sadanand, Kamlesh & Punitha, Susheela	*Spoken English: A Foundation Course (Part 2).*	*Orient Blackswan, Hyderabad. 2014*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Raman, Meenakshi & Sangeetha Sharma	*Technical Communication: Principles and Practice*	*Oxford University Press, New Delhi. 2011*
Vijay, Anbazhagan.J, & Jaishree.N	*Technical English-II*	*Global Publishers, Chennai, 2016*
Rizvi, Ashraf. M.	*Effective Technical Communication*	*Tata McGraw-Hill, New Delhi. 2005*
Herbert, A.J	*Structure of Technical English*	*The English Language Society, London. 1971*
Michigan, E.A	*Word Power and Speed Reading: English Improvement Series*	*Infinity Books, New Delhi, 2007*
Rajendrapal & Korlahalli. J.S	*Essentials of Business Communication*	*Sultan Chand & Sons*

WEBSITES
1. http://www.usingenglish.com
2. http://www.uefap.com

COURSE OUTCOMES:

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

CO1: The learners will be able to speak convincingly at work place and social contexts through guided listening tasks and different genres and strategies of reading.

CO2: The learner will understand advance level of grammar and write professionally to a larger Extent for workplace and general contexts.

CO3: The learners will familiarize themselves with Technical Vocabulary and Technical English.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1										H						L
CO2										H						L
CO3										H						L
16SHS2Z1										H						L

L-Low, M-Moderate(Medium), H-High

16SBS2Z2   **ENGINEERING MATHEMATICS II**   **CATEGORY : BS**
(Common to all Branches)   L T P C
3 2 0 4

PRE REQUISITES: Basics of - trigonometry- differential and integral formulae.

Course Objectives:

- o To acquire knowledge of techniques of ordinary differential equations leading to engineering problems.
- o To acquire knowledge of vector Calculus with engineering applications.
- o To gain standard techniques of complex variable applicable to fluid dynamics, heat conduction, and elasticity.
- o To develop skill of solving transforms leading to engineering applications.

UNIT I   ORDINARY DIFFERENTIAL EQUATIONS   **9+6 Periods**

Second and Higher order Differential Equations, Method of variation of parameters- Method of undetermined coefficients-Homogeneous equations of Euler's and Legendre's type-System of Simultaneous first order Linear equations with constant coefficients - Method of reduction of order.

UNIT II VECTOR CALCULUS   **9+6 Periods**

Gradient and directional derivative, Divergence and Curl – Irrotational and Solenoidal fields-Vector identities - Line, Surface and Volume Integrals – Green's Theorem in a Plane , Gauss Divergence and Stoke's Theorems (Statements only) –Verifications and Applications.

UNIT III COMPLEX DIFFERENTIATION   **9+6 Periods**

Functions of a Complex variable-Analytic functions- Cauchy Riemann equations and sufficient conditions (excluding proof)–Harmonic conjugates–Construction of analytic functions-Conformal mappings: $w=z+a$, $az,1/z$, z^2,e^z , $sinz$, $cosz$ and Bilinear Transformation.

UNIT IV COMPLEX INTEGRATION   **9+6 Periods**

Cauchy's integral theorem, Cauchy's integral formula -Taylor's and Laurent's theorems (Statements only) and expansions – Poles and Residues – Cauchy's Residue theorem – Contour integration – Circular and semi circular contours with no pole on real axis.

UNIT V LAPLACE TRANSFORMATIONS   **9+6 Periods**

Laplace transforms- Properties and standard transforms-Transforms of unit step, unit Impulse and error functions –Transforms of periodic functions- Inverse Laplace transforms- Initial and Final value theorems- Convolution theorem (Statement only) and applications - Applications to Solution of Linear differential equations of second order with constant coefficients.

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 30 periods   Practical: 0 periods   Total: 75 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Veerarajan T	*Engineering Mathematics" for Semesters I and II*	*Tata McGraw Hill Publishing Co., New Delhi, 2015.*
Kandasamy P, Thilagavathy K and Gunavathy K	*Engineering Mathematics" for I year B.E/B.Tech*	*S.Chand& Co, Ramnagar, New Delhi, Reprint 2013.*
S. Narayanan and Manicavachagom Pillai T.K.	*Calculus-Vol.III*	*S. Viswanathan, Printers and Publishers Pvt. Ltd, Chennai, 2009.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Erwin Kreyszig	*Advanced Engineering Mathematics*	*Wiley & sons(Asia) Ltd, 10th Edition, 2015.*
Ray Wylie.C and Louis Barrett	*Advanced Engineering Mathematics*	*Tata McGraw Hill Company, New Delhi, 2004.*
Grewal B. S	*Higher Engineering Mathematics*	*Khanna Publishers, New Delhi, 43rd Edition, 2014.*
Ramana B V	*Higher Engineering Mathematics*	*Tata McGraw Hill Co. Ltd, NewDelhi, 11th Print, 2010.*
Bali N., Goyal M and Watkins C	*Advanced Engineering Mathematics*	*Firewall Media (An Imprint of Laxmi Publications Pvt Ltd), New Delhi, 7th Edition, 2009.*
Bali N.P and Goyal M	*A text book of Engineering Mathematics*	*University Science Press (An Imprint of Laxmi Publications Pvt Ltd), New Delhi, 2014.*

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the kinds of differential equations and their solutions in the field of engineering.

CO2: Evaluate gradient, divergence and curl and also line, surface and volume integrals in cartesian form and simple coordinate systems and calculate integrals applying Greens, stokes and Gauss theorems.

CO3: Understand the concepts of analytic functions and conformal mappings.

CO4: Evaluate contour integrals using calculus of residues.

CO5: Apply Laplace transform methods to solve differential equations.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H						M	H	H	H	M	M	H
CO2	H	H	M	M						M		M	H	M	M	M
CO3	H	H	M	H		M				M	M	M	H	M	L	L
CO4	H	H	M	M		M				M	M	M	H	M	L	M
CO5	H	H	H	H		H				M	M	H	H	M	M	M
16SBS2Z2	H	H	M	H		M				M	M	M	H	M	M	M

Low, M-Moderate(Medium), H-High

16SBS2Z3	MATERIALS SCIENCE	CATEGORY : BS
	(Common to all Branches)	L T P C
		3 0 0 3

PREREQUISITES: Nil

Course Objectives:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with:

- o The properties of conducting materials.
- o The application of magnetic and super conducting materials.
- o Application and properties of dielectric and ferro electric materials.
- o Applications and properties of Modern engineering materials.
- o Nano materials and its properties.

UNIT I CONDUCTING MATERIALS   9 Periods

Introduction to Conductors – classical free electron theory of metals – Draw backs of classical theory – quantum theory - Electrical and Thermal conductivity of Metals – Derivation for Wiedeman – Franz law – Lorentz number — Fermi distribution function - effect of temperature – density of energy states – calculation of Fermi energy- carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS AND DEVICES   9 Periods

Introduction – Properties – elemental and compound semiconductors - Intrinsic and extrinsic semiconductors – properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature and carrier concentration - Electrical Conductivity – band gap determination - extrinsic semiconductors - Carrier concentration in P- type and N-type semiconductors – variation of Fermi level with temperature and impurity concentration – Hall effect- Determination of Hall Co-efficient in N type and P type Semiconductor - Applications.

UNIT III MAGNETIC AND SUPER CONDUCTING MATERIALS   9 Periods

Introduction - Origin of magnetic moment - Bohr magneton - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Ferrites - structure and applications. - Magneto optical recording and readout – Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- High Tc superconductors, Applications of superconductors- SQUID, Cryotron, Magnetic levitation.

UNIT IV DIELECTRICS AND FERROELECTRICS   9 Periods

Introduction to dielectric materials – Electric polarization and Dipole moment - Electrical susceptibility – dielectric constant – Various polarization mechanisms in dielectrics - electronic, ionic, orientational and space charge polarization– frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials - Ferro electricity –Ferro electric materials -$BaTiO_3$ – Applications- Ferro electric energy converter.

UNIT V MODERN ENGINEERING MATERIALS   9 Periods

Metallic glasses- preparation of metallic glasses - properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gel – ball Milling – properties of nanoparticles and applications of nanoparticles – Carbon Nanotubes (CNT) – structure – properties – applications of CNTs.

CONTACT PERIODS:

Lecture: 45 periods	Tutorial: 0 periods	Practical: 0 periods	Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
P.K.Palanisamy	*Engineering Physics–II*	*Scitech Publications (India) Pvt. Ltd 2015 (Unit I, Unit III & Unit IV)*
Dr.Jayakumar .S	*Materials science*	*R.K.Publishers,2008.(Unit II & IV)*
Dr.V.Rajendran	*Material Science*	*Tata McGraw Hill Publications, NewDelhi, 2011.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Charles P.Poole, Jr; Frank J.Owens	*Introduction to Nanotechnology*	*Wiley India, 2012.*
Gaur R.K. and Gupta S.L	*Engineering Physics*	*Dhanpat Rai Publishers, 2009.*
K.Rajagopal	*Engineering Physics*	*PHI Learning Private Ltd, New Delhi, 2015.*

COURSE OUTCOMES:

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

CO1: Analyze the properties of conducting materials. [Familiarity]

CO2: List and analyze the properties of Semiconducting materials and Devices. [Familiarity]

CO3: Identify, analyze the properties and applications of magnetic & super conducting materials. [Familiarity]

CO4: List and analyze the properties of dielectric Ferro electric materials. [Familiarity & Application]

CO5: List the properties and applications of modern engineering materials. [Familiarity & Application]

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L	L				L	L						L	L		L
CO2	L	L	L	L	L	L	L						L	L		L
CO3	L	L	L	L	L	L	L						L	L		L
CO4	L	L	L	L	L	L	L						L	L		L
CO5		L	L	L	L	L	L						L	L		L
16SBS2Z3	L	L	L	L	L	L	L						L	L		L

L-Low, M-Moderate(Medium), H-High

16SHS2Z4   ENVIRONMENTAL SCIENCE AND ENGINEERING   CATEGORY : HS
(Common to all Branches)
L T P C
3 0 0 3

PREREQUISITES: Nil
Course Objectives:
  o The course is aimed at creating awareness among students and also to inseminate the critical ideas of preserving environment.

UNIT I   ENVIRONMENTAL RESOURCES   9 Periods

Natural resources -Forest – benefits, over exploitation, deforestation & consequences – Water - unique features, hydrological cycle & over exploitation – Food -effect of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications - Energy resources - renewable & non-renewable resources - wind, solar and tidal - harnessing methods.

UNIT II ECO SYSTEM AND BIODIVERSITY   9 Periods

Ecology - ecosystem, physical and chemical components of ecosystem, biological components of ecosystem - forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle and carbon dioxide cycle, food pyramid, ecological succession, Biodiversity - types, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity –   in situ – ex situ conservation.

UNIT III ENVIRONMENTAL POLLUTION   9 Periods

Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_x, H_2S, CO, CO_2 and particulates, control methods - cyclone separator and electrostatic precipitator - Water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollutants Soil pollution - sources, effects and control - Noise pollution - decibel scale, sources, effects and control.

UNIT IV ENVIRONMENTAL THREATS   9 Periods

Acid rain, greenhouse effect, global warming and ozone depletion, disaster management, flood, drought, earthquake and tsunami, Threats to biodiversity - destruction of habitat, habit fragmentation - hunting, over exploitation and man - wildlife conflicts, The IUCN red list categories, status of threatened species.

UNIT V SOCIAL ISSUES AND ENVIRONMENT   9 Periods

Sustainable development - sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Pollution control Act, Wild life protection act, Forest conservation act, population growth - exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, role of information technology in human and health, HIV/AIDS - effects and preventive measures.

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 0 periods   Practical: 0 periods   Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Sharma J.P	*"Environmental Studies", 3rd Edition*	*University Science Press, New Delhi 2009.*
Anubha Kaushik and C.P. Kaushik	*"Environmental Science and Engineering", 3rd Edition*	*New age International Publishers, New Delhi, 2008.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
R.K. Trivedi	*Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards", Vol.I&II,*	*Environ Media, 2006.*
G. Tyler Miller Jr	*"Environmental Science", 10th Edition*	*Thomson Brooks/Cole Publishing, 2004.*
Gilbert M. Masters	*Introduction to Environmental Engineering and Science, 2nd Edition*	*Pearson Education, 2004.*

COURSE OUTCOMES:

Upon completion of the course, Students will be able to

CO1: To know about the various environmental resources, the effective utility and problems accompanied in over exploitation.

CO2: To acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.

CO3: To be aware of the source of various types of pollution, their ill effects and preventive methods.

CO4: To understand the environmental threats, Acid rain, Green house effect and Ozone depletion and natural disasters.

CO5: To create an idea about sustainable development and social issues.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	L	L	L	L	L	L	L	L	L	L	M	L	L	M
CO2	M	L	H	L	L	L	M	M	L	M	L	L	L	L	L	M
CO3	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L
CO4	L	L	H	L	L	L	H	H	L	M	L	L	M	L	M	L
CO5	M	L	M	L	L	L	H	H	L	L	L	L	M	L	M	M
16SHS2Z4	M	L	H	L	L	L	H	H	L	L	L	L	M	L	L	M

L-Low, M-Moderate(Medium), H-High

16SES2Z5   **PROGRAMMING IN C**   **CATEGORY : ES**
(Common to all Branches)   L T P C
                                                    3 0 0 3

PREREQUISITES: Nil
Course Objectives:
Upon completion of this course, the students will be familiar with,
- The Computer and Programming fundamentals
- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- Structures, List Processing, Input And Output

UNIT I COMPUTER AND PROGRAMMING FUNDAMENTALS   **9 Periods**

Computer fundamentals – Evolution, classification, Anatomy of a computer: CPU, Memory, I/O – Introduction to software – Generation and classification of programming languages – Compiling – Linking and loading a program – Translator – loader – linker – develop a program – software development – Introduction to OS –Types of OS – Algorithms – Structured programming concept.

UNIT II DATA TYPES AND FLOW OF CONTROL   **9 Periods**

An overview of C – Programming and Preparation – Program Output – Variables – Expressions, and Assignment, The use of #include, printf(), scanf() – Lexical elements, operators and the C systems – The fundamental data types – Flow of control

UNIT III FUNCTIONS, ARRAYS, POINTERS AND STRINGS   **9 Periods**

Functions and storage classes - 1D Arrays – Pointers – Call by reference – Relationship between Arrays and Pointers – Pointer arithmetic and element size – Arrays as function argument – Dynamic memory allocation – Strings – String handing functions – Multidimensional Arrays.

UNIT IV ARRAY OF POINTERS, BITWISE OPERATORS,   **9 Periods**
            PREPROCESSOR DIRECTIVES

Arrays of Pointers – Arguments to main () - Ragged Arrays – Functions as Arguments – Arrays of Pointers to Functions - Type qualifiers.-Bitwise operators and expressions – Masks – Software tools – Packing and unpacking – Enumeration types – The preprocessor directives.

UNIT V STRUCTURES AND UNIONS, I/O AND FILE OPERATIONS   **9 Periods**

Structures and Unions – Operator precedence and associativity – Bit fields – Accessing bits and bytes - Input and Output functions – File Processing Functions – Environment variables – Use of make and touch.

CONTACT PERIODS:
Lecture: 45 periods   Tutorial: 0 periods   Practical: 0 periods   Total: 45 periods

TEXT BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Pradip Dey, Manas Ghosh	*Computer Fundamentals and Programming in C, Second Edition*	*Oxford University Press, 2013.*
Al Kelley, Ira Pohl	*A Book on C-Programming in C, Fourth Edition*	*Addison Wesley, 2001.*

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
Stephen G. Kochan	*Programming in C-A complete introduction to the C programming language, Third Edition*	*Sams Publication, 2004.*
Yashavant P. Kanetkar	*Let Us C, 13th edition*	*BPB Publications, 2013.*
Brian W. Kernighan and Dennis Ritchie	*The C Programming Language", Second Edition*	*Prentice Hall Software Series, 1988.*
Stephen Prata	*C Primer Plus, Fifth Edition*	*Sams Publishing, 2005.*

COURSE OUTCOMES:

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

CO1: Articulate the programming environment [Familiarity]

CO2: Write algorithm for solving the given problem statement [usage]

CO3: Use right data types and flow control statement [Assessment]

CO4: Write programs using functions, arrays, pointers and strings [Usage]

CO5: Use right storage classes, preprocessor directives, bitwise operators in programs [Assessment]

CO6: Use structures, unions and files [Usage]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	H	H		M	M	M	M	L	M	H	H	M	M
CO2	H	H	M	H	H			M	M	M	L	M	H	H	M	M
CO3	H	H	M	H	H			M	M	M	L	M	H	H	M	M
CO4	H	H	M	H	H			M	M	M	L	M	H	H	M	M
CO5	H	H	M	H	H			M	M	M	L	M	H	H	M	M
CO6	H	H	M	H	H			M	M	M	L	M	H	H	M	M
16SES2Z5	H	H	M	H	H		M	M	M	M	L	M	H	H	M	M

L-Low, M-Moderate(Medium), H-High

16SBS206   **PHYSICS LAB**   **CATEGORY : BS**
                    (Common to EEE, ECE, EIE, CSE & IT Branches)   L T P C
                                                                           0 0 4 2

PREREQUISITES: Nil

Course Objectives:
   o To have a practical knowledge about the concepts behind physics and the need to apply in the emerging technology.

LIST OF EXPERIMENTS
   1. Spectrometer - Diffraction Grating Normal Incidence Method
   2. Air Wedge –Determination of thickness of a paper
   3. Young's Modulus – Cantilever Bending - Koenig's Method
   4. a. Laser - Particle size Determination
      b. Optical fiber - Determination of NA & Acceptance angle
   5. Ammeter and Voltmeter Calibration – Low Range
   6. Resistance Of The Given Coil Of Wire – Carey Foster's Bridge
   7. Determination of Band gap Energy of Semiconductor
   8. Ultrasonic Interferometer - Velocity of sound & Compressibility of liquids.
   9. Transistor Characteristics
   10. Torsional pendulum –Determination of Rigidity Modulus & Moment of Inertia

CONTACT PERIODS:

Lecture: 0 periods   Tutorial: 0 periods   Practical: 60 periods   Total: 60 periods

COURSE OUTCOMES:
         Upon completion of this practical classes, the students will be able to
   CO1: Determinate of all physical properties of any matter, basic idea of calibrating electrical measuring instruments and thereby effectively using it for particular applications.
   CO2: Experiment intrinsic characteristic features of electronic devices for electrical and electronic applications.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	L	L	L	L	L	L						L	L		L
CO2	L	L	L	L	L	L	L						L	L		L
16SBS206	L	L	L	L	L	L	L						L	L		L

   L-Low, M-Moderate(Medium), H-High

16SES207   **ENGINEERING GRAPHICS**   **CATEGORY : ES**
                  (Common to EEE, ECE, EIE, CSE & IT Branches)   L T P C
                                                                          2 0 4 4

PREREQUISITES: Nil
Course Objectives:
    o Geometrical constructions
    o Orthographic projections.
    o Performing section of solids and development of the same.
    o Interpretation of solids.
    o Pictorial view of solids

UNIT I   GEOMETRICAL CONSTRUCTIONS   **15 Periods**

Dimensioning-Lettering-Types of Lines-Scaling conventions-Dividing a given straight line in to
any number of equal parts- Bisecting a given angle- Drawing a regular polygon given one side-
Special methods of constructing a pentagon and hexagon- Construction of curves like ellipse,
parabola, cycloid and involute using one method.

UNIT II   ORTHOGRAPHIC PROJECTIONS   **25 Periods**

Introduction to Orthographic Projection-Projection of points-Projection of straight lines with
traces- Projection of planes-Conversion of pictorial views to orthographic views-Projection of
solids - Auxiliary projections.

UNIT III   SECTION OF SOLIDS AND DEVELOPMENT   **20 Periods**

Section of solids- Development of surfaces

UNIT IV INTERPENETRATION OF SOLIDS AND PICTORIAL VIEWS   **20 Periods**

Cylinder and cylinder, cone and cylinder only Isometric projections - Conversion of orthographic
views to pictorial views (simple objects).

UNIT V   INTRODUCTION TO AUTOCAD   **10 Periods**
Object Construction : Page layout – Layers and Line types – Creating, Editing and selecting the
Geometric Objects. Viewing, Annotating, Hatching and Dimensioning the drawing –Creating
Blocks and Attributes

CONTACT PERIODS:
Lecture: 30 periods   Tutorial: 0 periods   Practical: 60 periods   Total: 90 periods

REFERENCE BOOKS

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
K.Venugopal	*Engineering Graphics*	*New Age International (P) Limited, 2015.*
Dhananjay.A.Jolhe	*Engineering Drawing*	*Tata McGraw Hill Publishing Co., 2007.*
K.V.Nataraajan	*A text book of Engineering Graphics*	*Dhanalakashmi Publishers, Chennai, 2006.*
M.B.Shah and B.C. Rana	*Engineering Drawing*	*Pearson Education, 2005.*
Luzadder and Duff	*Fundamentals of Engineering Drawing*	*Prentice Hall of India Pvt Ltd, XIth Edition, 2001.*
K.L.Narayana and P.Kannaiah	*Text book on Engineering Drawing, 2nd Edition*	*SciTech Publications (India) Pvt. Ltd, Chennai, 2009.*

COURSE OUTCOMES:

Upon completion of this practical classes, the students will be able to

CO1: Represent planes and solids as per international standards.

CO2: Generate and interpret multiple views through development, interpretation and sectional views.

CO3: Generate and interrupt orthographic views.

CO4: Generate and interrupt pictorial views and interpenetration.

CO5: Generate and interrupt perspective views.

CO6: Apply the concept of AUTOCAD in engineering graphics.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		H	H			M		L	H	M		M	M	M		
CO2			H			M		L	H	M		M	M	M		
CO3			H			M		L	H	M		M	M	M		
CO4			H			M		L	H	M		M	M	M		
CO5			H			M		L	H	M		M	M	M		
CO6		H	H	H		M		L	H	M		M	M	M		
16SES207		H	H	L		M		L	H	M		M	M	M		

L-Low, M-Moderate(Medium), H-High

16SES2Z8 **PROGRAMMING IN C LAB** **CATEGORY : ES**
(Common to all Branches) L T P C
                                         0 0 4 2

PREREQUISITES: Nil

Course Objectives:
- o Data types in C and Flow control statements
- o Functions, Arrays, Pointers And Strings
- o Dynamic memory allocation and command line arguments
- o Bitwise Operators, Preprocessor Directives, Structures and Unions
- o Structures, List Processing, Input And Output

PRACTICALS
EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:
1. Operators , Expressions and IO formatting
2. Decision Making and Looping
3. Arrays and Strings
4. Functions and Recursion
5. Pointers
6. Dynamic Memory Allocation
7. Structures
8. Unions
9. Files
10. Command line arguments
11. Mini Project

CONTACT PERIODS:

Lecture: 0 periods   Tutorial: 0 periods   Practical: 60 periods   Total: 60 periods

COURSE OUTCOMES:
  Upon completion of this practical classes, the students will be able to
  CO1: Use appropriate data types and flow control statements [Usage]
  CO2: Write programs using functions, arrays, pointers and strings [Usage]
  CO3: Write programs using dynamic memory allocation [Usage]
  CO4: Implement programs using right storage classes, preprocessor directives, bitwise
        operators [Usage]
  CO5: Work with command line arguments, structures, unions and files [Usage]
  CO6: Develop applications using C [Usage]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	H	H			M	M	M	L	M	H	H	H	M
CO2	H	H	M	H	H			M	M	M	L	M	H	H	H	M
CO3	H	H	M	H	H			M	M	M	L	M	H	H	H	M
CO4	H	H	M	H	H			M	M	M	L	M	H	H	H	M
CO5	H	H	M	H	H			M	M	M	H	H	H	H	H	M
CO6	H	H	M	H	H			M	M	M	M	M	H	H	H	M
16SES2Z8	H	H	M	H	H			M	M	M	M	M	H	H	H	M

L-Low, M-Moderate(Medium), H-High

16SBS3Z1   **ENGINEERING MATHEMATICS III**   **CATEGORY:BS**
                              (Common to all Branches)

	L	T	P	C

PREREQUISITES: Nil
                                                     3   2   0   4

COURSE OBJECTIVE:

* To gain the knowledge of formation of Fourier series.
* To familiarize with Infinite and finite Fourier transforms functions.
* To be familiar with solution of first and second order differential equations.
* To acquire knowledge of techniques to solve one and two dimensional partial differential equations concerning to engineering applications.

UNIT – I   FOURIER SERIES   **(9+6)**
Dirichlet's conditions-Full range Expansions- Odd and even functions- Half range sine and cosine series –Parseval's identity on a Fourier serie*s*- Harmonic analysis.

UNIT – II   FOURIER TRANSFORMS   **(9+6)**
Fourier integral theorem (statement only)-Infinite Fourier transform pair-Fourier sine and cosine transform pair-Properties-Transforms of simple functions- Parseval's identity on a Fourier transform-Finite Fourier transforms.

UNIT – III   PARTIAL DIFFERENTIAL EQUATIONS   **(9+6)**
Formation of partial differential equations-First order PDE -Standard types and Lagrange's type-Linear partial differential second and higher order with constant coefficients-Homogeneous and Nonhomogeneous types.

UNIT – IV   BOUNDARY VALUE PROBLEMS   **(9+6)**
Method of separation of variables and Fourier series solution: One dimensional wave equation, one and two dimensional heat flow.

UNIT – V   Z TRANSFORMS   **(9+6)**
Z transforms-properties-Inverse Z transforms-Initial and final value theorems- Convolution theorem-Formation of difference equations- Solution to difference equations of second order difference equations with constant coefficients with Z transform.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 30 Periods   Practical: 0 Periods   Total: 75 Periods

Text Books:
1. *Veerarajan T,"Transforms and Partial Differential Equations", Tata McGraw Hill Publishing Co., New Delhi, 2015.*
2. *Kandasamy, Thilagavathy and Gunavathy, "Engineering Mathematics" for III Semester B.E/B.Tech,S.Chand& Co, Ramnagar, New Delhi, 2013.*

Reference Books:

1. *Grewal B .S ," Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition,2014.*
2. *Ramana B. V ," Higher Engineering Mathematics ", Tata McGraw Hill Co. Ltd., New Delhi, 11th Edition, Reprint, 2010.*
3. *Bali N., Goyal M," Transforms and Partial differential equations", University Science Press,New Delhi, 2010.*
4. *Ray Wylie C and Louis C Barrett," Advanced Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 6th Edition, Reprint, 2014.*
5. *Donald.A. McQuarrie," Mathematical Methods for Scientists and Engineers", Viva Books Pvt Ltd, New Delhi, Ist Edition, Reprint 2015.*

COURSE OUTCOMES:

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

CO1: Understand the concepts of Fourier series and its construction when discrete and continuous form is known **[Familiarity]**

CO2: Acquire fluency in Fourier transforms in order to solve improper integrals. **[Familiarity]**

CO3: Understand the standard and special types of partial differential equations. **[Familiarity]**

CO4: Gain fluency in solving boundary value problems**. [Familiarity]**

CO5: Understand the Z transform methods to find solutions of difference equations. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H							H			H	M		M
CO2	M	H	M							M			H		H	M
CO3	H	M								L			H			M
CO4	H	H	M			M				M	M		H		H	M
CO5	M	M	M										H			M
16SBS3Z1	H	H	M			M				M	M		H	M	H	M

L-Low, M-Moderate(Medium), H-High

16SES302   **ENGINEERING MECHANICS**   **CATEGORY:ES**
                                        (Common to CSE & IT)

                                                                           L   T   P   C
PREREQUISITES: Nil   3   2   0   4

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with

* To understand the force systems, geometrical properties and frictions in real life applications.
* To understand the dynamics behaviour of particles and impulse momentum principle.

UNIT – I   INTRODUCTION TO MECHANICS AND FORCE CONCEPTS   (9+6)
Principles and Concepts – Laws of Mechanics – system of forces – resultant of a force system – resolution and composition of forces – Lami's theorem – moment of a force – physical significance of moment-Varignon's theorem – resolution of a force into force and couple – forces in space – addition of concurrent forces in space – equilibrium of a particle in space.

UNIT – II   FRICTION   (9+6)
Frictional resistance – classification of friction- laws of friction – coefficient of friction-angle of friction – angle of repose — cone of friction – free body diagram-advantages-equilibrium of a body on a rough inclined plane – non-concurrent force system - ladder friction – rope friction – wedge friction.

UNIT – III   GEOMETRICAL PROPERTIES OF SECTION   (9+6)
Centroids – Determination by integration – centroid of an area – simple figures - composite sections – bodies with cut parts - moment of inertia – theorems of moment of inertia – moment of inertia of composite sections – principal moment of inertia of plane areas - radius of gyration.

UNIT – IV   BASICS OF DYNAMICS   (9+6)
Kinematics and kinetics – displacements, velocity and acceleration - Equations of motion – Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying acceleration – motion curves – motion under gravity – relative motion – curvilinear motion of particles – projectiles – angle of projection – range – time of flight and maximum height. Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamics equilibrium — work energy equation of particles– law of conservation of energy – principle of work and energy.

UNIT – V   IMPULSE MOMENTUM AND IMPACT OF ELASTIC BODIES   (9+6)
Principle of impulse and momentum – Equations of momentum – Laws of conservation of momentum. Impact – Time of compression, restitution, collision – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – Kinetic energy of a particle.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 30 Periods   Practical: 0 Periods   Total: 75 Periods

Text Books:
1. *S.S. Bhavikatti and K.G. Rajasekarappa "Engineering Mechanics" New Age International (P) Ltd. 1999.*
2. *S.C. Natesan "Engineering Mechanics" Umesh Publications, 5-B north market, Naisarak, Delhi , 2002.*
3. *Domkundwar V.M and Anand V. Domkundwar," Engineering Mechanics (Statics and Dynamics)", Dhanpat Rai and Co. Ltd, 1 st Edition, 2006.*

Reference Books:

1. *F.B. Beer and E.R. Johnson, "**Vector Mechanics for Engineers**", Tata Mc.Graw Hill Pvt. Ltd, 10th Edition,2013.*
2. *S. Timoshenko and Young, "**Engineering Mechanics**", Mc.Graw Hill, 4th Edition, 1995.*
3. *Irving Shames and Krishna Mohana Rao, "**Engineering Mechanics**", Prentice Hall of India Ltd, Delhi, 2006.*
4. *R.C. Hibbeller, "**Engineering Mechanics**", Prentice Hall of India Ltd,13th Edition,2013.*
5. *Vela Murali, "**Engineering Mechanics**", Oxford university Press,1st Edition,2010.*

COURSE OUTCOMES:

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

CO1: Know the concept of mechanics and system of forces.
CO2: Calculate the frictional properties at different bodies.
CO3: Identify the locations of centre of gravity and moment of inertia for different sections.
CO4: Understand the basics of dynamics of particles.
CO5: Know the impulse and momentum principle and impact of elastic bodies.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	L	L						L			M	L		
CO2	H	M	L	L									M			
CO3	L	H	M	L									M			
CO4	M	M	L	L						L			M	L		
CO5	L	L	M	H	L								M			
16SES302	M	M	M	M	L					L			M	L		

L-Low,M-Moderate(Medium), H-High

16SES303   **DIGITAL SYSTEMS**   **CATEGORY:ES**

	L	T	P	C
PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
- Basic aspects and designing of digital systems.
- Synthesis of combinational circuits.
- Synchronous and asynchronous sequential circuits.

UNIT – I   INTRODUCTION TO NUMBER SYSTEMS AND CODES   **(9)**
Binary Number Systems-Signed Binary Numbers-Binary Arithmetic-1's and 2's Complement-Octal And Hexadecimal Number Systems-Introduction To Gates-Minimization Of Boolean Function Using Karnaugh Map (Upto Four Variables)-SOP-POS-Quine Mclusky Methods-Code Conversion-Binary Code To Gray Code And Gray To Binary-BCD To Excess-3-Excess To BCD Code etc.

UNIT – II   COMBINATIONAL LOGIC CIRCUITS   **(9)**
Modular Combinational Logic Elements-Overview And Implementation Of Multiplexer/Demultiplexer - Implementation of Combinational Logic Circuits With Using Multiplexer/Demultiplexer -Decoders-Encoders-Priority Encoders-Design of Integer Arithmetic Circuits Using Combinational Logic:Integer Adder - Ripple Carry Adder And Carry Lookahead Adder-Integer Subtraction Using Adders-Design of Combinational Circuits Using Programmable Logic Devices(PLDS):Programmable Read Only Memories(PROM)-Programmable Logic Arrays(PLA)-Programmable Array Logic(PAL) Devices.

UNIT – III   SEQUENTIAL CIRCUITS   **(9)**
Latches:RS Latch And JK Latch-Flipflops-RS,JK,T And D Flipflops-Master-Slave Flipflops-Edge Triggred Flipflops-Analysis And Design of Synchronous Sequential Circuits: Introduction To Sequential Circuits - Characteristics Table-Characteristic Equations And Excitation Table

UNIT – IV   MODULAR SEQUENTIAL LOGIC CIRCUITS   **(9)**
Registers-Design of Synchronous/Asynchronous Using Different Flipflops-Overview Of Shift Register,-Counters-Synchronous/Asynchronous, Up-Down,Ring-Johnson Counters

UNIT – V   ALGORITHMS STATE MACHINES AND MEMORIES   **(9)**
ASM Charts-Notations-RTL Notations And Implementation Of Simple Controller-Multiplexer Controller Method-VHDL:Introduction To HDL-VHDL-Library-Random Access Memory-TTL RAM Cell-Parameter Read,Write Cycles-ROMS-EPROM-MOS Static RAM Cell-Dynamic RAM Cell-Refreshing Memory Cycle

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. M. Morris Mano, Michael D. Ciletti *"Digital Design"* 5th edition,Pearson Education, 2013
2. A P Malvino,D P Leach And Gountansala *"Digital Principles And Applications"* 7th Edition, Tata Mc Graw Hill, 2010

Reference Books:

1. *Stephen Brown,Zvonko Vranesic,"Fundamentals Of Digital Logic Design With Vhdl", 3rd Edition, Tata Mc Graw Hill, 2008.*
2. *Mark K Bach,"Complete Digital Design", Tata Mc Graw Hill, 2003.*
3. *Wakerly Pearson,"Digital Design:Principles And Practices", 4th Edition, Pearson Education, 2008*

COURSE OUTCOMES:

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

CO1: Apply knowledge of number systems and codes in problem solving related to code conversion and number system**[Usage]**

CO2: Apply the concepts of combinational logic devices in digital circuits design.**[Usage]**

CO3: Apply the concepts of sequential logic devices in digital circuits design.**[Usage]**

CO4: Explain fundamentals of different types of memories.**[Familiarity]**

CO5: Design of digital circuits using VHDL.**[Usage]**

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	M	M	M					M		M		M	
CO2	M	M	H	M	M	M					M		M		M	
CO3	M	M	H	M	M	M					M		M		M	
CO4	M	M	M	M		M		M					M		M	
CO5	M	M	M	M	M						M		M		M	
16SES303	M	M	H	M	M	M		M			M		M		M	

L-Low, M-Moderate(Medium), H-High

16SES304　　　　**ANALOG AND DIGITAL COMMUNICATION**　　　**CATEGORY:ES**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* ∗ Basic analog modulation techniques.
* ∗ Fundamental knowledge required to explore wireless communication systems.
* ∗ Spread spectrum techniques and multiple access techniques for wireless communication.
* ∗ Working principles of microwave and optical communication system.
* ∗ Digital transmission techniques

UNIT – I　FUNDAMENTALS OFANALOG COMMUNICATION　　　　　(9)

Principles of amplitude modulation-AM envelope - frequency spectrum – bandwidth - modulation index - percent modulation - Voltage and power distribution - AM detector – peak detector - Angle modulation - FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves - FM detector – slope detector.

UNIT – II　DIGITAL COMMUNICATION　　　　　　　　　　　(9)

Introduction- Shannon limit for information capacity- ASK transmitter, receiver and bandwidth- FSK transmitter, receiver and bandwidth- BPSK transmitter, receiver and bandwidth- QPSK transmitter, receiver and bandwidth- Quadrature Amplitude modulation – transmitter, receiver and bandwidth- bandwidth efficiency- carrier recovery – squaring loop- Costas loop- DPSK – transmitter and receiver.

UNIT – III　DIGITAL TRANSMISSION　　　　　　　　　　　(9)

Sampling theorem- reconstruction of message from its samples- Pulse modulation- PCM – PCM sampling, quantization- signal to quantization noise rate-companding – analog and digital – percentage error- delta modulation-transmitter and receiver- adaptive delta modulation- differential pulse code modulation-transmitter and receiver- pulse transmission – Intersymbol interference- ISI-Nyquist criteria for distortionless transmission.

UNIT – IV　SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES　　(9)

Pseudo-noise sequence -Direct Sequence spread spectrum with coherent binary PSK- Frequency-hop spread spectrum – slow and fast hopping. multiple access techniques: FDMA- TDMA-CDMA - SDMA- wireless communication-frequency reuse and cell splitting- TDMA and CDMA in wireless communication systems- source coding of speech for wireless communications

UNIT – V　MICROWAVE AND OPTICAL COMMUNICATION　　　　　(9)

UHF and microwave antennas –parabolic and conical horn antenna- frequency modulated microwave radio system – transmitter, receiver and repeater- Line of sight path characteristics. Optical fiber Communication System: Light propagation in fiber- Optical fiber classification- Losses in optical fibers- Sources and Detectors.

CONTACT PERIODS:

Lecture: 45 Periods　　　Tutorial: 0 Periods　　　Practical: 0 Periods　　　Total: 45 Periods

Text Books:
1. Wayne Tomasi "Electronic Communication Systems: Fundamentals Through Advanced" Pearson Education, Fifth edition, 2004.
2. Simon Haykin "Communication Systems" John Wiley & Sons, Third edition, 2004.

Reference Books:
1. B.P.Lathi, "Modern Analog And Digital Communication systems", Oxford University Press, Fourth Edition, 2009.
2. T G Kennedy, B Davis and S R M Prasanna "Electronic communication systems" Tata Mc-Graw Hill Educatio Pvt Limited, Fifth Edition 2011.

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

CO1: Explain the principles of Amplitude modulation, Frequency modulation and Phase modulation **[Familiarity]**

CO2: Describe the operation of transmitter and receiver system for digital communication. **[Familiarity]**

CO3: Apply the concept of pulse code modulation for telecommunication networks.**[Usage]**

CO4: Describe the concept of spread spectrum modulation to obtain secure communication. **[Familiarity]**

CO5: Differentiate multiple access techniques like FDMA,TDMA, CDMA and SDMA **[Familiarity]**

CO6: Explain the working principles of microwave antennas. **[Familiarity]**

CO7: Explain the optical fiber communication system. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	M	M	M					M		M		M	
CO2	M	M	H	M	M	M					M		M		M	
CO3	M	M	H	M	M	M					M		M		M	
CO4	M	M	M	M		M		M					M		M	
CO5	M	M	M	M	M						M		M		M	
CO6	M	M	M								M		M		M	
CO7	M	M	M								M		M		M	
16SES304	M	M	H	M	M	M		M			M		M		M	

L-Low, M-Moderate(Medium), H-High

16SPC305   **DATA STRUCTURES**   **CATEGORY: PC**

L	T	P	C
3	0	0	3

PRE-REQUISITES:
      1.16SES2Z5- Programming in C

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
   * Analyzing the time complexity of an algorithm
   * List, Stack, Queue, Tree Abstract Data Types
   * Graph Representation and Graph Traversals
   * Shortest Path Algorithm and Minimum Spanning Tree Algorithms
   * Various internal and external sorting Techniques

UNIT – I   INTRODUCTION AND ABSTRCT DATATYPES   (9)
Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List

UNIT – II   STACK AND QUEUE ADT   (9)
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications.

UNIT – III   TREE ADT   (9)
Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree : Implementation , Expression Tree – Search Tree ADT – AVL Trees , Rotation for Height Balancing - BTrees – Red Black Trees.

UNIT – IV   GRAPH ALGORITHMS   (9)
Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms : Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree : Prim's and Kruskal's algorithm.

UNIT – V   SORTING   (9)
Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Mark Allen Weiss "Data Structures and Algorithm Analysis in C" Second Edition, Pearson Education Limited, 2002.

Reference Books:
1. Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, PHI learning Pvt. Ltd., 2011.
2. Sartaj Sahni, "Data Structures, Algorithms and applications in C++", Second Edition, Universities Press, 2005.

COURSE OUTCOMES:

CO1: Analyze the time complexity of various algorithms **[Analyze]**
CO2: Define Abstract Data Types **[Usage]**
CO3: Explain shortest Path Algorithms **[Familiarity]**
CO4: Explain Minimum spanning tree algorithms.**[Familiarity]**
CO5: Use suitable sorting Technique **[Analyze]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H		L	L		L	L	L	H	H	H	H
CO2	H	H	H	H	M					L		L	H	M	H	
CO3	H		H	M								L	M	M	M	L
CO4	H	H	H	H						L		L	H	M	M	M
CO5	H	H	H	H						L		L	H	M	M	M
16SPC305	H	H	H	M	M		L	L		L	L	L	H	M	M	M

L-Low, M-Moderate(Medium), H-High

16SBS306   **DISCRETE STRUCTURES**   **CATEGORY: BS**

		L	T	P	C
PREREQUISITES: Nil		3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
- ∗ Syntax and semantics of sets, propositional and predicate logic
- ∗ Operations on discrete structures such as functions and relations
- ∗ Idea of a group, a ring, an integral domain and aware of examples of these structures in mathematics.
- ∗ Application of graph theory
- ∗ Graph mining

UNIT – I   SETS AND PROPOSITIONS   **(9)**
Sets: Introduction – Combinations of Sets – Finite and Infinite Sets – Mathematical Induction – Principle of Inclusion and Exclusion – Multisets.
Propositions: Logical Connectives – Conditional and Biconditionals –Well Formed Formulas- Tautologies –Logical Equivalences – Theory of inference for Statement calculus – Predicate Calculus

UNIT – II   RELATION AND FUNCTIONS   **(9)**
Relations: Introduction-A Relational Model for Data Bases-Properties of binary relations-Closure of relations-Warshall's Algorithm-Equivalence relations and Partitions- Partial ordering relations and Lattices-Chains and antichains- A Job scheduling problem- Compatible relation
Functions: Composition of functions-Invertible Functions-Recursive Functions-Hashing-Pigeonhole Principle

UNIT – III   GROUPS AND RINGS   **(9)**
Introduction-Groups-Subgroups-Generators and evaluation of powers-Cosets and Lagrange's Theorem-Permutation groups and Burnside's Theorem-Codes and group codes-Isomorphisms and Automorphisims-Homomorphisims and Normal subgroups-Rings, Integral domains and fields-ring homomorphisims-polynomial rings and cyclic codes

UNIT – IV   GRAPH THEORY   **(9)**
Introduction-Basic Terminology-Multigraphs and Weighted graphs-Digraphs and Relations-Representation of graphs-operations on graphs-Paths and Circuits-Graph traversals-shortest paths in weighted graphs-Euclidian paths and circuits-Hamiltonian Paths and Circuits-The Traveling Salesperson Problem-Planar Graphs-Graph Coloring –Case Study

UNIT – V   MODELLING COMPUTATION   **(9)**
Patterns in static graph –Patterns in Evolving graph – Patterns in weighted graph – structure of specific graph : world wide web – random graph models – generators for Internet topology – Case study

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. C.L. Liu,D.P. Mohapatra "Elements of Discrete Mathematics: A Computer Oriented Approach" Tata McGraw Hill, Third Edition (SIE), 2008.
2. William Kocay, Donald L. Kreher "Graphs, Algorithms, and Optimization" CRC Press, Second Edition,2017
3. Deepayan Chakrabarti, Christos Faloutsos "Graph Mining: Laws, Tools, and Case Studies" Margon & Claypool publishers 2012

Reference Books:

1. *Kenneth H. Rosen, Rosen "Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory", Tata McGraw Hill, Sixth Edition, 2007..*
2. *Tremblay.J.P and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Company, 1997.*
3. *Krishnaiyan Thulasiraman, Subramanian Arumugam, Andreas Brandstädt, Takao Nishizeki , "Handbook of Graph Theory, Combinatorial Optimization, and Algorithms", CRC press,2016*
4. *Donald binder,Martin Erickson , "A Student's Guide To The Study, Practice, and Tools Of Modern Mathematics",CRC Press,2011.*

COURSE OUTCOMES:

CO1: Verify the correctness of an argument using propositional and predicate logic. **[Assessment]**

CO2: Perform operations on discrete structures such as sets, functions and relations. **[Usage]**

CO3: Use the concepts of advanced algebra such as groups and rings in applied contexts **[Usage]**

CO4: Use graph as a powerful modelling tool to solve practical problems in various fields. **[Usage].**

CO5: Use graph mining as a powerful pattern tool to derive valuable information **[Usage**].

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H		L						H	H	H		H
CO2	L	L	H	M		L						L	H			
CO3	L	L														
CO4	H	H	H	H								H	H	H		H
CO5	H	H	H	H								H	H	H	L	H
16SBS306	H	H	H	H		L						H	H	H	L	H

L-Low, M-Moderate(Medium), H-High

16SES307   **DIGITAL SYSTEMS LABORATORY**   **CATEGORY: ES**

	L	T	P	C
PREREQUISITES: Nil	0	0	4	2

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Usage of Logic gates.
* Simplification of Boolean functions to the minimum number of literals.
* Design of Multiplexer and Demultiplexer.
* Design of Flip flops and Shift registers.
* Design of synchronous and asynchronous counter.
* Storage and retrieval of data from a RAM

LIST OF EXPERIMENTS

1. Verification of Truth Tables of logic gates.
2. Design and verify the implementation of Half /Full Adder.
3. Design and verify the implementation of Half /Full subtractor.
4. Implementation of given Boolean Function using logic gates in both SOP and POS form
5. Verification of State Tables of R S, J-K, T and D Flip-Flops using NAND and NOR Gates
6. Implementation and Verification of Decoder/De-Multiplexer and Encoder /Multiplexer Using Logic Gates.
7. Design and implementation of Shift registers
8. Design and implementation of Synchronous and Asynchronous Counter using VHDL
9. Implementation of a Sequence generator.
10. To store and retrieve data from a RAM.
11. Mini project

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

CO1: Verify the truth table of logic gates **[Usage]**

CO2: Analyze and design combinational systems using standard gates and minimization methods such as Karnaugh maps **[Assessment]**

CO3: Analyze and design combinational systems composed of standard combinational modules, such as multiplexers /encoders and De- multiplexers /decoders **[Assessment]**

CO4: Design and implement different types of sequential logic circuits using Flip Flops **[Assessment]**

CO5: Design and implement different types of Counters, registers and sequence generators. **[Assessment]**

CO6: Analyze and design circuits with needed components for simple application using logic gates **[Assessment]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M	M	L								H	H	H	L	L
CO2	H		H	L		L	L					H	H	H	L	L
CO3	H		H	L		L	L					H	H	H	L	L
CO4	H		H	L		L	L					H	H	H	L	L
CO5	H		H	L		L	L					H	H	H	L	L
CO6	H	H	H	L	L	L	L	L	L	L	L	L	H	H	H	L	L
16SES307	H	H	H	L	L	L	L	L	L	L	L	L	H	H	H	L	L

L-Low, M-Moderate(Medium), H-High

16SPC308   **DATA STRUCTURES LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PRE-REQUISITES:
   1. 16SES2Z8 - Programming in C Laboratory

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
   ∗ Implementation of linear data structures.
   ∗ Implementation and analysis of sorting and searching techniques.
   ∗ Performing various operations of nonlinear data structures.
   ∗ Implementation of dynamic memory management.
   ∗ Real time application Development.

LIST OF EXPERIMENTS:

Experiments should be implemented in C/C++
   1. Stack Operations in array and Linked List Implementation
   2. Queue operations in array and Linked List Implementation
   3. Application of stacks: Recursion, Expression Evaluation
   4. Application of Queue: Simulation of FCFS Scheduling
   5. Linked list: Linear list, circularly linked list, Doubly linked list.
   6. Application of Linked List: Polynomial Manipulations
   7. Trees: Operations on binary tree and binary search tree.
   8. Applications of Trees:
   9. Implementation of Graph Traversal Algorithms
   10. Implementation of Minimum Spanning Algorithms
   11. Implementation of hashing techniques.
   12. Implementation of sorting techniques.
   13. Implementation of searching techniques.
   14. Implementation of Dynamic Memory Management

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:
               Upon completion of this course, the students will be able to,
   CO1:   Implement queue and stack data structures using arrays and Linked Lists **[Usage]**
   CO2:   Implement Tree Data structure and perform tree traversals. **[Usage]**
   CO3:   Implement traversal on Graph Data structure. **[Usage]**
   CO4:   Implementation of various sorting and searching Techniques. [**Usage**]
   CO5:   Implement and analyze dynamic memory management. [**Assessment**]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	L					M	M		H	H	H		M
CO2	H	H	M	L					M	M		H	H	H		M
CO3	H	H	M	L					M	M		H	H	H		M
CO4	H	H	M	L					M	M		H	H	H		M
CO5	H	H	M	L					M	M		H	H	H		M
16SPC308	H	H	M	L					M	M		H	H	H		M

L-Low, M-Moderate(Medium), H-High

16SEE309   **BUSINESS COMMUNICATION SKILLS**   **CATEGORY: EEC**

	L	T	P	C
PREREQUISITES: Nil	0	0	4	2

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

  ∗ Usage of English language.
  ∗ Correct pronunciation of English words.
  ∗ Different methods of presentation needed for doing GD, Debate & Mock Interview.
  ∗ Steps for writing good resume and general articles.
  ∗ Reading of books in English.
  ∗ Apt body language and soft skills.

LIST OF EXPERIMENTS

1. Listening to American accent
2. Listening to British accent
3. Practising pronunciation
4. Practising stress and intonation
5. Watching & doing Presentation and GD
6. Watching and doing Debate and Mock Interviews
7. Writing resume
8. Writing articles in English
9. Reading English books
10. Reading technical texts
11. Developing body language
12. Developing soft skills

CONTACT PERIODS:

 Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

 CO1: Listen to and understand spoken English **[Familiarity]**
 CO2: Use correct pronunciation and speak English with proper stress and intonation. **[Familiarity]**
 CO3: Do presentation, GD, Debate & Mock interview confidently. **[Familiarity]**
 CO4: Write good resume and articles in English. **[Familiarity]**
 CO5: Read books in English with confidence. **[Familiarity]**
 CO6: Develop body language and soft skills. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						H			H	H		H		H	H	
CO2						H			H	H		H		H	H	
CO3						H			H	H	H	H	H	L	H	M
CO4						H			H	H	H	H	H	M	H	H
CO5						H	H	M	H	H	M	H	H	H	H	H
CO6						H			H	H	M	H	H	M	H	H
16SEE309						H	L	L	H	H	M	H	H	H	H	H

L-Low, M-Moderate(Medium), H-High

16SBS401   **PROBABILITY, RANDOM PROCESSES AND**   **CATEGORY: BS**
                               QUEUEING THEORY
                          (Common to EIE,CSE & IT)

	L	T	P	C
PREREQUISITES: Nil	3	2	0	4

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* To gain the knowledge of basics of probability.
* To familiarize with standard distributions both discrete and continuous cases and problems of two dimensional distributions.
* To obtain the knowledge of Random process and Markov chains.
* To acquire knowledge of queuing models with finite/infinite capacity in single/ multi servers

UNIT – I   PROBABILITY AND RANDOM VARIABLES   **(9+6)**

Axioms of probability-Conditional probability-Total probability-Baye's theorem-Random variables-Discrete and continuous random variables-Moments- Moment generating functions and their properties.

UNIT – II   STANDARD DISTRIBUTIONS   **(9+6)**

Binomial ,Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties- Functions of Random variable.

UNIT – III   TWO DIMENSIONAL RANDOM VARIABLES   **(9+6)**

Joint distributions-Marginal Distributions-Conditional distributions-Covariance-Correlation and Regression-Transformation of random variables-Central Limit theorem.

UNIT – IV   RANDOM PROCESSES AND MARKOV CHAINS   **(9+6)**

Definition and Examples-first and second order, strictly stationary, wide sense stationary and ergodic processes-Markov process-Poisson processes-Birth and Death processes-Markov chains-Transition probabilities-Limiting distributions.

UNIT – V QUEUEING THEORY   **(9+6)**

Markovian models- M/M/1 and M/M/c, finite and infinite capacity, M/G/1 queue (steady state solutions only) Pollazack Khintchine formula-special cases.

CONTACT PERIODS:

 Lecture: 45 Periods   Tutorial: 30 Periods   Practical: 0 Periods   Total: 75 Periods

Text Books:

1. Veerarajan T "Probability and Random Processes (with Queueing Theory and Queueing Networks)" McGraw Hill Education(India) Pvt Ltd., New Delhi, Fourth Edition 2016.

Reference Books:

1. Gupta S.P, "Statistical Methods", Sultan Chand & Sons, New Delhi, 2015.
2. Kandasamy, Thilagavathy and Gunavathy, "Probability and Random Process", S. Chand & Co, Ramnagar, New Delhi, Reprint 2013.
3. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2015.
4. Trivedi K.S, "Probability and Statistics with Reliability, Queuing and Computer Science Applications",Prentice Hall of India, New Delhi. 2013.

COURSE OUTCOMES:

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

CO1: Understand the concepts of probability and random variables.

CO2: Understand the distributions of discrete and continuous random variables.

CO3: Understand marginal and conditional probability densities under two dimensional distributions.

CO4: Understand the first and second order stationary process and probabilities of Markovian processes.

CO5: Understand queuing models.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	M						H			M	L		
CO2	H	H	M		M					H			M	L		
CO3	H	H	M				L			H			M	L		
CO4	H	H	H				M			M	M		H	M		
CO5	H	H	H	M			M			H	H		H	M		
16SBS401	H	H	M	M	L		M			H	M		M	M		

L-Low,M-Moderate(Medium), H-High

16SPC402   **THEORY OF COMPUTATION**   **CATEGORY: PC**

L	T	P	C
3	2	0	4

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
- ∗ Regular languages and Finite Automata
- ∗ Context Free Languages and Push Down Automata
- ∗ Turing Machines
- ∗ Recursively and Recursively Enumerable Languages
- ∗ Undecidable problems.

UNIT – I   REGULAR LANGUAGES   **(9+6)**
Regular Languages and Regular Expressions - Memory Required to Recognize a Language -Finite Automata - Distinguishing One String from Another - Unions, Intersections, and Complements. Nondeterministic Finite Automata - Nondeterministic Finite Automata with -transitions -Kleene's Theorem. Criterion for Regularity- Minimal Finite Automata-Pumping Lemma for Regular Languages

UNIT – II   CONTEXT FREE LANGUAGES   **(9+6)**
Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages – Equivalence of Parse Trees and Derivation – Simplification of Context-free Grammar – Chomsky Normal Form – Greibach Normal Form - Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG– Pumping Lemma for CFL – Closure Properties - Deterministic Pushdown Automata

UNIT – III   TURING MACHINES   **(9+6)**
Turing Machines – Language of a Turing Machine – Turing Machine as a Computing Device - Techniques for TM – Modifications of Turing Machines – Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines – Multi Tape Turing Machines, Non-deterministic Turing machine.

UNIT – IV   RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES   **(9+6)**
Recursively Enumerable and Recursive-Enumerating a Language –More General Grammars- Context –Sensitive Languages and the Chomsky hierarchy- Not all Languages and Recursively Enumerable.

UNIT – V   UNDECIDABILITY   **(9+6)**
A Language that is not Recursively Enumerable (RE) – An Undecidable Problem that is RE – Undecidable Problems about Turing Machine – Rice Theorem for Recursive and Recursively Enumerable Languages – Post's Correspondence Problem (PCP) – Modified Post Correspondence Problem

CONTACT PERIODS:
 Lecture: 45 Periods   **Tutorial: 30 Periods**   **Practical: 0 Periods**   **Total: 75 Periods**

Text Books:
1. John C. Martin "Introduction to languages and the theory of computation" Third edition, McGrawHil, 2015

Reference Books:
1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson, 2013.
2. Michael Sipser, "Introduction to Theory of Computation", Third Edition, Cengage learning, 2013.
3. Adam Brooks Webber, "Formal languages: a practical introduction", Jim Leisy, 2008

COURSE OUTCOMES:

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

        CO1: Write Regular Expression/Context free grammar for the given language **[Usage**]

        CO2: Construct Automata for the given language**. [Usage]**

        CO3: Design Turing machines for the given problem **[Usage]**

        CO4: Identify recursive and recursively enumerable language**. [Usage]**

        CO5: Find whether the given problem is decidable or not**. [Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H							M	H	M	L	H
CO2	H	H	H	H	H							M	H	M	L	H
CO3	H	H	H	H	H							M	H	M	L	H
CO4	H	H	H	H	H							M	H	M	L	H
CO5	H	H	H	H	H							M	H	M	L	H
16SPC402	H	H	H	H	H							M	H	M	L	H

L-Low,M-Moderate(Medium), H-High

16SPC403   **COMPUTER ARCHITECTURE**   **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Memory addressing modes used by the instructions and to expose the major differentials of RISC and CISC architectural characteristics with performance evaluation of CPU.
* Basics of number representation of signed integers and to perform operations like addition and subtraction of signed integers represented multiplication and floating point addition.
* Organization of a computer system including the CPU data path and control
* Concept of pipelining and the various hazards that arise in a pipeline and the typical solutions to the hazards.
* Concept of memory Technologies and Parallelism and Memory Hierarchies.
* Concepts of Multicore and Shared Memory Multiprocessors.

UNIT – I   INTRODUCTION   (9)
Introduction – Eight Great Ideas in Computer Architecture - –Technologies for Building Processors and Memory - performance -CPU performance and its factors – evaluating performance - The Power Wall -Uniprocessors to Multiprocessors - classes of computing- high - level language to language of hardware – operation of computer hardware – operands of the computer hardware –instructions – Special-purpose instructions - Addressing modes - Supporting procedures in computer hardware. Parallelism and Instructions: Synchronization.

UNIT – II   ARITHMETIC FOR COMPUTERS   (9)
Signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction - multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic - Parallelism and Computer Arithmetic: Subword Parallelism

UNIT – III   PROCESSOR AND PIPELINING   (9)
Single -Cycle Datapath and Control - Multi-cycle Datapath and Control-Micro-programming and Hard-wired Control Units- Introduction to Pipelining; Pipelined Datapath and Control - Pipeline Hazards: Structural, Data Hazards: Forwarding versus Stalling–Control – Exceptions- Parallelism via Instructions.

UNIT – IV   MEMORY SYSTEMS AND I/O INTERFACING   (9)

Introduction - Memory Technologies - The Basics of Caches - Measuring and Improving Cache Performance - Dependable Memory Hierarchy - Virtual Machines - Virtual Memory - A Common Framework for Memory Hierarchy - Parallelism and Memory Hierarchies: Cache Coherence - Redundant Arrays of Inexpensive Disks.

UNIT – V   PARALLEL PROCESSORS FROM CLIENT TO CLOUD   (9)
Introduction - Difficulty of Creating Parallel Processing Programs - SISD, MIMD, SIMD, SPMD, and Vector - Hardware Multithreading - Multicore and Shared Memory Multiprocessors - Graphics Processing Units - Clusters, Warehouse Scale Computers, and Message-Passing Multiprocessors - Multiprocessor Network Topologies - Cluster Networking - Multiprocessor Benchmarks and Performance Models.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *David. A. Patterson, John L. Hennessy "Computer Organization and Design: The Hardware/SoftwareInterface" Fifth Edition, Morgan-Kaufmann Publishers Inc. 2014.*

Reference Books:
1. *Carl Hamachar, ZvoncoVranesic and SafwatZaky, "Computer Organization", McGraw Hil,5th edition,2002.*
2. *John P.Hayes, " Computer Architecture and Organization " Mc-Graw Hill International, Third Edition, 1998.*
3. *William Stallings,"Computer Organization and Architecture: Designing for Performance", Pearson Education,7th Edition,2006.*
4. *Morris Mano. M,"Computer system Architecture",PHI publication, 3rd edition,2008.*

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

CO1: Describe and analyze the main functional units of a computer and its performance evaluation .[**Usage**]

CO2: Explain the Computer Arithmetic .To demonstrate the performance impact of subword parallelism. [**Familiarity**]

CO3: Identify different pipelining hazards and their inference.**[Assessment]**

CO4: Explain the Single –Cycle, Multi-cycle Data path and Control and Micro-programming and Hard-wired Control Units.[**Familiarity**]

CO5: Exploit the advantages of computer memory having virtual memory and cache.[**Usage**]

CO6: Explain the Multicore and Shared Memory Multiprocessors.[**Familiarity**]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H		H				H	M	H	H	M	L
CO2	H	H	H	H	H		H				H	M	H	H	M	L
CO3	H	H	H	H	H		H				H	M	H	H	M	L
CO4	H	H	H	H	H		H				H	M	H	H	M	L
CO5	H	H	H	H	H		H				H	M	H	H	M	L
CO6	H	H	H	H	H		H				H	M	H	H	M	L
16SPC403	H	H	H	H	H		H				H	M	H	H	M	L

L-Low, M-Moderate(Medium), H-High

16SPC404 **DATABASE MANAGEMENT SYSTEMS** **CATEGORY: PC**

	L	T	P	C
	3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Database system and its architecture
* Data models and data modeling
* Database theory and normalization
* Query Processing and Transaction Processing
* Distributed Database architecture and Processing
* NoSQL Databases
* Enhanced data models such as spatial, temporal, multimedia and active databases.

UNIT – I   DATABASE SYSTEM CONCEPTS AND DATA MODELS   **(9)**
Data base approach : Characteristics, Advantages, Applications – Data Models - Three Schema Architecture- Data base System Environment- Data Modeling with ER model- Enhanced ER Model

UNIT – II   RELATIONAL DATA MODEL AND SQL   **(9)**
Relational Model: Concepts, Constraints, Schemas – Basic SQL: Data Definition, Data types, Constraint Specification, Data retrieval Queries, Triggers, Views and Schema Modification- ER and EER to Relational mapping

UNIT – III   DATABASE DESIGN AND QUERY PROCESSING   **(9)**
Design Guidelines – Functional Dependencies – Normal Forms based on Primary Keys – Second and Third Normal Forms – BCNF – Multi valued Dependencies and Fourth Normal Form – Join Dependency and Fifth Normal Form. Strategies for Query Processing – Query Optimization

UNIT – IV   TRANSACTION PROCESSING, CONCURRENCY CONTROL   **(9)**
        AND RECOVERY
Transaction: Desirable Properties, Schedules based on recoverability and Serializability, Transaction support in SQL. Concurrency Control: Locking Technique, Time stamp based ordering, Multi version concurrency control, Validation and Snapshot isolation concurrency control. Recovery Techniques: Concepts, NO-UNDO/ REDO Recovery based on deferred update, Recovery based on immediate update, Shadow paging, ARIES algorithm, Recovery in multi database systems

UNIT – V   ADVANCED TOPICS   **(9)**
Distributed Databases: Concepts, Data fragmentation, Allocation and replication Techniques, Concurrency control, recovery, query processing and optimization, Architecture- NOSQL Systems: CAP Theorem, Document based systems and MongoDB, NOSQL Key-value stores, Column based and NOSQL Graph Databases- Enhanced Data models: Active Database, Temporal Database, Spatial, multimedia and Deductive Databases.

CONTACT PERIODS:

Lecture: 45 Periods   **Tutorial: 0 Periods**   **Practical: 0 Periods**   **Total: 45 Periods**

Text Books:
1. Ramez Elmasri, Shamkant B. Navathe *"Fundamentals of Database Systems" Seventh Edition, Pearson Education Limited, 2015.*

Reference Books:
1. *Abraham Silberschatz , Henry F. Korth and S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill, 2012*
2. *Raghu Ramakrishnan and Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 200.3*

COURSE OUTCOMES:

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

CO1: Explain the various data models **[Familiarity]**

CO2: Design a good relational data base system **[Usage]**

CO3: Use right data model for data storage and retrieval **[Assessment]**

CO4: Explain query processing and optimization techniques**[Familiarity]**

CO5: Write Transaction processing applications considering concurrency control and recovery issues **[Usage]**

CO6: Design Database applications**[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M	M					L	L	L	H	M	M	
CO2	H	H	H	H	M	M	M	M	M	L	H	M	H	H	H	M
CO3	H	H	H	H	H		M	M	M				H	H	H	H
CO4	H	H	H	H	H	M		H	H	M	H	H	H	H	H	H
CO5	H	H	H	H	H	H				L	L	L	H	H	H	
CO6	H	H	H	H	H	H				L	L	L	H	H	H	
16SPC404	H	H	H	H	M	M	M	M	M	L	H	H	H	H	H	L

L-Low, M-Moderate(Medium), H-High

16SPC405   **PRINCIPLES OF OPERATING SYSTEMS**   **CATEGORY: PC**

                                                          L   T   P   C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with:

* Basics of operating system concepts.
* Features of processes, including scheduling, creation, and termination.
* Deadlock Detection, Prevention and Avoidance.
* Different approaches to memory management such as paging and segmentation
* Issues related to file system interface and implementation, disk management
* Protection and security mechanisms.

UNIT – I   INTRODUCTION   **(9)**

Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – Distributed Systems – Computing Environments – System Structures: Operating System Services – User Operating - System Interface – System Calls – Types of System Calls.

UNIT – II   PROCESS MANAGEMENT   **(9)**

Process management: Process concepts – operation on processes - scheduling - Interprocess communication. Threads: Overview- Multicore programming – Multithread models – Thread Library –Implicit threading - Threading issues. CPU Scheduling: Basic concepts-Scheduling criteria-Scheduling algorithms-Multiple- Processor scheduling-Thread scheduling.

UNIT – III   PROCESS SYNCHRONIZATION   **(9)**

Process synchronization: The critical- section problem. Peterson's Solution, synchronization Hardware, semaphores, classical problems of synchronization, monitors. Deadlock: System model-Deadlock characterization- Prevention-Avoidance and detection- Recovery from deadlock.

UNIT – IV   MEMORY MANAGEMENT   **(9)**

Memory Management Requirements – Memory partitioning – paging – segmentation – Segmentation –security issues - Paged segmentation-Virtual memory concepts-Demand paging, Performance of demand paging-Page replacement algorithms-Thrashing-Cache memory organization-Locality of reference.

UNIT – V   STORAGE MANAGEMENT   **(9)**

Disk Structure-Disk Attachment - Disk scheduling- Disk Management-Swap Space Management – RAID Structure. File System- File concept- Access methods- Directory and Disk Structure- File system Mounting-File sharing- File system implementation issues-File system protection and security.

CONTACT PERIODS:

 Lecture: 45 Periods   **Tutorial: 0 Periods**   **Practical: 0 Periods**   **Total: 45 Periods**

Text Books:

1. A. Silberschatz & Peter Baer Galvin and Greg Gagne "Operating System concepts" 9th edition, John Wiley and sons Inc., 2012.
2. William Stallings "Operating Systems: Internals and design Principles" 8th Edition, Prentice Hall, 2014.

Reference Books:

1. *Andrew S. Tanenbaum, Albert S. Woodhull: "Operating Systems, Design and Implementation", 3rd Edition, Prentice Hall, 2011.*

2. *Gary Nutt: "Operating Systems", 3rd Edition, Pearson Education, 2009.*

3. *D M Dhamdhere, "Operating Systems: A Concept-based Approach", 2nd Edition, Tata McGraw-Hill Education, 2009.*

COURSE OUTCOMES:

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

CO1: Explain the structure &functions of operating systems **[Familiarity]**

CO2: Explore inter process communication using shared memory and Message Passing **[Usage]**

CO3: Solve problems using CPU Scheduling algorithms like FCFS,SJF and RR **[Usage]**

CO4: Use locks, semaphores, monitors for synchronization in multithreaded programs **[Usage]**

CO5: Identify and handle Resource allocation, deadlock prevention, avoidance and detection techniques in multiprogramming environment **[Usage]**

CO6: Use different kinds of memory management techniques like paging and segmentation **[Usage]**

CO7: Use disk management and disk scheduling algorithms for better utilization of external memory **[Usage]**

CO8: Recognize file system interface, protection and security mechanisms **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H		M									M	H	H		H
CO2	H	L	M	L								M	H	H	M	M
CO3	M	H	H	L								M	H	H	M	M	M
CO4	M	H	H	L								M	H	H	M	M	M
CO5	H	H	H	H	L								H	H	H	M	M
CO6	H	M	H	M	L								H	M	M	M	M
CO7	H	M	H	M	L								H	M	M	M	M
CO8	H	M	M	M	M	M	M	H					H	H	M	H	H
16SPC405	H	M	H	M	L	M	M	H				M	H	H	M	M	M

L-Low, M-Moderate(Medium), H-High

16SPC406
DESIGN AND ANALYSIS OF ALGORITHMS

CATEGORY: PC

L	T	P	C
2	0	2	3

PRE-REQUISITES:
1. 16SPC305 – Data Structures

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Different approaches for algorithm analysis.
* Decrease and Conquer technique.
* Greedy approach, Divide and Conquer and Dynamic Programming technique.
* Backtracking and Branch and Bound technique.
* Approximation and Randomized algorithms.

UNIT – I   INTRODUCTION TO ALGORITHM ANALYSIS   L(6)+P(6)
Fundamentals of Algorithmic Problem Solving - Important Problem Types - Fundamentals of the Analysis of Algorithm Efficiency - Asymptotic Notations and Basic Efficiency Classes - Mathematical Analysis of Nonrecursive Algorithms - Mathematical Analysis of Recursive Algorithms - Amortized Analysis - Empirical Analysis of Algorithms - Algorithm Visualization

UNIT – II   DECREASE AND CONQUER TECHNIQUE   L(6)+P(6)
Decrease by constant: Insertion sort - Topological algorithm. Decrease-by-a-Constant-Factor: Binary Search - Fake-Coin Problem - Russian Peasant Multiplication - Josephus Problem. Variable-Size-Decrease - Computing a Median and the Selection Problem - Interpolation Search - Searching and Insertion in a Binary Search Tree - The Game of Nim.

UNIT – III   ALGORITHM DESIGN TECHNIQUES -I   L(6)+P(6)
Greedy Approach : Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm - Huffman Trees and codes .Divide and Conquer : Merge Sort – Quick sort - Matrix Multiplication of Large Integers - Strassen's Matrix Multiplication .Dynamic Programming : Matrix Chain Multiplication – Knapsack problem and Memory Function   – optimal binary search tree - Warshall's and Floyd's Algorithms – Longest common Subsequence

UNIT – IV   ALGORITHM DESIGN TECHNIQUES -II   L(6)+P(6)
Backtracking: n-Queen problem – Hamilton Circuit Problem – Subset sum problem - CNF – SAT Branch and Bound: Assignment problem – Knapsack problem - Travelling Salesman Problem.

UNIT – V   NP COMPLETENESS   L(6)+P(6)
Introduction to NP Class – NP Completeness and Reducibility - Approximation Algorithm for NP Hard Problems: TSP - Knapsack problem – Randomization and Linear Programming.

LIST OF EXPERIMENTS:
1. Determine the time required to sort given set of elements using insertion sort, selection sort, Quick sort and merge sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement and analyze the performance of Fake-Coin Problem, Josephus Problem and Game of Nim using Decrease and Conquer Technique.
3. Implement and analyze the performance of 0/1 Knapsack problem , optimal binary search tree and Matrix chain multiplication using dynamic programming.
4. Implement and analyze the performance of N Queen's problem and Subset sum problem using Back Tracking.

5. Implement and analyze the performance of Assignment problem and Travelling Salesman problem using branch and bound technique.
6. Sorting using MapReduce Implementing algorithm using Squid and HAProxy.

CONTACT PERIODS:
Lecture: 30 Periods   **Tutorial: 0 Periods**   **Practical: 30 Periods**   **Total: 60 Periods**

Text Books:
1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" ThirdEdition, Pearson Education, 2012.
2. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein "Introduction to Algorithms" Third Edition, MIT Press/McGraw-Hill, 2009.
Reference Books:
1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Second Edition, Wiley, 2006.
2. Mark de Berg, Mark van Kreveld, Mark Overmars and Otfried Shwarzkopf (Cheong), "Computational Geometry: Algorithms and Applications", Third edition, Springer-Verlag, 2008.
3. Skiena S. Steven "The algorithm design manual", Second edition, Springer 2008.

COURSE OUTCOMES:
   Upon completion of this course, the students will be able to,
   CO1: Analyze the time complexity of given problem. **[Assessment]**
   CO2: Explain and apply Decrease and Conquer algorithm. **[Usage]**
   CO3: Derive and solve recurrences describing the performance of divide-and-conquer
       algorithms. **[Usage]**
   CO4: Identify and apply Greedy approach and Dynamic Programming technique. **[Usage]**
   CO5: Analyze algorithm deploying Backtracking and Branch and Bound technique.**[Assessment]**
   CO6: Describe Approximation and randomized algorithm. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	L	L	H								H	H	L		L
CO2	H	M	M	M								H	H	H	L	L
CO3	H	M	M	M								H	H	H	L	L
CO4	H	M	M	M								H	H	H	L	L
CO5	H	M	M	M								H	H	H	L	L
CO6		L	L	L								L				
16SPC406	H	M	M	H								H	H	H	L	L

L-Low,M-Moderate(Medium), H-High

16SPC407   **DATABASE MANAGEMENT SYSTEMS LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* ∗ DDL, DML, DCL and TCL commands.
* ∗ Operations in Relational Algebra
* ∗ Concepts of Views, triggers, Stored procedures and functions
* ∗ Concepts of Cursors and packages
* ∗ Front end design using PHP
* ∗ Algorithm to enforce query optimization and concurrency control

LIST OF EXPERIMENTS

1. DDL, DML, DCL and TCL commands.
2. Relational Algebra Operations
3. Views
4. Stored Procedures and Functions.
5. Cursors, Packages and Triggers
6. Form Design using PHP and report generation using JDBC connectivity
7. Query Processing and Optimization
8. Concurrency Control
9. Mini Project

CONTACT PERIODS:

Lecture: 0 Periods   **Tutorial: 0 Periods**   **Practical: 60 Periods**   **Total: 60 Periods**

COURSE OUTCOMES:

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

CO1: Manipulate a database using DDL, DML, DCL and TCL commands. **[Usage]**

CO2: Implement a database schema for any real world problem. **[Usage]**

CO3: Impose integrity constraints on a database. **[Usage]**

CO4: Apply PL/SQL constructs to practice Stored Procedures, Functions, Cursors, Packages and Triggers. **[Usage]**

CO5: Implement storage and retrieval algorithms for Query processing and Optimization. **[Usage]**

CO6: Implement Concurrency Control algorithms. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	H	H				H	H	H	H	M	H	H	M
CO2	H	H	H	H	H				H	H	H	H	M	H	H	M
CO3	L	L	L	L	H				L	L	L	H	M	H	H	M
CO4	L	H	M	L	H				H	M	L	H	L	H	H	L
CO5	H	H	H	M	H				H	H	M	H	M	H	H	M
CO6	L	H	M	L	H				H	M	L	H	L	H	H	L
16SPC407	M	H	M	L	H				H	M	M	H	M	H	H	M

L-Low, M-Moderate(Medium), H-High

16SPC408   **OPERATING SYSTEMS LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Process scheduling and Inter process communication.
* Process synchronization using mutex and semaphore.
* Deadlock prevention and avoidance.
* Paging and disk scheduling.
* Storage allocation techniques.

LIST OF EXPERIMENTS

1. Implementation of process scheduling algorithms.
2. Implementation of inter process communication using shared memory and message passing.
3. Implementation of Bounded-Buffer problem using mutex.
4. Implementation of Readers-Writers problem using semaphore.
5. Implementation of Dining Philosophers problem using semaphore.
6. Implementation of Resource Allocation Graph.
7. Implementation of Banker's algorithm.
8. Implementation of page replacement algorithms.
9. Implementation of disk scheduling algorithms.
10. Illustration of file storage allocation techniques

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Implement process scheduling and inter process communication. **[Usage]**

CO2: Implement process synchronization using mutex and semaphore. **[Usage]**

CO3: Generate resource allocation graph and implement deadlock avoidance**. [Usage]**

CO4: Implement page replacement and disk scheduling algorithm. **[Usage]**

CO5: Illustrate the file storage allocation techniques. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1				H					M			L	M	H		
CO2				H					M			L	M	H		
CO3				H					M			L	M	H		
CO4				H					M			L	M	H		
CO5				H					M			L	M	H		
16SPC408				H					M			L	M	H		

L-Low,M-Moderate(Medium), H-High

16SEE409   HARDWARE TROUBLESHOOTING SKILLS   CATEGORY: EEC

	L	T	P	C
PREREQUISITES: Nil	0	0	4	2

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* ∗ Components of the motherboard
* ∗ System Administration tasks
* ∗ Different storage media
* ∗ System related problem
* ∗ Troubleshooting

LIST OF EXPERIMENTS

1. Study and identification of standard desktop personal computer
2. Understanding of Motherboard and its interfacing components
3. Install and configure computer drivers and system components.
4. Disk formatting, partitioning and Disk operating system commands
5. Install, upgrade and configure Windows operating systems.
6. Remote desktop connections and file sharing.
7. Identify, install and manage network connections Configuring IP address and Domain name system
8. Install, upgrade and configure Linux operating systems.
9. Installation Antivirus and configure the antivirus.
10. Installation of printer and scanner software.
11. Disassembly and Reassembly of hardware.
12. Troubleshooting and Managing Systems

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Identify the components of the motherboard. **[Familiarity]**

CO2: Assemble and configure a Personal Computer **[Familiarity]**

CO3: Perform disk formatting and Partitioning **[Familiarity]**

CO4: Install, upgrade and configure Windows/Linux operating systems **[Familiarity]**

CO5: Installation of Antivirus, Printer and Scanner software **[Familiarity]**

CO6: Troubleshoot and Manage Systems **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H			M		M		M	H	H	M	H
CO2	H	H	H	H	H			M		M		M	H	H	M	H
CO3	H	H	H	H	H			M		M		M	H	H	M	H
CO4	H	H	H	H	H			M		M		M	H	H	M	H
CO5	H	H	H	H	H			M		M		M	H	H	M	H
CO6	H	H	H	H	H			M		M		M	H	H	M	H
16SEE409	H	H	H	H	H			M		M		M	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SPC501   **EMBEDDED COMPUTING SYSTEMS**   **CATEGORY: PC**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Basic hardware and software components and their selection for embedded computing systems.
* Hardware software co-design and firmware design approaches.
* Programming and RTOS and apply for different applications.

UNIT – I   EMBEDDED COMPUTING, INSTRUCTION SETS, CPUS   (9)

Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design Design Example: Model Train Controller. ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

UNIT – II   BUS-BASED COMPUTER AND DISTRIBUTED EMBEDDED   (9)
**   SYSTEMS**

CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System Level Performance Analysis - Design Example: Alarm Clock. Distributed Embedded Systems: Distributed Network Architectures, Networks for Embedded Systems: I2C Bus, CAN Bus, SHARC Link Ports, Ethernet, Myrinet, Internet, Network Based Design. Design Example: Elevator Controller

UNIT – III   PROGRAM DESIGN AND ANALYSIS   (9)

Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

UNIT – IV   REAL TIME OPERATING SYSTEM (RTOS) BASED DESIGN   (9)

Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization - Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering Machine.

UNIT – V   EMBEDDED SYSTEMS DEVELOPMENT ENVIRONMENT   (9)

The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler /Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.

CONTACT PERIODS:

 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Wayne Wolf **"Computers as Components, Principles of Embedded Computing Systems Design"** 2nd Edition, Elsevier, 2008.
2. Shibu K V **"Introduction to Embedded Systems"** Tata McGraw Hill, 2009

Reference Books

1. James K. Peckol, **"Embedded Systems, A contemporary Design Tool",** Wiley India, 2008
2. Tammy Neorgaard, **"Embedded Systems Architecture",** Elsevier, 2005.

COURSE OUTCOMES:

CO1: Apply the microcontroller cores (ARM, RISC, CISC, and SOC) for the Embedded systems**. [Usage]**

CO2: Explain the design components of embedded systems **[Familiarity]**

CO3: Develop programs using embedded programming **[Usage]**

CO4: Apply RTOS concepts of task and time management, memory management for embedded systems. **[Usage]**

CO5: Develop Embedded applications using Embedded systems development environment**[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	M	M	H	M	M	M			L		M	L	L	H	H	L
CO2	M	M	H	M	M	M	M	M	H	H	M	H	L	H	H	M
CO3	M	M	H	M	M	M	L	M	M	M	M	H	M	H	H	M
CO4	M	M	M	M		M	M	M	M	M		M	M	H	H	H
CO5	M	M	M	M	M		H	H	H	M	M	H	L	H	H	H
16SPC501	M	M	M	M	M	M	M	M	H	M	M	H	M	H	H	M

L-Low, M-Moderate(Medium), H-High

16SES502   **SCIENCE OF PROGRAMMING**   **CATEGORY: ES**

	L	T	P	C
	3	0	0	3

PREREQUISITES:

      1.16SBS306 -Discrete Structures

      2.16SPC402 - Theory of Computation

COURSE OBJECTIVE:

Upon completion of this course the students will be familiar with:

    ∗ The mathematical and computational methods used to ensure program correctness

    ∗ The most common approaches to program verification

    ∗ The fundamental theories used to develop software systems

UNIT – I   INTRODUCTION TO PROGRAMME CORRECTNESS   **(9)**

Preliminaries – Mathematical notations - Sets, Tuples, Relations, Functions, Sequences, Strings, Prrofs, Induction, Grammars – Typed Expressions –Types, Variables, Constants, Expressions, Subscripted Variables – Semantics of Expressions:Fixed structures, States, definition of semantics, Updates of states- Formal Proof systems, Assertions, semantics of Assertions, Substitution, Substitution Lemma –

UNIT – II   DETERMINISTIC PROGRAMS   **(9)**

While programs: Syntax, Semantics, Properties of semantics, Verification- Partial correctness, Total Correctness – Completeness- Parallel Assignment, Failure Statement – Case study: Partioning an Array - Systematic Development Correct Programs: Summation Problem, Minimum-sum Section Problem**.**

UNIT – III   RECURIVE PROGRAMS   **(9)**

Syntax, Semantics, Properties of semantics, Verification- Partial correctness, Total Correctness – Completeness- Parallel Assignment, Failure Statement – Case study: Binary Search- recursive Programs with Parameters: Syntax, Semantics, Verification – Partial Correctness: Non Recursive procedures – Recursive Procedures, Modularity, Total Correctness, Soundness – Case study: Quick Sort, Formal Problem Specification, Properties of Partition: Permutation Property, Sorting Property – Total Correctness.

UNIT – IV   OBJECT ORIENTED PROGRAMS   **(9)**

Syntax, Local Expressions, Statements and Programs – semantics, Semantics of local Expressions – Updates of States –Semantics of statements and programs –assertions, Substitutions, verification, partial Correction, total Correction –Adding parameters, _ Transformation of Object oriented Programs – Object Creation: semantics, assertions, Verification, Soundness – Case Study: Zero Search in Linked lists, Insertion in a Linked List.

UNIT – V   NON DETERMINISTIC AND DISTRIBUTED PROGRAMS   **(9)**

Use of non deterministic programs – Non Determinism, Failures, Modeling Concurrency – Partial correction, Total Correction – transformation of parallel programs – Distributed Programs: Syntax, sequential Process, Distributed Programs, Transformation into Nondeterministic Programs – Verification: Partial Correctness, Weak Total Correctness, Soundness –Case Study: A transmission Problem.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Krzysztof R. Apt, Frank S. de Boer, Ernst-R¨udiger Olderog, ***"Verification of sequential and Concurrent programs",*** *Springer.*

Reference Books:

1. *James L Hein, **"Discrete Structures, Logic and Computability",** Jones and Bartlett Learning, 4th edition, 2015.*
2. *David Gries **"The Science of Programming",** Springer, 1981.*

COURSE OUTCOMES:

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

CO1: Use mathematical and computational method to ensure the correctness of the programme **[Usage]**

CO2: Develop deterministic programs systematically and verify its correctness **[Usage]**

CO3: Develop recursive programs and verify its correctness **[Usage]**

CO4: Develop object oriented programs and verify its correctness **[Usage]**

CO5: Develop non-deterministic programs and verify its correctness **[Usage]**

CO6: Develop distributed programs and verify its correctness **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	M	L	L	M	M	L		H	H	H	H	H
CO2	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H
CO3	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H
CO4	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H
CO5	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H
CO6	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H
16SES502	H	H	H	H	H	L	L	M	M	L		H	H	H	H	H

L-Low,M-Moderate(Medium), H-High

16SPC503　　　　　　**COMPUTER NETWORKS**　　　　**CATEGORY: PC**

	L	T	P	C

PREREQUISITES: Nil　　　　　　　　　　　　　　　　　3　　0　　0　　3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with:

∗ The division of network functionality into layers.

∗ The functions and protocols of each layer of TCP/IP protocol suite.

∗ The flow of information from one node to another node in the network.

∗ The components required to build different types of network.

∗ The concepts of network addressing

UNIT – I　INTRODUCTION TO LAYER ARCHITECTURE AND APPLICATION LAYER　　　　　　　　　　**(9)**

The Network edge and core – Delay, loss and throughput in packet switched networks - Layered Architecture – ISO/OSI Model – Internet Architecture (TCP/IP) - Principles of Network applications - Application Layer Protocols – Web and HTTP – FTP – Telnet – Email – DNS – Peer to peer applications.

UNIT – II　TRANSPORT LAYER　　　　　　　　　　　　**(9)**

Network Security - Introduction to Transport layer services – Multiplexing and demultiplexing – Principles of reliable data transfer - User Datagram Protocol (UDP)– Connection Oriented Transport - Transmission Control Protocol (TCP) - Flow Control – Congestion Control.

UNIT – III　NETWORK LAYER　　　　　　　　　　　　**(9)**

Virtual Circuit and datagram networks – Routers - Internet Protocol – Routing algorithms – Routing in the Internet – Broadcast and Multicast routing.

UNIT – IV　COMPRESSION TECHNIQUES　　　　　　　　**(9)**

Link Layer – Framing – Addressing – Error Detection/Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics – CSMA/CD – Frame Format – Switching – Types (datagram, virtual) – Hubs, Bridges, Switches – Virtual LAN (VLAN) – Wireless LAN (802.11) – WAN Technologies.

UNIT – V　PHYSICAL LAYER　　　　　　　　　　　　**(9)**

Transmission – Impairments – Bandwidth Limitations – Modulation – Frequency Spectrum – Multiplexing – Encoding Techniques – Transmission Media - Copper – Fiber – Optical – Radio.

CONTACT PERIODS:

Lecture: 45 Periods　　　**Tutorial: 0 Periods**　　　**Practical: 0 Periods**　　　**Total: 45 Periods**

Text Books:

1. James F. Kurose, Keith W. Ross "Computer Networking, A Top-Down Approach Featuring the Internet"Sixth Edition, Pearson Education, 2012.
2. Larry L. Peterson, Bruce S. Davie "Computer Networks: A Systems Approach" Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.

Reference Books:

1. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.
2. Behrouz A. Forouzan and Firouz Mosharraf, "Computer Networks a Top Down Approach",
3. Tata McGraw-Hill, 2011.
4. Andrew S. Tanenbaum, "Computer networks", Pearson Education, 5th edition 2012.
5. Douglas E. Comer, "Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture", Sixth Edition, Pearson Education, 2013.

COURSE OUTCOMES:

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

CO1: Explain data communication systems and its components **[Familiarity]**

CO2: Identify the different types of network topologies and protocols **[Familiarity]**

CO3: Enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer **[Familiarity]**

CO4: Identify the design issues of physical, data link, network, transport and application layers **[Familiarity]**

CO5: Describe basic protocols of Computer Networks and how they can be used to assist in network design and implementation. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M	L	M	L	H	L	M		L	H	H	M	H
CO2	H	M	M	M	L	M	L	H	L	M		L	H	H	M	H
CO3	H	M	M	M	L	M	L	H	L	M		L	H	H	M	H
CO4	H	M	M	M	L	M	L	H	L	M		L	H	H	M	H
CO5	H	M	M	M	L	M	L	H	L	M		L	H	H	M	H
16SPC503	H	H	H	H	M	M	L	H	L	M		M	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SPC504   SOFTWARE ENGINEERING METHODOLOGIES   CATEGORY: PC

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Software Process models
* Software Requirement Analysis and design
* Aspects related to Software Quality
* Software Estimation techniques and Testing Methodology
* SCRUM Development Process.

UNIT – I   SOFTWARE PROCESS MODEL   (9)
Principle of Software engineering – Software myths - Prescriptive process model: Waterfall Model - Incremental Process Models - Evolutionary Process Models - Concurrent Models– Unified process – Agile Development: Agility Principles – Extreme Programming – Other Agile Process Model.

UNIT – II   SOFTWARE REQUIREMENT MODELING   (9)
Requirement Engineering – Eliciting Requirement - Quality Function Deployment – Building Requirement model –Negotiating Requirement -   Validating Requirement –Requirement Analysis – Scenario Based Modeling – Data Modeling – Class Based Modeling – Flow Oriented Modeling – Requirement Modeling for Web App -Case Study

UNIT – III   SOFTWARE DESIGN AND ESTIMATION   (9)
Design Process - Design Concepts – Design Model - Architectural Design - Component level design – User interface design - pattern based design – Web App design – Case Study.
Software Project Estimation – Decomposition techniques- Empirical Estimation model – Specialized Estimation Technique for Agile Development - Project Scheduling - Risk Management.

UNIT – IV   SOFTWARE QUALITY AND TESTING   (9)
Software Quality – Review Techniques – Software Quality Assurance – Strategic approach to software testing – Testing Strategies for Conventional software-Object- Oriented software – WebApps – Validation testing –system testing –Art of Debugging – Testing Conventional Application – Testing Object- Oriented Application – Testing Web Applications -Case study Tarantula : Software testing tool for Agile Development.

UNIT – V   INTRODUCTION TO SCRUM DEVELOPMENT PROCESS   (9)
Basics of Scrum – Running a Scrum project – Steps for transition to scrum – Metrics for scrum –Case Study.

CONTACT PERIODS:
 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
*1. Roger Pressman.S **"Software Engineering: A Practitioner's Approach"** Eighth Edition, McGraw Hill, 2010.*
*2. Ian Sommerville **"Software Engineering"** Nineth Edition, Pearson Education Asia, 2011.*
Reference Books:
*1. Shari Lawrence Pfleeger, Joanne M. Atlee, **"Software Engineering: Theory and Practice",** Fourth Edition, Pearson Education, 2011.*

COURSE OUTCOMES:

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

CO1: Describe different models of the software development process, their drawbacks and when they are applicable **[Familiarity]**

CO2: Perform architectural design, component level design, UI design and Web design for a given project. **[Usage]**

CO3: Identify risks and construct RMMM plan for a software project .**[Usage]**

CO4: Apply effort and schedule estimation models .**[Usage**

CO5: Construct Configuration management plan for traditional and agile project.**[Assessment]**

CO6: Verify and validate the software applications using different types of black box and white box testing.**[Assessment]**

CO7: Application of SCRUM Development Process to develop software.**[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M	L				L	L	H	M	H	H	M	H
CO2	H	H	H	H	H				H	H	H	H	H	H	M	H
CO3	H	M	M	H	H				H	H	H	H	H	H	M	H
CO4	M	M	M	H	H				M	M	M	H	H	M	M	H
CO5	M	M	M	L	H				H	H	H	M	H	H	L	H
CO6	M	M	M	H	H				M	M	M	M	H	H	M	H
CO7	H	M	H	L	H				H	H	M	M	H	H	L	H
16SPC504	H	H	H	H	H				H	H	H	H	H	H	M	H

L-Low, M-Moderate(Medium), H-High

16SPC505　　　　**DIGITAL SIGNAL PROCESSING AND**　　　　**CATEGORY: PC**
　　　　　　　　　　　　　　　APPLICATIONS

L	T	P	C
2	2	0	3

PREREQUISITES:
　　　　1.16SES304 - Analog and Digital Communication

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
　　　∗ Describing the fundamentals of signals and systems.
　　　∗ Solving the problems using DFT and FFT.
　　　∗ Describing methods to learn the IIR filters
　　　∗ Describing methods to learn the FIR filters
　　　∗ Acquiring knowledge on signal conversion and errors in real time applications of DSP

UNIT – I　SIGNALS AND SYSTEMS　　　　　　　　　　　　　　　　**(6+6)**
Basic Elements of Digital Signal Processing – Concept of Frequency in Continuous Time and Discrete Time Signals – Sampling Theorem – Discrete Time Signals – Discrete Time Systems – Analysis of Linear Time Invariant Systems – Z Transform – Convolution and Correlation

UNIT – II　FAST FOURIER TRANSFORMS　　　　　　　　　　　　　**(6+6)**
Introduction to DFT – Efficient Computation of DFT – Properties of DFT – FFT Algorithms – Radix-2 and Radix-4 FFT Algorithms – Decimation in Time – Decimation in Frequency– Use of FFT Algorithms in Linear Filtering and Correlation.

UNIT – III　IIR FILTER DESIGN　　　　　　　　　　　　　　　　**(6+6)**
Structure of IIR – System Design of Discrete Time IIR filter From Continuous Time Filter – IIR Filter Design by Impulse Invariance – Bilinear Transformation – Approximation Derivatives – Design of IIR Filter in the Frequency Domain.

UNIT – IV　FIR FILTER DESIGN　　　　　　　　　　　　　　　　**(6+6)**
Symmetric and Antisymteric FIR Filters – Linear Phase Filter – Windowing Technique – Rectangular– Kaiser Windows– Frequency Sampling Techniques – Structure for FIR Systems.

UNIT – V　FINITE WORD LENGTH EFFECTS　　　　　　　　　　　**(6+6)**
Quantization Noise – Derivation for Quantization Noise Power – Fixed Point and Binary Floating Point Number Representation – Comparison – Over Flow Error – Truncation Error – Co-Efficient Quantization Error – Limit Cycle Oscillation – Signal Scaling – Analytical Model of Sample and Hold Operations – Application of DSP – Model of Speech Wave Form – Vocoder.

CONTACT PERIODS:
Lecture: 30 Periods　　　**Tutorial: 30 Periods**　　　**Practical: 0 Periods**　　　**Total: 60 Periods**

Text Books:
1. John G Proakis and Dimtris G Manolakis **"Digital Signal Processing Principles – Algorithms and Application"** Fourth Edition, PHI/Pearson Education, 2007.
2. Alan V Oppenheim, Ronald W Schafer and John R Buck **"Discrete Time Signal Processing"** Edition, PHI/Pearson Education, 2000.

Reference Books:
1. SanjitK.Mitra, **"Digital Signal Processing A Computer - Based Approach"**, Second Edition, Tata McGraw-Hill, 2001.
2. JohnyR.Johnson, **"Introduction to Digital Signal Processing"**, Prentice Hall of India/Pearson Education, 2002.

COURSE OUTCOMES:

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

CO1:Explain the primitives of signal and systems. **[Familiarity]**

CO2: Compute convolution of continuous and discrete time signals **[Usage]**

CO3: Use Z Transform to analyse discrete time systems. **[Usage]**

CO4: Analyse computational complexity of Fast Fourier transform **[Assessment]**

CO5: Apply FFT for liner filtering and correlation **[Usage]**

CO6:Transform differential equations into direct form structures for IIR filters**. [Usage]**

CO7: Design FIR filters using windowing, rectangular, Kaiser and frequency sampling techniques**.**
   [Usage]

CO8:Compare overflow, truncation and Co-efficient errors**.[Assessment]**

CO9:Describe the application of DSP in designing of vocoder**.[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M	M		L		L	L	M	L	L	M	M	L
CO2	H	M	H	M	M				M	L	M	L	L	M	H	H
CO3	H	H	H	M	M			M	L	M	M	H	M	M	M
CO4	H	H	M	H	M				L	M	M	H	M	M	H
CO5	H	M	H	M	M			M	M	H	M	M	H	H	M	M
CO6	H	M	H	M	M				M	M	M	M	M	L	M	M
C07	H	M	H	M	M		L		M	M	M		M	L	M	M
C08	H	M	M	H	M			L	L	H	M	M	M	M	M	H
CO9	H	M	H	M	M	L	L	H	H	M	M	M	H	H	H	H
16SPC505	H	M	H	M	M	L	L	M	M	M	M	M	M	M	M	H

L-Low, M-Moderate(Medium), H-High

16SPC507   **EMBEDDED COMPUTING SYSTEMS LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PRE-REQUISITES:

1. 16SES307 – Digital Systems Laboratory

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Implementation of Assembly programs on ARM based Processor
* Configuration of GPIO port pins
* Usage of Timer and Interrupt handler
* Concept of Interfacing with other devices.

LIST OF EXPERIMENTS

1. The Experiments need to be implemented on ARM based Processor
2. Simple Assembly Program for
   a. Addition | Subtraction | Multiplication | Division
   b. Operating Modes, System Calls and Interrupts
   c. Loops, Branches, Operators.
3. Write an Assembly programs to configure and control General Purpose Input/output (GPIO) port pins.
4. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.
5. Program to perform reading and writing from a file
6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment
7. Program to demonstrate a simple interrupt handler and setting up a timer.
8. Program to Interface 8 Bit LED and Switch Interface
9. Program to implement Buzzer Interface on IDE environment
10. Program to display a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
11. Mini project.

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Write simple Assembly program in an ARM based Processor **[Usage]**

CO2: Write Assembly program for configuring GPIO port pin ,Timer and Interrupts **[Assessment]**

CO3: Demonstrate the Usage of Files **[Usage]**

CO4: Write programs that interact with other devices like LED, Switch and LCD **[Assessment]**

CO5: Develop simple Embedded applications **[Assessment]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L	H	M								M	H	H	H	H
CO2	M	L	H	M	M							M	H	H	H	H
CO3			L		M							M			L	M
CO4	L	L	L		M	L						M	L	H		M
CO5	H	L	H	M	M	L	L	L	L	L	L	M	H	H	H	H
16SPC507	H	L	H	M	M	L	L	L	L	L	L	M	H	H	H	H

L-Low, M-Moderate(Medium), H-High

16SPC508   **COMPUTER NETWORKS LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Implementation of various network protocols
* Client-server communication using socket programming
* TRACEROUTE, PING commands and RPC
* Configuration of routers and switches
* Network simulation tools

LIST OF EXPERIMENTS

Experiments should be implemented in Java/NS2/NS3/Wireshark.

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Implement Socket Programming and Client – Server model.
3. Write a code to simulate ARP /RARP protocols.
4. Write a code to simulate PING and TRACEROUTE commands.
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call).
7. Devise IP address plan for a mid-size Org network using ideas of subnetting and VLSM. Implement the plan on a simulated network and assign addresses using a DHCP server.
8. Study and configure functionalities of a router and switches (or by simulation).
9. Packet sniffing using WIRESHARK application.
10. Perform the following:
    * LEACH protocol simulation.
    * Performance comparison of MAC protocols.
    * LAN simulation.
    * Measuring network performance.
    * Simulating a MANET.

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Implement various network protocols **[Usage]**

CO2: Create client-server communication using socket programming **[Usage]**

CO3: Simulate TRACEROUTE, PING, RPC **[Usage]**

CO4: Configure routers and switches **[Usage]**

CO5: Use network simulation tools **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	M	M	M	M	M		M	H	H	M	H
CO2	H	H	H	H	H	M	M	M	M	M		M	H	H	M	H
CO3	H	H	H	H	H	M	M	M	M	M		M	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M	M		M	H	H	M	H
CO5	H	H	H	H	H	M	M	M	M	M		M	H	H	M	H
16SPC508	H	H	H	H	H	M	M	M	M	M		H	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SEE509   **APPLICATIONS DEVELOPMENT SKILLS**   **CATEGORY: EEC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

  * Mobile application Development
  * Usage of J2ME, Android SDK and iPhone SDK

LIST OF EXPERIMENTS

1. General Form Design
2. Mobile browser based interactive applications
3. Mobile networking applications (SMS/Email)
4. Applications involving Data Retrieval
5. Launching services in a mobile phone
6. Web portal development
7. Applications using Android SDK framework (like interactive applications, applications that make use of accelerometer sensor, video applications)
8. Applications that use the iPhone SDK framework
9. Testing the applications using emulators

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

  CO1: Design mobile based interactive applications **[Usage]**
  CO2: Implement a data storage and retrieval based applications **[Usage]**
  CO3: Implement web portals **[Usage]**
  CO4: Design Mobile Networking applications**[Usage]**
  CO5: Design applications using Android SDK Framework**[Usage]**
  CO6: Design applications using iphone SDK Framework**[Usage]**
  CO7: Implement Concurrency Control algorithms**. [Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	M	H	M		H	H	H	M	L	H	H	H	H
CO2	H	M	H	M	H				H		M	L	H	H	H	L
CO3	H	M	H	M	H			H	H		M	L	H	H	H	L
CO4	H	M	H	M	H	M			H	H	M	L	H	H	H	H
CO5	H	M	H	M	H	M		H	H	H	M	L	H	H	H	H
CO6	H	M	H	M	H	M		H	H	H	M	L	H	H	H	H
CO7	H	M	H	M	H				H		M	L	H	H	H	L
16SEE509	H	M	H	M	H	L		M	H	M	M	L	H	H	H	M

L-Low,M-Moderate(Medium), H-High

16SPC601   **DISTRIBUTED COMPUTING**   **CATEGORY: PC**

L	T	P	C
3	0	0	3

PRE-REQUISITES:
1. 16SPC503 - Computer Networks

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Need and Characteristics of a Distributed system.
* Inter-process Communication and Remote Method Invocation.
* Distributed file systems and Services.
* Concepts of local Vs global clocks and distributed mutual exclusion. Concepts related to Transactions and Concurrency control in a distributed Environment.

UNIT – I   INTRODUCTION   **(9)**
Need for Distributed systems - Characteristics of Distributed Systems – System Models – Physical, Architectural and Fundamental Models – Inter Process Communication – External Data representation, Marshalling, Network Virtualization, Overlay Networks – Client/ Server Communication.

UNIT – II   INDIRECT COMMUNICATION   **(9)**
Protocols for Request – Reply, Remote Procedure Call, Remote Method Invocation, Case Study – Java RMI. Group Communication – Publish/ Subscribe Systems – Message Queues – Shared Memory Approaches. Operating System Support – Processes and Threads – Communication and Invocation – Virtualization at the operating system level.

UNIT – III   DISTRIBUTED FILE SYSTEMS   **(9)**
Distributed Objects – CORBA - From Objects to Components. File Service Architecture – Sun Network File system and the Andrew File system – Name Services and Domain Name Services – Directory Services – Case Study: Global Name Services and X.500 Directory Services.

UNIT – IV   TIME AND GLOBAL STATES   **(9)**
Clocks, events and Process States – Synchronizing Physical clock's- Logical Time and Logical Clocks – Global states – Debugging in the distributed System. Coordination and Agreement – distributed Mutual Exclusion – Elections – Coordination and agreement in group communication – Consensus and related problems.

UNIT – V   CLOUD ARCHITECTURE MODEL   **(9)**
Technologies for Network based systems – System Models for distributed Cloud computing – NIST cloud computing – Reference architecture. – Cloud Models – Services – Public vs Private clouds – Distributed solutions for data storage – Service management – Computing on demand.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. George Coulouris, Jean Dollimore, Tim Kindberg **"Distributed Systems: Concepts and Design"** 5th Edition, Pearson Education, 2012.
2. Andrew S. Tanenbaum and Maarten van Steen **"Distributed Systems: Principles and Paradigms"** 2nd Edition, Prentice Hall, 2007.

Reference Books:

1. Mukesh Singhal, *"Advanced Concepts In Operating Systems"*, *McGrawHill Series in Computer Science, 2001*
2. Ajay D. Kshemkalyani and Mukesh Singhal, *"Distributed Computing: Principles, Algorithms and Systems"*, *Cambridge University Press, 2008.*
3. M. L. Liu, *"Distributed Computing: Principles and Applications"*, *Addison-Wesley, 2004.*
4. Anthony T.Velte, Toby J.Velte and Robert Elsenpeter, *"Cloud computing: A Practical Approach"*, *Mc-Graw Hill, 2010.*

COURSE OUTCOMES:

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

CO1: Explain architectural models of a Distributed System **[Familiarity]**

CO2: Use Inter-Process Communication to coordinate distributed activities between processes.**[Usage]**

CO3: Use Remote Method Invocation to implement Request /Reply communication. **[Usage]**

CO4: Explain network file system, Name Services and directory Services**. [Familiarity]**

CO5: Use global clocks to order events in a distributed System.**[Usage]**

CO6: Apply Election algorithms and Agreement protocols to solve Consensus problems. **[Assessment]**

CO7: Use Cloud services for distributed applications **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	H	H				H	H	H	H	M	H	H	M
CO2	H	H	H	H	H				H	H	H	H	M	H	H	M
CO3	L	L	L	L	H				L	L	L	H	M	H	H	M
CO4	L	H	M	M	H				H	M	L	H	L	H	H	L
CO5	H	H	H	M	H				H	H	M	H	M	H	H	M
CO6	H	H	H	M	H				H	M	L	H	M	H	H	M
CO7	H	H	H	H	H		M	M	H	H	M	H	M	H	H	M
16SPC601	H	H	M	M	H		M	M	H	M	M	H	M	H	H	M

L-Low, M-Moderate(Medium), H-High

16SPC602   COMPUTER GRAPHICS AND VISUALIZATIONS   CATEGORY: PC

L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Computer graphics hardware, software and algorithms which includes line, circle and ellipse drawing.
* Geometric transformations on graphics objects.
* Classical two and three dimensional viewing
* Representation of Curves and surfaces.
* Color models, Visualization Principles and algorithms.

UNIT – I   INTRODUCTION   (9)
Computer Graphics hardware–software–Introduction to OpenGL–Basic OpenGL programming–graphics Output primitives–Attributes of graphics primitives–Implementation algorithms for graphics primitives and attributes-Line-Circle and Ellipse drawing algorithms.

UNIT – II   2D GEOMETRIC TRASFORMATIONS & VIEWING   (9)
Basic 2D Geometric Transformations – Matrix Representations – Composite Transformations – Reflection and Shearing Transformations- 2D Viewing-The Viewing pipeline – Normalization and Viewport Transformations – Two Dimensional Viewing Functions- Clipping Operations – Point Clipping –Cohen-Sutherland Line Clipping – Liang-Barsky Line Clipping -Sutherland-Hodgman Polygon Clipping.

UNIT – III   3D GEOMETRIC TRASFORMATIONS   (9)
3D   Transformations-Translation–Rotation–Scaling–Reflection   and   Shear-   Composite transformations –Transformations between 3D coordinate systems-Affine Transformations - 3D clipping algorithms – Clipping in Three-Dimensional Homogeneous Coordinates- Three-Dimensional Region Codes- Three-Dimensional Point and Line clipping - Three-Dimensional Polygon Clipping.

UNIT – IV   3D OBJECT VIEWING & REPRESENTATIONS   (9)
3D viewing pipeline-viewing coordinate parameters- Transformation from World to Viewing coordinates – Projection Transformations-Viewport Transformation and 3D screen coordinates-Parallel Projection-Perspective Projection – Curved surfaces – Quadric surfaces–Interpolation and Approximation Splines- Bezier Spline curves.

UNIT – V   COLOR MODELS AND VISUALIZATION   (9)
Color Models – Standard Primaries and the Chromaticity Diagrams –The RGB Color Model – YIQ and related Color Models – CMY and CMYK Color Models – HSV and HLS Color Models–Visualization: Visualization Principles-Color in Graphics and Visualization-Scientific Visualization algorithms.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *Donald Hearn and Pauline Baker,* **"Computer Graphics with OpenGL"** *fourth edition, Pearson Education, 2014.*
2. *T. Theoharis, Georgios Papaioannou, Nikolaos Platis* **"Graphics and Visualization: Principles and Algorithms"** *CRC Press, 2008.*

Reference Books:

1. *John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley, "Computer Graphics: Principles and Practice", Third Edition, AddisonWesley Professional, 2013.*

2. *F. S. Hill Jr. and S. M. Kelley, "Computer Graphics using OpenGL" , third edition , Prentice Hall, 2007 .*

COURSE OUTCOMES:

Upon completion of this course, the students will be familiar with:

CO1: Implement the drawing algorithms such as line, circle and ellipse. **[Usage]**

CO2: Perform transformations (rotation, scaling, translation, shearing) on 2D and 3D geometric objects. **[Usage]**

CO3: Apply line and polygon clipping algorithms on 2D and 3D objects **[Usage]**

CO4: Explain various 3D projections and current models for surfaces. **[Familiarity]**

CO5: Apply color and transformation techniques for various applications of computer graphics in the development of computer games, information visualization, and business applications. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	L	M	M		M	M	H		M	H	L	H	M
CO2	H	L	M	M	M				M	H		M	H	L	M	M
CO3	H	L	M	M	M				M	H		H	H	M	M	H
CO4	H	L	M	M	M				M	H		M	H	L	M	M
CO5	H	M	H	L	M	M	M	M	H	H	M	M	H	L	H	M
16SPC602	H	L	M	M	M	M	M	M	M	H	M	M	H	L	M	M

L-Low, M-Moderate(Medium), H-High
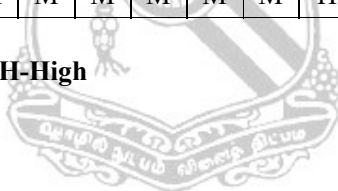
16SPC603   **COMPILER DESIGN**   **CATEGORY: PC**

	L	T	P	C
	2	2	0	3

PREREQUISITES:
    1.16SPC402 – Theory of Computation

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Lexical Analysis
* Syntax Analysis
* Intermediate code generation
* Runtime environment and code generation
* Code optimization

UNIT – I   LEXICAL ANALYSIS   **(6+6)**
Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools -Programming Language basics. Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA.

UNIT – II   SYNTAX ANALYSIS   **(6+6)**
Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

UNIT – III   INTERMEDIATE CODE GENERATION   **(6+6)**
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

UNIT – IV   RUNTIME AND OBJECT CODE GENERATION   **(6+6)**
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

UNIT – V   CODE OPTIMIZATION   **(6+6)**
Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

CONTACT PERIODS:
Lecture: 30 Periods   Tutorial: 30 Periods   Practical: 0 Periods   Total: 60 Periods

Text Books:
1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman **"Principles, Techniques and Tools"** Second Edition, Pearson Education, 2009.

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.*

COURSE OUTCOMES:

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

CO1: Construct lexical analyzer **[Usage]**

CO2: Design top down and bottom up parsers **[Usage]**

CO3: Generate intermediate codes **[Usage]**

CO4: Simulate run time environment **[Usage]**

CO5: Generate Machine codes **[Usage]**

CO6: Apply right code optimization techniques **[Assessment]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	M	L	H	M	M	L	M	H	H	M	H
CO2	H	H	H	H	H	M	L	H	M	M	L	M	H	H	M	H
CO3	H	H	H	H	H	M	L	H	M	M	L	M	H	H	M	H
CO4	H	H	H	H	H	M	L	H	M	M	L	M	H	H	M	H
CO5	H	H	H	H	H	M	L	H	M	M	L	M	H	H	M	H
CO6	H	H	M	H	H	M	L	H	M	M	L	H	H	H	M	H
16SPC603	H	H	H	H	H	M	L	H	M	M	L	H	H	H	M	H

L-Low, M-Moderate(Medium), H-High

16SPC604　　　**WIRELESS COMMUNICATION AND**　　　**CATEGORY: PC**
NETWORKS

	L	T	P	C
PREREQUISITES: Nil | 3 | 0 | 0 | 3 |

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* ∗ Wireless communication technologies and wireless systems
* ∗ Wireless Application Protocol and Wireless Local Area Networks
* ∗ 4G Technologies and Mesh Networks
* ∗ Ad Hoc and Wireless Sensor Networks
* ∗ Mobile IP and Security issues of Wireless Systems

UNIT – I　INTRODUCTION　　　　　　　　　　　　　　　　　　　**(9)**
Wireless Communication Technologies: Frequency Spectrum, Wireless Communication Primer, Spread Spectrum, Global System for Mobile and General Packet Radio Service, Code-Division Multiple Access, GSM Versus CDMA, 3G Cellular Systems, 2G Mobile Wireless Services, 802.11 Wireless LANs, Bluetooth, Ultra-Wideband, Radio-Frequency Identification, Wireless Metropolitan Area Networks, Satellite, Wireless Sensor Networks, Standardization in the Wireless World - Overview of Wireless Systems

UNIT – II　WAP AND WIRELESS LANS　　　　　　　　　　　　　**(9)**
Wireless Application Protocol: WAP and the World Wide Web (WWW), The WAP Programming Model, WAP Architecture, Traditional WAP Networking Environment, WAP Advantages and Disadvantages, Applications of WAP, imode, imode Versus WAP - Wireless Local Area Networks

UNIT – III　NEW WIRELESS TECHNOLOGIES　　　　　　　　　　**(9)**
New Wireless Technologies: 4G Vision, Features and Challenges, Applications, 4G Technologies - Mesh Networks: Optimal Routing and Scheduling.

UNIT – IV　AD HOC AND WIRELESS SENSOR NETWORKS　　　**(9)**
Ad Hoc and Wireless Sensor Networks: Communication and sensing Coverage, Localization, Function Computation, Scheduling - Sensor Network Platforms and Tools: Sensor Node Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms, Node-Level Simulators, Programming Beyond Individual Nodes: State-Centric Programming.

UNIT – V　MOBILE IP AND SECURITY ISSUES　　　　　　　　　**(9)**
Mobile IP: Requirements of Mobile IP, Extending the Protocols, Reverse Tunneling, Security Concerns - Mobile IPv6 - Security and Survivability of Wireless Systems.

CONTACT PERIODS:
Lecture: 45 Periods　　　Tutorial: 0 Periods　　　Practical: 0 Periods　　Total: 45 Periods

Text Books:
1. *Pei Zheng, Feng Zhao, David Tipper, Jinmei Tatuya* **"Wireless Networking Complete"** *Elsevier, 2010.*

Reference Books:

1. *Asoke K Talukder, Roopa Yavagal, **"Mobile Computing – Technology, Application and Service Creation",** McGraw Hill, 2007.*
2. *Leonhard Korowajczuk, **"LTE, WiMAX and WLAN Network Design, Optimization and Performance Analysis",** Wiley-Blackwell, 2011.*
3. *Erik Dahlman, Stefan Parkvall, Johan Skold, **"4G: LTE/LTE-Advanced for Mobile Broadband",** Second Edition, Academic Press Inc., 2013.*
4. *Maritn Sauter, **"From GSM to LTE: An Introduction to Mobile Networks and Mobile Broadband",** John Wiley and Sons, 2011.*

COURSE OUTCOMES:

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

CO1: Summarize Wireless communication technologies and wireless systems **[Familiarity]**

CO2: Explain Wireless Application Protocol and Wireless Local Area Networks **[Familiarity]**

CO3: Describe 4G Technologies and Mesh Networks **[Familiarity]**

CO4: Explain Ad Hoc and Wireless Sensor Networks **[Familiarity]**

CO5: Describe Mobile IP and Security issues of Wireless Systems **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H
CO2	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H
CO3	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H
CO4	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H
CO5	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H
16SPC604	H	M	M	M	L	M	M	H	L	H		L	H	H	M	H

L-Low, M-Moderate(Medium), H-High

16SPC607   **COMPILER DESIGN LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* ∗ Compiler writing tools.
* ∗ Implement the different Phases of compiler
* ∗ Control flow and data flow analysis
* ∗ Storage allocation strategies
* ∗ Simple optimization techniques

LIST OF EXPERIMENTS

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C.
   (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool

   a. Tokenizer with LEX for declarations in C language.

   b. Tokenizer with LEX for assignment statement.
4. Generate YACC specification for a few syntactic categories.

   a) Program to recognize a valid arithmetic expression that uses operators +, - , *   and

   b) Program to recognize a valid variable which starts with a letter followed by any
   number of letters or digits. d) Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into Yacc form and write code to generate
   Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies
   (Heap,Stack,Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and
    produces the 8086 assembly language instructions that can be assembled and run using a
    8086 assembler. The target assembly instructions can be simple move, add, sub, jump.
    Also simple addressing modes are used.
11. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Implement the different Phases of compiler using tools **[Usage]**

CO2: Analyze the control flow and data flow of a typical program **[Usage]**

CO3: Illustrate storage allocation strategies **[Usage]**

CO4: Optimize a given program **[Usage]**

CO5: Generate an assembly language program equivalent to a source language
program **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H
CO2	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H
CO3	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H
CO4	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H
CO5	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H
16SPC607	H	H	H	H	H	L	M	M	M	M		M	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SEE608   **MINI PROJECT**   **CATEGORY:EEC**

	L	T	P	C
PREREQUISITES: Nil	0	0	8	4

COURSE OBJECTIVE:

Upon completion of this course the students will be familiar with:

* Knowledge of the mathematical, computational and natural sciences to develop applications for the benefit of society.
* Design, implement and document a project.

COURSE OUTCOMES:

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

CO1: Identify problem by considering societal / industrial demands**[Assessment]**

CO2: Use programming languages, design and simulation tools for implementation**[Usage]**

CO3: Function in a team at any role**.[Usage]**

CO4: Develop and deliver a good quality formal presentation**.[Usage]**

CO5: Write clear, concise, and accurate technical document **.[Usage]**

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 120 Periods   Total: 120 Periods

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	H	H	H			H	H	H	H	H	H
CO2	H	H	H	H	H							H	H	H	H	H
CO3	H	H							H			H				H
CO4	H	H								H	H	H				H
CO5	H	H								H	H	H				H
16SEE608	H	H	M	M	M	L	L	L	M	M	H	H	M	M	M	H

L-Low,M-Moderate(Medium), H-High

16SHS701   **INDUSTRIAL MANAGEMENT**   **CATEGORY: HS**
(Common to CSE & IT Branches)

                                                          L   T   P   C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

* Systematic management of people and resources.
* Scientific methods of plan formulation and execution for effective organization
* Strategies for effective communication and control.

UNIT – I BASICS OF MANAGEMENT THOUGHT   **(9)**

Evolution of Management, Management Definition, Levels, Principles, Differences with administration. Roles of Managers, Social Responsibility of Business, External environment of business, Management Ethics.

UNIT – II PLANNING   **(9)**

Nature, Purpose, Types, Steps, Management by objectives, Strategic planning process, Decision-making - Types of decisions, Approaches to decision- making under uncertainty.

UNIT – III ORGANIZING   **(9)**

Formal, Informal organization- span of Management- Departmentation- Line, Staff authority, Decentralization and Delegation of authority- Effective organization and organization culture.

UNIT – IV STAFFING AND LEADING   **(9)**

Systems approach to staffing – Performance appraisal process and career strategy formulation, Leadership theories, Theories of motivation, Communication – Process, Barriers, Guidelines for effective communication – Electronic media in communication.

UNIT – V CONTROLLING   **(9)**

Process, Feedback loop of Management control, Requirements for effective control – control techniques – Operations research for controlling, Overall and Preventive control.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Harold Koontz, Weihrich, "Essentials of Management", TataMcGrawHill,NewDelhi,2010.

2. Tripathy, P.C and Reddy, P.N, "Principles of Management" TataMcGrawHill, 2010.

Reference Books:

1. Joseph Massie, "Essentials of Management", Prentice Hall of India, NewDelhi, 2007.

2. Prasad, L.M., "Principles and Practice of Management", Sultan Chand and Sons, NewDelhi,2010

3. Maxwell, C. John, "The 21 Irrefutable Laws of Leadership", Thomas Nelson Publishers, USA, 1999.

4. Chandrani Singh, "Principles and Practice of management and Organizational Behaviour", Jain Books, 2016.

5. Templar Richard, "The Rules of Management", Pearson Education, New Delhi, 2015.

COURSE OUTCOMES:

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

CO1: Systematically analyse situations and scientifically employ the appropriate strategies for success.

CO2: Work as an effective team player utilizing the knowledge of the functions of Management.

**CO3:** Take a strategically informed position in making and implementing high risk decisions.

CO4: Effectively manage the intricacies of diversity of individuals in organizations.

CO5: Practice a harmonious and interpersonally sound style of communication suitable to the situation and individuals involved.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1					M	H		M					L	M		
CO2								M	H	M	M			M		
CO3								H		M	H			M		
CO4								M			M			M		
CO5					M	M	M	M	M	M	M			M		
16SHS701					L	M	L	M	M	M	M	M	L	M		

L-Low, M-Moderate(Medium), H-High
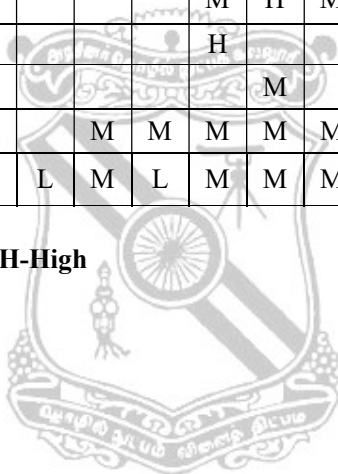
16SPC702   **MACHINE LEARNING**   **CATEGORY: PC**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

∗ Basic underlying concepts, Characterise for machine learning algorithms.
∗ Neural networks, support vector machine and few machine learning tools.
∗ Bayesian techniques and Inference and learning algorithms for the hidden Markov Model.
∗ Instant based learning and clustering.
∗ Ensemble methods and reinforcement learning algorithms.

UNIT – I   INTRODUCTION, CONCEPT LEARNING   **(9 Periods)**

Introduction- Well-Posed learning problems, Designing a learning system, perspectives and Issues in machine learning. Types of machine learning – Concept Learning – version spaces and candidate elimination algorithm – inductive bias –machine learning tools-R, Scikit Learn.

UNIT – II SUPERVISED LEARNING   **(9 Periods)**

Linear Regression – Classification – Support Vector Machines – Neural Network Representation – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Decision tree Learning – issues in decision tree learning- K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions.

UNIT – III UNSUPERVISED LEARNING   **(9 Periods)**

Clustering- Mixture Densities- K-means clustering- Hierarchical Clustering-Distributional clustering - Association Rules - The Curse of dimensionality- Dimensionality reduction. - Principal Component Analysis.

UNIT – IV BAYESIAN AND PROBABILISTIC GRAPHICAL MODELS   **(9 Periods)**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Graphical models - Directed and undirected graphical model - Conditional Independence properties-Hidden Markov Models.

UNIT – V ENSEMBLE METHODS AND REINFORCED LEARNING   **(9 Periods)**

Ensemble Methods- basic concepts - popular learning algorithms - Evaluation and Comparison- Bagging - Boosting-Combination Methods - Averaging, Voting– Reinforcement Learning – introduction – Learning Task – Q-Learning – Temporal Difference Learning.

Contact Periods:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

TEXT BOOKS:

1. *Tom Mitchell, "Machine Learning" McGraw-Hill, 2013.*
2. *Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.*

REFERENCE BOOKS:

1. *Zhi Hua Zhon, "Ensemble Methods: Foundation and Algorithms", CRC Press, 2012.*
2. *Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.*
3. *Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.*
4. *Richard Sutton and Andrew Barto, "Reinforcement Learning: An introduction". MIT Press, 2017.*

COURSE OUTCOMES:

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

CO1: Explain and discuss the basic concepts, the fundamental issues and challenges of machine learning algorithms and the Decision tree learning. **[Familiarity].**

CO2: Apply effectively neural networks and support Vector Machines for appropriate applications. **[Usage].**

CO3: Design and implement some basic machine learning algorithms using Machine learning tools**. [Usage].**

CO4: Apply Bayesian techniques and Hidden Markov Models.**[Usage].**

CO5: Discuss the basic concepts Instant based learning and Clustering**. [Familiarity].**

CO6: Explain and discuss the basic concepts and architecture of reinforcement learning algorithms and Ensembles Methods. **[Familiarity].**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	L		M	M			M	H	M	H	L
CO2	H	H	H	H	H	L		M	M			M	H	M	H	L
CO3	H	H	H	H	H	L		M	M			M	H	M	H	L
CO4	H	H	H	H	H	L		M	M			M	H	M	H	L
CO5	H	H	H	H	H	L		M	M			M	H	M	H	L
CO6	H	H	H	H	H	L		M	M			M	H	M	H	L
16SPC702	H	H	H	H	H	L		M	M			M	H	M	H	L

L - Low, M - Moderate (Medium), H - High

16SPC707   **MACHINE LEARNING LABORATORY**   **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Basic knowledge of Machine learning tools.
* Basic concepts of learning algorithm.
* Back-propagation algorithm and Naive Bayes Algorithm.
* Instant based learning algorithm.
* Analytical learning algorithm.

LIST OF EXPERIMENTS
EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:
1. Study of machine learning tool R.
2. Study of machine learning tool Scikit Learn.
3. Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
4. Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.
5. Implement the ID3 algorithm for learning Boolean–valued functions for classifying the training examples by searching through the space of a Decision Tree.
6. Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
7. Design and implement Naive Bayes Algorithm for learning and classifying TEXT DOCUMENTS.
8. Design and implement K-nearest Neighbor learning algorithm.
9. Design and implement Sequential covering algorithm.
10. Design and implement the KBANN algorithm.
11. Design and implement the FOCL algorithm.

CONTACT PERIODS:
Lecture: 0 Periods   **Tutorial: 0 Periods**   **Practical: 60 Periods**   **Total: 60 Periods**

COURSE OUTCOMES:
Upon completion of this course, the students will be able to,
CO1: Use appropriate Machine Learning tools **[Usage]**
CO2: Implement the CANDIDATE – ELIMINATION algorithm **[Usage]**
CO3: Implement the FIND–S algorithm **[Usage]**
CO4: Implement the ID3 algorithm.**[Usage]**
CO5: Design and implement the Back-propagation algorithm **[Usage]**
CO6: Design and implement Naïve Bayes Algorithm **[Usage]**
CO7: Design and implement K-nearest Neighbor learning algorithm. **[Usage]**
CO8: Design and implement Sequential covering algorithm. **[Usage]**
CO9: Design and implement the KBANN algorithm. **[Usage]**
CO10: Design and implement the FOCL algorithm. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO2	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO3	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO4	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO5	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO6	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO7	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO8	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO9	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO10	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
16SPC707	H	H	M	M	H	L	M	H	H	H	H	M	H	M	H	L

L-Low, M-Moderate(Medium), H-High

16SEE708   **OPEN SOURCE USAGE SKILLS**   **CATEGORY: EEC**

	L	T	P	C
	0	0	4	2

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Open source tools.
* Concepts of open source tools to Design web based application.

LIST OF EXPERIMENTS

1. To build better Web apps using Django Python Web framework.
2. To build Library website using Django and PyCharm
3. To build Bus ticket booking system application using Ruby on rails.
4. To build Online cloth store application using Ruby on rails
5. To build Hotel management system using PHP
6. To build Online Polling System using PHP.
7. To build Movie Ticket reservation using MySQL.
8. To create Blog using GitHub.
9. To build Banking system using GitHub.

Open Source Tools.

1. Python with Django and PyCharm.
2. Ruby on rails.
3. GitHub
4. PHP
5. MySQL.

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 60 Periods   Total: 60 Periods

COURSE OUTCOMES:

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

CO1: Create web based application using Django Python Web framework. [**Usage**]

CO2: Develop Library applications using Django and PyCharm. [**Usage**]

CO3: Create Bus ticket booking and online cloth store applications using Ruby on rails[**Usage**]

CO4: Create web based Hotel management and Online Polling system application using PHP. [**Usage**]

CO5: Develop Movie ticket reservation application using MySQL. [**Usage**]

CO6: Create Blog and Banking system using GitHub. [**Usage**]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO2	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO3	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO4	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO5	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
CO6	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L
16SEE708	H	H	H	M	H	L	M	H	H	H	H	M	H	M	H	L

L-Low, M-Moderate(Medium), H-High

16SEE803 PROJECT WORK CATEGORY:EEC

	L	T	P	C
PREREQUISITES: Nil	0	0	16	8

COURSE OBJECTIVE:

Upon completion of this course the students will be familiar with:

* Applying mathematical, computational and natural sciences knowledge gained by study, experience and practice with judgment to develop effective use of matter, energy and information to the benefit of mankind.
* Planning, executing and documenting a project.
* To construct logical and physical models to demonstrate the skills at assimilating, synthesizing and critically appraising all materials relevant to the project.

COURSE OUTCOMES:

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

CO1: Identify problem by considering societal / industrial demands**[Assessment]**
CO2: Perform exhaustive literature survey on identified problem**.[Assessment]**
CO3: Build feasible mathematical / logical model**. [Assessment]**
CO4: Use design / simulation tools like MATLAB, NS2, NS3, WEKA, etc.**[Usage]**
CO5: Function in a team at any role.**[Usage]**
CO6: Develop and deliver a good quality formal presentation.**[Usage]**
CO7: Write clear, concise, and accurate technical document. .**[Usage]**

CONTACT PERIODS:

Lecture: 0 Periods   Tutorial: 0 Periods   Practical: 240 Periods   Total: 240 Periods

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	H					H	H	H	H	H	H
CO2	H	H	H	H							H	H	H	H		H
CO3	H	H	H	H	H						H	H	H			H
CO4					H		H	H	H					H		H
CO5							H			H						
CO6										H						
CO7										H						
16SEE803	H	H	H	H	H	L	M	M	M	H	M	H	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SPEx01   **INTRODUCTION TO WEB TECHNOLOGY**   **CATEGORY: PE**

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Hyper Text Markup Language
* Cascading Style Sheets
* Client side scripting with Java script
* XML and Ajax enabled Internet application design
* Server side Development

UNIT – I   INTRODUCTION TO HTML AND CSS   (9)
Introduction to computers and Internet – HTML: Basic HTML Elements, Input and page structure Elements- Cascading Style Sheet: Inline and embedded Styles, Positioning elements, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types and queries, Shadows, Gradients, Animations, Transitions and Transformations, Web Font, Multi column Layout.

UNIT – II   CLIENT SIDE SCRIPTING   (9)
Java script: Programming Basics- Introduction to Scripting, Control Statement, Functions, Arrays, Objects: Math, String, Date, Boolean, document Objects, Document Object Model, Event Handling.

UNIT – III   XML and AJAX ENABLED RICH INTERNET APPLICATIONS   (9)
XML: Basics, Structuring Data, XML Name spaces, DTDs-Schema Documents, Extensible style sheet Language and XSL Transformation, DOM – Web application Development: Traditional Vs Ajax web application Development, RIA with Ajax, XMLHttp Request Object, Using XML and DOM, Application creation.

UNIT – IV   SERVER SIDE DEVELOPMENT   (9)
Web Servers: HTTP Transactions, Multi tier Application Architecture, Accessing Web Servers, Apache, MySQL and PHP Installation, IIS Express and Web Matrix-Database: MySQL - PHP: Data Types, Operators, Arrays, String Processing, Form Processing and Business Logic, Reading from a Database, Cookies, Dynamic Content

UNIT – V   SERVER-SIDE DEVELOPMENT WITH JSF AND JAVA   (9)
Java Server Faces: Application Development, Model View Controller Architecture, JSF Components, Validation, Session Tracking, Accessing Databases in Web Apps, Web Services: SOAP, REST, JSON, Publishing and Consuming SOAP based web services, REST based XML Web services, REST Based JSON Web Service.

CONTACT PERIODS:
 Lecture:45 Periods   Tutorial:0 Periods   Practical:0 Periods   Total:45 Periods

Text Books:
*1. Paul Deitel, Harvey Deitel, Abbey Deitel **"Internet and World Wide Web- How to Program"** Fifth Edition, Pearson, 2012.*
Reference Books:
 1. *Achyut Godbole, Atul Kahate,* **"Web Technologies:TCP/IP to Internet Application Architectures",** *Tata McGraw-Hill Education, 2002.*
 2. *Nicholas C. Zakas,* "Professional Javascript for Web Developers", *Third Edition, Wrox Press, 2011.*
 3. *Jon Duckett , "Beginning Web Programming with HTML, XHTML and CSS", Wrox Press, 2004*

COURSE OUTCOMES:

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

CO1: Design a web page with HTML elements and CSS **[Usage]**
CO2: Write client side scripts using Javascript **[Usage]**
CO3: Structure Data using XML **[Usage]**
CO4: Create and access the web servers. **[Usage]**
CO5: Develop applications using JSF and Java **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	M			M		L	L	H	H	H	H	H
CO2	H	H	H	H	H			M		L	L	H	H	H	H	H
CO3	H	H	H	H	H			M		L	L	H	H	H	H	H
CO4	H	H	H	H	H			M		L	L	H	H	H	H	H
CO5	H	H	H	H	H			M		L	L	H	H	H	H	H
16SPEx01	H	H	H	H	H			M		L	L	H	H	H	H	H

L-Low,M-Moderate(Medium), H-High

16SPEx02   **SIMULATION AND MODELING**   **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
  ∗ Role of modeling and simulation
  ∗ Simulation models
  ∗ Human interaction
  ∗ Verification and validation of simulation
  ∗ Uses and Future of Simulation

UNIT – I   INTRODUCTION TO MODELING AND SIMULATION   (9)
Modeling and Simulation: Models, History, Application areas, Advantages and disadvantages – Role of modeling and simulation: Using simulations to solve problems, uncertainty and its effects, Gaining insight, Simulation's lifetime.

UNIT – II   SIMULATION MODELS   (9)
Discrete Event Simulation – Continuous Simulation – Queue Modeling and Simulation: Analytical solution, Queueing modeling, Sequential Simulation, SimPack queueing implementation, Parallel Simulation.

UNIT – III   HUMAN INTERACTION, VERIFICATION AND VALIDATION   (9)
Simulation and data dependency – visual representation – performing verification and validation, Verification and validation examples.

UNIT – IV   USES AND FUTURE OF SIMULATION   (9)
Facts of simulation, Experimentation aspects of simulation, Experience aspects of simulation, Examples of uses of simulation, Ethics in the use of simulation, Excuses to avoid using the simulation – convergent simulation –serious games – Human computer interfaces – Computing technology.

UNIT – V   CASE STUDY   (9)
Transportation modeling and simulation – Business modeling and simulation – Medical modeling and simulation – Social science modeling and simulation – Communication systems modeling and simulation.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
 1. John A Sokolowski, Catherine M Banks **"Principles of Modeling and Simulation, A Multidisciplinary approach"**, Wiley 2009.

Reference Books:
 1. John A Sokolowski, Cathereine M Banks, **"Modeling and Simulation fundamentals: Theoretical underpinnings and practical domains"**, Wiley 2010.

 2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim **"Theory of Modeling and Simulation"**, Second Edition, Integrating discrete event and continuous complex dynamic systems, Academic Press 2000.

 3. Hans-Joachim Bungartz, Stefan Zimmer, Martin Buchholz, Dirk Pflüger **"Modeling and Simulation: An Application-Oriented Introduction"**, Springer 2014.

 4. K. C. Raveendranathan, **"Communication Systems Modelling and Simulation, using MATLAB and Simulink"**, University Press 2011.

COURSE OUTCOMES:

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

      CO1: Model and Solve problems using simulation **[Usage]**

      CO2: Apply discrete event and continuous simulation models **[Usage]**

      CO3: Use right queueing models to represent the problem **[Assessment]**

      CO4: Perform verification and validation of simulation models **[Usage]**

      CO5: Summarize the simulation facts, Ethics and Excuses **[Familiarity]**

      CO6: Simulate the models such as Transportation models, Business models, Medical models, Social science models, Communication systems models. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H	L	L	M	L	L	L	M	H	M	L	H
CO2	H	H	H	H	H	L	L	M	L	L	L	M	H	M	L	H
CO3	H	H	M	H	H	L	L	M	L	L	L	H	H	M	L	H
CO4	H	H	H	H	H	L	L	M	L	L	L	M	H	M	L	H
CO5	H	M	M	M	L	L	L	H	L	L	L	L	H	M	L	H
CO6	H	H	H	H	H	L	L	M	L	L	L	M	H	M	L	H
16SPEx02	H	H	H	H	H	L	L	M	L	L	L	M	H	M	L	H

L-Low,M-Moderate(Medium), H-High

16SPEx03   **PATTERN RECOGNITION**   CATEGORY: PE

L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Representation of patterns and its importance
* Nearest Neighbor classifiers and Bayes Classifiers
* Hidden Markov models and Decision Trees
* Support Vector Machines and Clustering Approaches
* Pattern classification using fuzzy approach and genetic algorithms

UNIT – I   INTRODUCTION   **(9)**
Introduction to Pattern Recognition – Different Paradigms and data sets - Data Structures for Pattern Representation – Representation of Clusters – Proximity Measures – Size of Pattern – Feature Extraction - Fisher's Linear Discriminant - Principal Component Analysis - Feature Selection – Evaluation of Clustering and Classifiers.

UNIT – II   PATTERN CLASSIFIERS   **(9)**
Nearest Neighbor Based Classifiers - Nearest Neighbor Algorithm – Variant – KNN, MKNN - Fuzzy KNN, r Near Neighbors - Branch and Bound Algorithm - The Cube Algorithm - Ordered Partitions – Prototype Selection - Minimal Distance Classifier – condensed and Editing Algorithms – Bayes classifier – Bayesian Belief Network

UNIT – III   OPTIMAL AND USER FRIENDLY CLASSIFIERS   **(9)**
Markov Models for Classification - Hidden Markov Models - HMM Parameter – Learning HMMs - Classification Using HMMs - Classification of Test Patterns - Decision Trees for Pattern Classification – Construction – Splitting, Overfitting and Pruning – Example of a Decision Tree Induction.

UNIT – IV   BINARY CLAASIFIERS AND CLUSTERING   **(9)**
Support Vector Machines - Linear Discriminant Functions – Learning the Linear Discriminant Functions - Neural Networks - SVM for Classification - Linearly Separable and Non-linearly Separable. Combination of Classifiers - Methods for Constructing Ensembles of Classifiers - Methods for Combining Classifiers. Clustering – Hierarchical, Partitioned clustering.

UNIT – V   OTHER CLASSIFIERS   **(9)**
Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception. Case Study: Handwritten Digit Recognition - Description of the Digit Data - Pre-processing of Data - Selection of Representative Patterns.
CONTACT PERIODS:
 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
 1. M. Narasimha Murthy and V. Susheela Devi **"Pattern Recognition. An Algorithmic approach"**
   Springer, 2011.
 2. S.Theodoridis and K.Koutroumbas **"Pattern Recognition",** 4th Edition, Academic Press, 2009.

Reference Books:
1. *C.M.Bishop,* ***"Pattern Recognition and Machine Learning"** , Springer, 2006.*
2. *R.O.Duda, P.E.Hart and D.G.Stork,* ***"Pattern Classification",*** *John Wiley, 2001.*
3. *Earl Gose, Richard Johnsonbaugh, Steve Jost,* ***"Pattern Recognition and ImageAnalysis",*** *PHI, 2007.*
4. *Edwin Hancock, Marcello Pelillo,"Similarity Based Pattern Recognition", Springer, 2011.*

COURSE OUTCOMES:

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

CO1: Define patterns, identify and isolate desired features of a pattern. **[Usage]**

CO2: Apply feature Selection techniques to improve classification accuracy. **[Assessment]**

CO3: Compare variants of Nearest Neighbor algorithms and estimate their performance.
[Usage]

CO4: Apply Bayes theorem and Bayes probabilistic model to estimate pattern parameters.
[Assessment]

CO5: Use Markov models and Decision trees for optimal pattern classification. **[Usage]**

CO6: Classify patterns using a linear decision boundary. [**Usage]**

CO7: Group patterns using Clustering techniques. **[Usage]**

CO8: Apply Fuzzy logic and genetic algorithms to classify patterns. **[Assessment]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	H	H				H	H	H	H	M	H	H	M
CO2	H	H	H	H	H				H	H	H	H	M	H	H	M
CO3	L	L	L	L	H				L	L	L	H	M	H	H	M
CO4	L	H	M	M	H				H	M	L	H	L	H	H	L
CO5	H	H	H	M	H				H	H	M	H	M	H	H	M
CO6	H	H	H	M	H				H	M	L	H	M	H	H	M
CO7	H	H	H	H	H				H	H	M	H	M	H	H	M
CO8	H	H	H	H	H				H	M	L	H	M	H	H	M
16SPEx03	M	H	M	M	H				H	M	M	H	M	H	H	M

L-Low,M-Moderate(Medium), H-High

16SPEx04   **ARTIFICIAL INTELLIGENCE**   CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES:
  1. 16SBS306 - Discrete Structures

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
  * Fundamental concepts of Artificial Intelligence.
  * Algorithms to solve real world problems
  * Methods to represent knowledge and understand real world problems
  * Construction of plans and making decisions in the presence of uncertainty.
  * Learning techniques and Natural Language Processing

UNIT – I   INTRODUCTION   (9)
Introduction to Artificial Intelligence – AI Applications – Turing test and Rational Test Approaches – Problem Solving – AI problems - Production systems – Control Strategies – Reasoning – Forward and Backward Reasoning. AI Agents – Types – Structure – Behavior and Environment separated by hyphen.

UNIT – II   SEARCHING TECHNIQUES AND GAME PLAYING   (9)
Breadth first Search – Depth first Search – Heuristics Search – Iterative Deepening – Hill Climbing –Simulated annealing - Best first search, A* algorithm, AO* algorithm, Minmax & game trees, refining minmax, Alpha – Beta pruning, Means End analysis and constraint satisfaction.

UNIT – III   KNOWLEDGE REPRESENTATION   (9)
First order predicate calculus, Resolution, Unification, Natural deduction system, Refutation, Logic programming, PROLOG, Semantic networks, Frame system, Value inheritance, Conceptual dependency, Ontologies

UNIT – IV   PLANNING AND UNCERTAINTY   (9)
Representation for planning, Symbolic-Centralized vs. Reactive-Distributed, Partial order planning algorithm. Uncertainty – Types - degree of belief and truth, Probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule,Dempster-Shafer theory.

UNIT – V   LEARNING AND NATURAL LANGUAGE PROCESSING   (9)
Learning from Observations – Inductive Learning – Learning Decision Trees. Natural Language Processing - Parsing Techniques, components of communication – Formal Vs Natural Languages in the context of grammar - Parsing – Semantics - Recursive and Augmented Transition Nets.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
  1. Russell and Norvig *"Artificial Intelligence- A Modern Approach"* 3rd edition, Pearson Prentice Hall, 2010.
  2. ElaineRich, KevinKnight, Shivashankar B. Nair *"Artificial Intelligence"* 3rd edition, Tata McGraw Hill, 2009.

Reference Books:
1. Dan W. Patterson, **_"Introduction to Artificial Intelligence and Expert Systems",_** _Prentice Hall of India, 2006._
2. R. Akerkar, **_"Introduction to Artificial Intelligence",_** _Prentice-Hall of India, 2005._
3. Deepak Khemani, **_" A First Course in Artificial Intelligence",_** _Tata Mc Graw Hill Education, 2013._
4. William F. Clocksin, Christopher S. Mellish, **_"Programming in Prolog",_** _5th Edition Springer Verlag, 2003._

COURSE OUTCOMES:
Upon completion of this course the students will be able to:

CO1: Explain applications of Artificial Intelligent and structure of AI Agents
[Familiarity]
CO2: Use Search Algorithms to solve real world AI problems **[Usage]**
CO3: Use PROLOG to express relations and computations **[Usage]**
CO4: Represent Knowledge using Semantic Nets **[Assessment]**
CO5: Reason facts by constructing plans and understand uncertainty by effective decision
making **[Usage]**
CO6: Generate Knowledge by Learning methods **[Assessment]**
CO7: Understand Natural Language Processing techniques **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	H	L				H	H	H	H	M	L	L	M
CO2	H	H	H	H	L				H	H	H	H	M	L	L	M
CO3	L	L	L	L	M				L	L	L	H	M	L	L	M
CO4	L	H	M	M	M				H	M	L	H	L	L	L	L
CO5	H	H	H	M	L				H	H	M	H	M	L	L	M
CO6	H	H	H	M	L				H	M	L	H	M	L	L	M
CO7	M	H	H	H	L				H	H	H	H	M	L	L	M
16SPEx04	H	H	H	M	M				H	M	L	H	M	L	L	M

L-Low,M-Moderate(Medium), H-High

16SPEx05	**DIGITAL IMAGE PROCESSING**	**CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:

* Fundamentals of digital image processing and simple operations.
* Image transformation and image enhancement techniques.
* Image analysis
* Different kinds of image compression techniques.
* Segmentation methods used in image processing, image understanding and recognition.

UNIT – I   DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS   (9)
Fundamental Steps in Digital Image processing – Digital Image Fundamentals - elements of visual perception – Image Sampling and Quantization – Basic relationships between pixels – Basic Geometric transformations, Introduction to Fourier Transform and DFT,Properties of 2D Fourier Transform, FFT, Separable Image Transforms, Walsh – Hadamard , Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

UNIT – II   IMAGE IMPROVEMENT   (9)
Image Enhancement: Contrast Manipulation - Histogram Modification - Noise Cleaning - Edge Crispening - Color Image Enhancement.
Image Restoration Techniques : Sensor and Display Point Nonlinearity Correction - Continuous Image Spatial Filtering Restoration – Pseudo inverse Spatial Image Restoration - SVD Pseudo inverse Spatial Image Restoration - Statistical Estimation Spatial Image Restoration - Constrained Image Restoration - Blind Image Restoration - Multi-Plane Image Restoration.

UNIT – III   IMAGE ANALYSIS   (9)
Morphological Image Processing : Binary Image Connectivity- Binary Image Hit or Miss Transformations - Binary Image Shrinking, Thinning, Skeletonizing and Thickening - Binary Image Generalized Dilation and Erosion - Binary Image Close and Open Operations - Gray Scale Image Morphological Operations.
Image Feature Extraction: Image Feature Evaluation - Amplitude Features - Transform Coefficient Features - Texture Definition - Visual Texture Discrimination - Texture Features.

UNIT – IV   IMAGE COMPRESSION   (9)
Fundamentals - Image Compression Models -Elements of Information theory – Error Free Compression - Variable length coding, LZW coding, Bit plane coding, Lossless predictive coding. Lossy Compression: Lossy predictive coding - Transform coding – Wavelet coding. Image compression standards.

UNIT – V   IMAGE SEGMENTATION AND REPRESENTATION   (9)
Edge detection, Thresholding, Region Based segmentation, Boundary representation: chair codes, Polygonal approximation, Boundary segments, boundary descriptors: Simple descriptors, Fourier descriptors - Regional descriptors, Simple descriptors, Texture. Case study: PIKS Image Processing Software.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. William k. Pratt **"Digital image processing PIKS Scientific Inside"** *Forth edition, Willey, 2007*
2. Rafael C. Gonzalez and Richard E. Woods **"Digital Image Processing"** *Third Edition, Pearson Education, 2009*

Reference Books:
1. Milan Sonka, Vaclav Hlavac and Roger Boyle, **"Image Processing, Analysis and Machine Vision",** *Fourth Edition, Cengage Learning, 2014.*

COURSE OUTCOMES:

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

CO1: Process digital images using fundamental steps of image processing and simple arithmetic, logical and geometric operations **[Usage]**

CO2: Analyze and apply image transforms like FFT, DCT, Hadamard, Haar, Slant, KL transforms on images **[Usage]**

CO3: Apply operations to convert an image to a format better suited for machine processing.
[Usage]

CO4: Identify the degradation model and restore the image using spatial filtering.
[Usage]

CO5: Use image analysis techniques to detect structures such as edges, lines and corners on given image **[Usage]**

CO6: Apply lossy and lossless image compression techniques for digital images
[Usage]

CO7: Perform edge detection and segmentation **[Assessment]**

CO8: Classify or recognize an object using shape and texture measures **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	M	M	H	H	H							L	H	H	M	H
CO2	H	H	H	H	H	L						L	H	H	H	H
CO3	H	M	H	H	H	L						L	H	H	H	H
CO4	H	M	H	H	H							M	H	H	H	H
CO5	H	M	H	H	H							M	H	H	M	H
CO6	H	H	H	H	H							M	H	H	M	H
CO7	M	H	H	H	H	L						M	H	H	M	H
CO8	M	H	H	H	H	L						M	H	H	H	H
16SPEx05	H	H	H	H	H	L						M	H	H	H	H

L-Low,M-Moderate(Medium), H-High

16SPEx06   **CRYPTOGRAPHY**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Symmetric Encryption techniques
* Asymmetric Encryption techniques
* Principle of digital signatures, Hash functions and MAC.
* Fundamental Principles of Key Management
* Applications of Cryptography.

UNIT – I   INTRODUCTION TO CRYPTOGRAPHY   (9)
Overview of Cryptology – Symmetric Cryptography – Cryptanalysis – historical ciphers – Stream ciphers – Encryption and decryption with stream ciphers –Unbreakable stream cipher – Shift register based Stream cipher .Block Cipher – Data Encryption Standard (DES) – Internal Structure –Algorithm – Security – Advanced Encryption Standard (AES) - Internal Structure –Algorithm –Triple DES – Lightweight Cipher PRESENT – Block Ciphers –Mode of Operation –Increasing Security of Block Cipher.

UNIT – II   PUBLIC KEY CRYPTOGRAPHY   (9)
Symmetric vs. Asymmetric Cryptography- Practical Aspects of Public-Key Cryptography – Essential Number Theory for Public-Key Algorithms - Euclidean Algorithm - Extended Euclidean Algorithm- Euler's Phi Function- Fermat's Little Theorem and Euler's Theorem - The RSA Cryptosystem -- Public-Key Cryptosystems Based on the Discrete Logarithm Problem- Elliptic Curve Cryptosystems

UNIT – III   AUTHENTICATION TECHNIQUES   (9)
Digital Signatures - Principles of Digital Signatures - The RSA Signature Scheme - The Elgamal Digital Signature Scheme - The Digital Signature Algorithm (DSA)- The Elliptic Curve Digital Signature Algorithm (ECDSA) . Hash Functions - Security Requirements of Hash Functions - Dedicated Hash Functions: The MD4 Family - Hash Functions from Block Ciphers - The Secure Hash Algorithm SHA-1 - Message Authentication Codes (MACs) - MACs from Hash Functions: HMAC - MACs from Block Ciphers: CBC-MAC - Galois Counter Message Authentication Code (GMAC).

UNIT – IV   KEY MANAGEMENT   (9)
Key Establishment - Using Symmetric-Key Techniques - Using Asymmetric Techniques - Unique key per transaction schemes - Quantum key establishment- Key Storage - Key backup, archival and recovery

UNIT – V   APPLICATIONS   (9)
Cryptography on the Internet - Cryptography for wireless local area networks - Cryptography for mobile telecommunications - Cryptography for secure payment card transactions - Cryptography for video broadcasting - Cryptography for identity cards - Cryptography for home users.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *Bart Preneel and Christ of Paar* **"Understanding Cryptography A Textbook for Students and Practitioners"** *Springer-Verlag Berlin Heidelberg, 2010.*
2. *Keith M. Martin* **"Everyday Cryptography -Fundamental Principles and Applications"** *OXFORD University Press, 2012.*

Reference Books:
1. *William Stallings,* **"Cryptography & Network Security",** *Pearson Education, 6th Edition 2014.*
2. *Jonathan Katz, Yehuda Lindell,* **"Introduction to Modern Cryptography",** *Second Edition, CRC Press, 2014.*
3. *Niels Ferguson, Bruce Schneier, Tadayoshi,* **"Cryptography Engineering: Design Principles and Practical Applications",** *Wiley Publishing, 2011.*

COURSE OUTCOMES:
Upon completion of this course the students will be able to:

CO1: Describe and implement some of the prominent Symmetric encryption techniques in stream and block cipher **[Usage]**

CO2: Apply suitable encryption techniques for confidentiality related security issues in networks **[Usage]**

CO3: Use suitable authentication methods for integrity related security issues **[Usage]**

CO4: Explain the important Key management approaches in both private and public key encryption **[Familiarity]**

CO5: Explain the protocols behind the application of cryptography in everyday life **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M	L	M	L	H				H	H	M	H	H
CO2	H	H	H	M	L	M	L	H				H	H	M	H	H
CO3	H	H	H	M	L	M	L	H				H	H	M	H	H
CO4	H	H	H	M	L	M	L	H				H	H	M	H	H
CO5	H	H	H	M	L	M	H	H			L	H	H	M	H	H
16SPEx06	H	H	H	M	L	M	L	H			L	H	H	M	H	H

L-Low, M-Moderate(Medium), H-High

16SPEx07   **REAL TIME SYSTEMS**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with:

* ∗ Fundamental concepts of real time systems.
* ∗ Real time task scheduling and resource sharing.
* ∗ Various real time operating systems.
* ∗ Basics of real time communication.
* ∗ Fundamentals of real time databases.

UNIT – I   INTRODUCTION   (9)

Real-time systems – Applications of Real Time Systems – Basic Model of Real Time Systems – Characteristics of real time systems – Safety and Reliability – Types of Real Time tasks – Timing Constraints – Modelling Timing Constraints.

UNIT – II   REAL-TIME TASK SCHEDULING AND RESOURCE SHARING   (9)

Basic concept of Task Scheduling – Clock-Driven Scheduling – Event-Driven Scheduling – Earliest Deadline First Scheduling – Rate Monotonic Algorithm - Resource Sharing Among Real Time Tasks – Priority Inversion – Priority inheritance protocol - Highest Locker Protocol - Priority Ceiling Protocol(PCP)– Types of Priority Inversions Under PCP – Features of PCP – Issues in using Resource Sharing Protocol – Handling Task Dependencies.

UNIT – III   REAL-TIME OPERATING SYSTEMS(RTOS)   (9)

Time Services – Features of Real Time Operating System – Unix as a RTOS – Unix Based RT OS – Windows as a RTOS – POSIX – PSOS – VRTX – VxWorks – QNX - µC/OS-II – RT Linux – Lynx – Windows CE – Benchmarking Real Time Systems.

UNIT – IV   REAL-TIME COMMUNICATION   (9)

Basic Concepts of networks– Examples of Applications requiring Real Time Communication - Real Time Communication in a LAN – Soft and Hard Real Time Communication in a LAN – Bounded Access Protocols for LANs – Performance Comparison – Real Time Communication Over Packet Switched Networks – QoS Framework – Routing – Resource Reservation – Rate Control – QoS Models.

UNIT – V   REAL-TIME DATABASES   (9)

Basic Concepts of Databases– Examples of Applications requiring Real Time Databases - Design Issues of Real Time Databases – Characteristics of temporal data – Concurrency control in Real Time Databases - Commercial Real-Time Databases.

CONTACT PERIODS:

 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

*1. Rajib Mall **"Real-Time Systems: Theory and Practice"** Pearson Education India, 2008*

Reference Books:

*1. Jane W. Liu, **"Real-Time Systems"**, Pearson Education, 2001.*

*2. C.M. Krishna and Kang G.Shin, **"Real Time Systems"**, McGraw Hill, 1999.*

*3. Alan C. Shaw, **"Real-Time Systems and Software"**, Wiley, 2001.*

*4. Raymond J.A. Buhr, Donald L. Bailey, **"An Introduction to Real Time Systems"**, Prentice Hall, 1999.*

*5. Jane W. Liu, **"Real-Time Systems"** Pearson Education, 2001.*

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of real time systems **[Familiarity]**

CO2: Describe the real time scheduling algorithms and resource sharing protocols **[Familiarity]**

CO3: Elaborate the features of real-time operating systems **[Familiarity]**

CO4: Explain the working of real time communication protocols **[Familiarity]**

CO5: Illustrate the transactions in real time databases **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	L	L	L	L						M	M	H	M	M
CO2	M	M	H	H	M	L						M	M	H	M	M
CO3	M	M	M	M	M	L						M	M	H	M	M
CO4	M	M	H	H	M	L						M	M	H	M	M
CO5	M	M	H	H	M	L						M	M	H	M	M
16SPEx07	M	M	H	H	M	L						M	M	H	M	M

L-Low,M-Moderate(Medium), H-High

16SPEx08   **SOFTWARE DEFINED NETWORKS**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with:

* Advance and emerging networking technologies.
* Software defined networking and how it is changing the way communications networks are managed, maintained, and secured.
* The concepts of virtualization and virtual machines.

UNIT – I   SDN: BACKGROUND AND MOTIVATION   (9)

Evolving Network Requirements - The history of SDN -The SDN Approach - SDN architecture and its fundamental abstractions - SDN- and NFV-Related Standards - -Why SDN? - How SDN Works? Open Flow Concept and Implementation - OpenFlow Limitations. Mininet: A simulation environment for SDN.

UNIT – II   SDN DATA PLANE AND CONTROL PLANE   (9)

SDN Data Plane and OpenFlow : SDN Data Plane -OpenFlow Logical Network Device - OpenFlow Protocol **SDN Control Plane:** SDN Control Plane Architecture - ITU-T Model - OpenDaylight - REST - Cooperation and Coordination Among Controllers. Programming SDNs - Frenetic, Procera.

UNIT – III   SDN APPLICATION PLANE   (9)

SDN Application Plane Architecture - Network Services Abstraction Layer-Traffic Engineering - Measurement and Monitoring - Security - Data Center Networking - Mobility and Wireless - Information-Centric Networking.

UNIT – IV   NETWORK FUNCTIONS VIRTUALIZATION   (9)

Concepts and Architecture - Background and Motivation for NFV -Virtual Machines -NFV Concepts - NFV Benefits and Requirements - NFV Reference Architecture - NFV Functionality: NFV Infrastructure - Virtualized Network Functions -SDN and NFV- Network Virtualization: OpenFlow VLAN Support - Network Virtualization - OpenDaylight's Virtual Tenant Network- Software Defined Infrastructure.

UNIT – V   QUALITY OF SERVICE AND SECURITY   (9)

Quality of Service : QoS Architectural Framework - Integrated Services Architecture (ISA) - Differentiated Services - Service Level Agreements - IP Performance Metrics - OpenFlow QoS Support.

Quality of Experience: Definition of QoE- QoE Strategies in Practice-Factors Influencing QoE-Measurements of QoE -Application of QoE

SECURITY: Security Requirements - SDN Security -NFV Security - Applying Programming Techniques to Networks, Security Applications.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. William Stallings **"Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud."** 1st edition,,Pearson Education, Inc. 2016.

Reference Books:
1. Paul Goransson and Chuck Black, *"Software Defined Networks: A Comprehensive Approach"*, edition, Morgan Kaufmann Publishers, Inc., 2014.
2. Thomas D. Nadeau; Ken Gray, *"SDN: Software Defined Networks"*, O'Reilly Media, Inc. 2013.
3. Vivek Tiwari, *"SDN and OpenFlow for beginners with hands on labs"*, Amazon Digital Services, Inc. 2013.
4. Kreutz et al.: *Software-Defined Networking: A Comprehensive Survey*, Proceedings of the IEEE, Vol. 103, No. 1, January 2015.

COURSE OUTCOMES:

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

CO1: Differentiate between traditional networks and software defined networks. **[Familiarity]**

CO2: Explain and discuss the basic concepts and architecture of SDN. **[Familiarity]**

CO3: Compare the performance of various open flow versions. Analyse and apply implementation of SDN through Open Flow Switches **[Assessment]**

CO4: Identify various SDN applications and environments that benefits from its use. **[Usage]**

CO5: Explain and discuss the basic concepts and architecture of Network Functions Virtualization. **[Familiarity]**

CO6: Evaluate the security issues and Quality of Service related to SDN. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H			L				M	H	M	H	L
CO2	H	H	H	H	H			L				M	H	M	H	L
CO3	H	H	H	H	H			L				M	H	M	H	L
CO4	H	H	H	H	H			L				M	H	M	H	L
CO5	H	H	H	H	H			L				M	H	M	H	L
CO6	H	H	H	H	H			L				M	H	M	H	L
16SPEx08	H	H	H	H	H			L				M	H	M	H	L

L-Low,M-Moderate(Medium), H-High

16SPEx09   **CLOUD ENGINEERING**   **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Cloud Architecture
* Cloud Services
* Web Based Cloud Computing
* Cloud Security

UNIT – I   INTRODUCTION   **(9)**
Introduction – Cloud types – Characteristics - Assessing the Value Proposition -Cloud Computing Stack - Connecting to the Cloud -Infrastructure as a Service (IaaS) -Platform as a Service (PaaS) -Software as a Service (SaaS) -Identity as a Service (IDaaS)- Compliance as a Service (CaaS)

UNIT – II   VIRTUALIZATION   **(9)**
Basics of virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – tools and Mechanisms – Virtualization of CPU, Memory, I/O Devices – Virtual clusters and resource management – Virtualization for data –center Automation.

UNIT – III   CLOUD INFRASTRUCTURE   **(9)**
Architectural Design of Compute and Storage clouds – Layered Cloud Architecture Development – Design Challenges – Inter Cloud Resorce Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT – IV   CLOUD APPLICATION PROGRAMMING AND THE ANEKA
                    PLATFORM   **(9)**
Aneka - Framework overview - anatomy of the Aneka container - Cloud programming and management - Programming applications with threads - Multithreading with Aneka - Task computing - Task-based application models - Aneka task-based programming - Data-Intensive Computing - Aneka Map Reduce programming.

UNIT – V   SECURITY IN THE CLOUD   **(9)**
Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security- Identity Management and Access Control – Autonomic Security.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *Sosinsky, Barrie.* ***"Cloud computing bible."*** *Vol. 762. John Wiley & Sons, 2010.*
2. *Tim Mather, Subra Kumaraswamy, Shahed Latif* ***"Cloud Security & Privacy"*** *O'ReillyMedia, September 2009.*

Reference Books:

1   *Haley Beard,* ***"Cloud Computing Best Practices for Managing and Measuring Processes for On demand Computing, Applications and Data Centers in the Cloud with SLAS",*** *Emereo Pvt Limited, July 2008.*
2   *John Rittinghouse & James Ransome,* ***"Cloud Computing, Implementation, Management and Strategy",*** *CRC Press, 2010.*

COURSE OUTCOMES:

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

      CO1: Explain the cloud architecture and cloud storage**[Familiarity]**

      CO2: Create Cloud computing applications **[Usage]**

      CO3: Use Cloud services **[Usage]**

      CO4: Explain web based cloud services and tools**[Familiarity]**

      CO5: Explain the necessity and approaches for cloud security.**[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	M				M				H	H	M	H	M
CO2	H	H	H	M				M				H	H	M	H	M
CO3	H	H	H	M				M				H	H	M	H	M
CO4	H	H	H	M				M				H	H	M	H	M
CO5	H	H	H	M				M				H	H	M	H	M
16SPEx09	H	H	H	M				M				H	H	M	H	M

L-Low,M-Moderate(Medium), H-High

16SPEx10   **COMPUTER VISION**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Fundamentals of image models.
* Filters, Features, Texture and Edge detection.
* Geometry of multiple views.
* Segmentation, Fitting and Tracking methods.
* Relationship between object features, image features and camera models.

UNIT – I   IMAGE FORMATION AND IMAGE MODELS   (9)
Radiometry: Light in Space - Light at Surfaces - Radiosity - Directional Hemispheric -Reflectance - Lambertian Surfaces and Albedo - Specular Surfaces - Sources, Shadows and Shading: Radiometric Properties of Light Sources - Qualitative Radiometry - Local Shading Models - Global Shading Models. Colour: Human Colour Perception - Representing Colour - Geometric Image Features: Elements - Contour Geometry -Analytical Image Features: Elements - Geometric Camera Parameters - Calibration.

UNIT – II   EARLY VISION-ONE IMAGE   (9)
Linear Filters: Linear Filters and Convolution - Shift invariant linear systems - Spatial Frequency and Fourier Transforms – Sampling- Edge Detection: Estimating Derivatives with Finite Differences - Noise - Edges and Gradient-based Edge Detectors. Filters and Features: Filters as Templates - Filters and Primate Early Vision - Normalised Correlation and Finding Patterns - Corners and Orientation Representations - Advanced Smoothing Strategies and Non-linear Filters. Texture: Representing Texture - Analysis Using Oriented Pyramids - Application: Synthesizing Textures for Rendering - Shape from Texture.

UNIT – III   EARLY VISION-MULTIPLE IMAGES   (9)
The Geometry of Multiple Views -Two Views - Three Views - More Views. Stereopsis: Reconstruction - Binocular Fusion - Trinocular Stereo - Multiple-Baseline Stereo - Affine Structure from Motion: Elements - Affine Structure from Two Images and Multiple Images - Affine to Euclidean Images - Affine Motion Segmentation. Projective Structure From Motion: Elements - Projective Scene Reconstruction from Two Views - Motion Estimation from Two or Three Views - Motion Estimation from Multiple Views - From Projective to Euclidean Structure and Motion.

UNIT – IV   MID-LEVEL VISION   (9)
Segmentation Using Clustering Methods - Human vision: Grouping and Gestalt -Applications: Shot Boundary Detection, Background Subtraction and Skin Finding - Image Segmentation by Clustering - Segmentation by Graph-Theoretic Clustering. Fitting: The Hough Transform -Fitting Lines - Fitting Curves - Fitting to the Outlines of Surfaces .Tracking: Tracking as an Abstract Inference -Linear Dynamic Models and the Kalman Filter - Non-Linear Dynamic Models -Particle Filtering - Data Association.

UNIT – V   HIGH-LEVEL VISION   (9)
Correspondence and Pose Consistency - Pose Consistency for Perspective Cameras - Affine and Projective Camera Models - Linear Combinations of Models - Obtaining Hypotheses by Pose Clustering - Obtaining Hypotheses Using Invariants - Finding Templates Using Classifiers - Building Classifiers From Class Histograms - Finding Skin Pixels Using A Classifier - Feature Selection - Recognition By Relations Between Templates - Finding Objects by Voting on Relations between Templates - Relational Reasoning using Probabilistic Models and Search - Using Classifiers to Prune Search.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. David Forsyth and Jean Ponce *"Computer vision: a modern approach"* 2nd edition, Pearson India Education Services Pvt. Ltd, 2012.

Reference Books:
1. Richard Szeliski, *"Computer Vision- Algorithms and Applications"*, Springer Science & Business Media, 2011.
2. Simon J.D. Prince, *"Computer Vision - Models, Learning and Inference"*, Cambridge University Press, 2012.
3. Linda G. Shapiro, George C. Stockman, *"Computer Vision"*, Prentice Hall, 2001.

COURSE OUTCOMES:

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

CO1: Apply fundamentals concepts of camera model and calibration to image formation and image model **[Usage]**

CO2: Apply Filters, Features, Texture and Edge detection techniques to enhance an image**[Usage]**

CO3: Recover 3D structure and Motion of objects using two views and multiple views of an object. **[Usage]**

CO4: Identify objects or other relevant information in digital images using segmentation, clustering and tracking methods. **[Assessment]**

CO5: Find the relationship between the position of image features, and the position and orientation of an object. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	M	L							M	H	M	M	M
CO2	H	H	M	M	L							M	H	M	M	M
CO3	H	H	M	M	L							M	H	M	M	M
CO4	H	H	L	M	L							M	H	M	M	M
CO5	H	H	L	M	L							M	H	M	M	M
16SPEx10	H	H	M	M	L							M	H	M	M	M

L-Low,M-Moderate(Medium), H-High

16SPEx11 PARALLEL COMPUTING **CATEGORY: PE**

L	T	P	C

PREREQUISITES: Nil 3 0 0 3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* Parallel computing architecture.
* Fundamentals of parallel algorithm design and communication.
* Parallel programming with MPI, OpenMP, CUDA.
* Parallel algorithms for matrix operations and sorting.
* Parallel graph algorithms.

UNIT – I   INTRODUCTION (9)

Motivating Parallelism - Scope of Parallel Computing -Parallel Programming Platforms - Implicit Parallelism: Trends in Microprocessor Architectures - Limitations of Memory System Performance - Dichotomy of Parallel Computing Platforms - Physical Organization of Parallel Platforms - Communication Costs in Parallel Machines -Routing Mechanisms for Interconnection Networks - Impact of Process-Processor Mapping and Mapping Techniques.

UNIT – II   ALGORITHM DESIGN AND COMMUNICATION OPERATIONS (9)

Parallel Algorithm Design -Decomposition Techniques -Characteristics of Tasks and Interactions - Mapping Techniques for Load Balancing -Methods for Containing Interaction Overheads -Parallel Algorithm Models - Basic Communication Operations : One-to-All Broadcast and All-to-One Reduction - All-to-All Broadcast and Reduction - All-Reduce and Prefix-Sum Operations - Scatter and Gather - All-to-All Personalized Communication - Circular Shift -Improving the Speed of Some Communication Operations - Analytical Modeling of Parallel Programs.

UNIT – III   PARALLEL PROGRAMMING (9)

Principles of Message-Passing Programming - Send and Receive Operations - MPI: the Message Passing Interface - Topologies and Embedding - Programming Shared Address Space Platforms - Thread Basics - Controlling Thread and Synchronization Attributes - Thread Cancellation - Composite Synchronization Constructs – OpenMP – Introduction to CUDA.

UNIT – IV   PARALLEL ALGORITHM (9)

Matrix-Vector Multiplication - Matrix-Matrix Multiplication - Solving a System of Linear Equations –Sorting: Issues in Sorting on Parallel Computers - Sorting Networks - Bubble Sort and its Variants - Quicksort - Bucket and Sample Sort.

UNIT – V   PARALLEL GRAPH ALGORITHM (9)

Minimum Spanning Tree: Prim's Algorithm - Single-Source Shortest Paths: Dijkstra's Algorithm - All-Pairs Shortest Paths - Transitive Closure - Connected Components - Algorithms for Sparse Graphs - Parallel Depth-First Search - Parallel Best-First Search.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. A.Grama, A.Gupta, G.Karypis and V.Kumar **"Introduction to Parallel Computing"**, 2nd Edition, Addison-Wesley, 2003.

Reference Books:

1   *Barry Wilkinson and Michael Allen,* **"Parallel programming: techniques and applications using networked workstations and parallel computers",** *Pearson Education, 2003.*
2   *Peter Pacheco,* **"Introduction to Parallel Programming",** *Morgan Kaufmann Publishers, 2009.*
3   *Michael Jay Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill Publishers, 2003.*
4   *David B. Kirk and Wen-mei W. Hwu,* **"Programming Massively Parallel Processors",** *2nd edition, Morgan Kaufmann publications, 2012.*

COURSE OUTCOMES:

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

CO1: Explain the architecture of parallel computing architecture. **[Familiarity]**

CO2: Apply parallel algorithm design techniques using appropriate communication model. **[Usage]**

CO3: Write programs using MPI, Open MP and CUDA **[Usage]**

CO4: Write parallel algorithms for solving matrix multiplication, system of linear equations, sorting, etc.**[Usage]**

CO5: Apply parallelization on graph algorithms.**[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	H	L	L							H	H	H	M	H
CO2	M	H	H	H	L							H	H	H	M	H
CO3	H	H	H	M	H							H	H	H	M	H
CO4	H	H	H	M	L							H	H	H	M	H
CO5	M	H	H	H	L							H	H	H	M	H
16SPEx11	H	H	H	M	L							H	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SPEx12   **GRAPH THEORY**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,

* The concept of graph theory, graph representations and the basic classes of graphs.
* The several famous graph problems and associated algorithms.
* The abstract concepts of graph theory in modeling and solving non-trivial problems in different fields of study

UNIT – I   INTRODUCTION   (9)
Graphs -the degree of a vertex - paths and cycles -connectivity -Tree and forests -Bipartite graphs-contraction and minors - Euler tours -- Matching in bipartite graphs -general graphs - path covers.

UNIT – II   CONNECTIVITY AND PLANAR GRAPHS   (9)
2-Connected graphs and subgraphs - The structure of 3-connected graphs - Menger's theorem - Mader's theorem - Edge-disjoint spanning trees - paths between given pairs of vertices - Topological prerequisites - plane graphs -drawings- kuratowski's theorem -Algebraic planarity criteria -plane duality.

UNIT – III   COLORING AND FLOWS   (9)
Coloring maps and planar graphs - coloring vertices and edges - List coloring - Perfect graphs - Circulations - Flows in networks -Group-valued flows - k-flows for small k - Flow-coloring duality.

UNIT – IV   DENSE AND SPARSE GRAPHS   (9)
Subgraphs - Szemeredi regularity lemma - Applying the regularity lemma - Topological minors -Minors - Hadwiger's conjecture- The Graph minor theorem for tree - Tree decompositions - Tree-width and forbidden minors- The graph minor theorem.

UNIT – V   HAMILTON CYCLES AND RANDOMGRAPHS   (9)
Sufficient conditions - Hamilton cycles and degree sequences - Hamilton cycles in the square of a graph - Notion of a random graph - Probabilistic method- properties of almost all graphs - Threshold functions and second moments.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
 1. R. Diestel **"Graph Theory"** *Springer-Verlag, 2nd edition, 2000*

Reference Books:
 1. Deo, N, **"Graph theory with applications to Engineering and Computer Science",** *PHI*
 2. N. Alon and J. Spenser, **"Probabilistic Methods",** *John Wiley and Sons, 2nd edition, 2000.*
 3. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH.
 4. Robin J. Wilson, Introduction to Graph Theory, Pearson Education.

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of graphs **[Familiarity]**

CO2: Solve problems using basic graph theory **[Usage]**

CO3: Identify different kinds of special graphs and describe the basic properties of each kind. **[Familiarity]**

CO4: Demonstrate understanding of the basic techniques and strategies of applying graph theory to solve advanced data structures and other real world problems on a computer system. **[Familiarity]**

CO5: Solve problems involving vertex and edge coloring **[Usage]**

CO6: Model real world problems using graph theory **[Usage]**

CO7: Explain the Hamilton cycles and random graphs. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H							M	H	M	H	L
CO2	H	H	H	H	H							M	H	M	H	L
CO3	H	H	H	H	H							M	H	M	H	L
CO4	H	H	H	H	H							M	H	M	H	L
CO5	H	H	H	H	H							M	H	M	H	L
CO6	H	H	H	H	H							M	H	M	H	L
CO7	H	H	H	H	H							M	H	M	H	L
16SPEx12	H	H	H	H	H							M	H	M	H	L

L-Low, M-Moderate(Medium), H-High
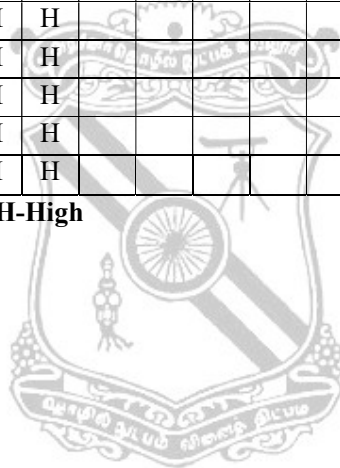
16SPEx13   OBJECT ORIENTED ANALYSIS AND DESIGN   CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Basic terminology and OO concepts.
* Object Oriented Methodologies & UML Diagrams.
* Process of object-oriented analysis for software development
* Design axioms and corollaries, design patterns and UML object constraint language.
* Testing techniques for object oriented software

UNIT – I   INTRODUCTION   (9)
An overview – Object basics – Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations – Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.

UNIT – II   METHODOLOGY AND UML   (9)
Introduction – Rumbugh- Booch- Jacobson methods – Patterns – Frameworks – Unified approach – Unified modeling language – Static and Dynamic models – UML diagrams – Class diagram – Use case diagrams – Dynamic modeling – Model organization – Extensibility.

UNIT – III   OBJECT ORIENTED ANALYSIS   (9)
Identifying Use case – Business object analysis – Use case driven object oriented analysis – Use case model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super sub class – A part of relationships Identifying attributes and methods – Object responsibility.

UNIT – IV   OBJECT ORIENTED DESIGN   (9)
Design process – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – Purpose of a view layer interface.

UNIT – V   SOFTWARE QUALITY ASSURANCE   (9)
Quality Assurance test–testing Strategies-Black box testing-White box testing-Top-Down Testing-Bottom-up Testing-Impact of Object Orientation on Testing- Test cases– test plan – usability testing –User satisfaction – testing-Case Study: Developing Usability test plans and test cases for Developing Usability test plans and test cases -Inventory Control System-ATM System-Mobile Applications.

CONTACT PERIODS:
 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Ali Bahrami *"Object Oriented System Development" Tata McGraw Hill International Edition, 2008*

Reference Books:
 1. Craig Larman, *"Applying UML and Patterns",* 2nd Edition, Pearson Education, 2012
 2. Stephan R. Schach, *"Object Oriented and Classical Software Engineering",* McGraw-Hill, 2007.
 3. Mike O'Docherty *"Object-Oriented Analysis & design – understanding system development with UML 2.0",* 2nd Edition, John Wiley & Sons, 2005.
 4. Booch, Jacobson, Rumbagh, *"The UML user Guide",* 2nd Edition, Pearson Education, 2005.

COURSE OUTCOMES:

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

CO1: Describe how modeling supports the OOSD process **[Familiarity]**

CO2: Identify and describe the essential elements in a UML Use Case diagram **[Usage]**

CO3: Apply appropriate object oriented methodologies for solving the problem with the help of various case studies **[Usage]**

CO4: Analyze problem scenario and model the system using UML diagrams **[Usage]**

CO5: Identify actors, attributes, classes/ Objects, their properties and associations by analyzing the given scenario and develop Usecase **[Familiarity]**

CO6: Identify and Use the appropriate patterns in solving problems **[Familiarity]**

CO7: Analyze the given case study, identify the appropriate testing strategies and Create the test plan and test cases **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	M	M							M	L	M	M	H
CO2	M	H	H	M	M					M		M	L	M	M	H
CO3	M	H	H	H	M							M	H	M	H	H
CO4	M	H	H	H	M					M		M	H	M	H	H
CO5	M	M	H	L	L							L	M	M	L	M
CO6	M	M	H	L	L							L	M	M	L	M
CO7	M	H	H	M	M	L	L	L	L	L	M	H	M	M	M	M
16SPEx13	M	H	H	H	M	L	L	L	L	L	M	M	M	M	M	M

L-Low,M-Moderate(Medium), H-High

16SPEx14   **FUZZY LOGIC AND NEURAL NETWORKS**   **CATEGORY: PE**

L	T	P	C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,

* ∗ Basics of fuzzy setz and fuzzy logic.
* ∗ Fundamentals of fuzzy system.
* ∗ Neural network training algorithms.
* ∗ Different neural network architecture.
* ∗ Application of neural networks and fuzzy logic

UNIT – I   INTRODUCTION TO FUZZY LOGIC   (9)
Classical Sets - Fuzzy Sets - Classical Relations - Fuzzy Relations - Properties of Membership Functions – Fuzzification – Defuzzification.

UNIT – II   FUZZY SYSTEM   (9)
Logic and Fuzzy Systems - Development of Membership Functions - Automated Methods for Fuzzy Systems - Fuzzy Systems Simulation - Decision Making with Fuzzy Information.

UNIT – III   INTRODUCTION TO NEURAL NETWORKS   (9)
Basic model – Classification - Feed forward and Recurrent topologies - Activation functions - Learning algorithms: Supervised, Un-supervised and Reinforcement - McCulloach – Pits model, Perceptron – Adaline - Madaline – Backpropagation.

UNIT – IV   TYPES OF NEURAL NETWORKS   (9)
The BAM and the Hopfield Memory- Simulated Annealing - The Counterpropagation Network - Self-Organizing Maps - Adaptive Resonance Theory.

UNIT – V   APPLICATIONS OF FUZZY LOGIC AND NEURAL NETWORKS   (9)
Applications of Fuzzy Logic: Fuzzy Pattern Recognition – Fuzzy Image compression – Fuzzy Logic Controllers - Applications of Neural Networks: Pattern Recognition – Image Compression – Communication Control system.

CONTACT PERIODS:
 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
 1. Timothy J. Ross *"Fuzzy Logic with Engineering Applications"* 3rd edition, John Wiley & Sons Ltd., 2010
 2. James A. Freeman, David M. Skapura *"Neural Networks - Algorithms, Applications and Programming Techniques"* Addison-Wesley Publishing Company, 1991.

Reference Books:
 1. H.-J. Zimmermann, *"Fuzzy set theory - and its applications",* 4th edition, Springer Science and   Business Media, 2001.
 2. Simon Haykin, *"Neural Networks -- a Comprehensive Foundation",* Prentice Hall, 2nd edition. 1999.
 3. Mohamad H. Hassoun, *"Fundamentals of Artificial Neural Networks",* MIT press, 1995.
 4. Bart Kosko, *"Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence",* Prentice-Hall International, 1992.

COURSE OUTCOMES:

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

CO1: Explain the fuzzy sets, fuzzification and defuzzification methods
[Familiarity]

CO2: Solve problems by designing appropriate membership function. **[Usage]**

CO3: Describe the architecture and training methods of neural networks.
[Familiarity]

CO4: Explain the architecture and working of different types of neural network.
[Familiarity]

CO5: Apply neural network and fuzzy logic in various fields like pattern
recognition, image compression and control systems. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	L	M	H						M	H	H	H	M	H
CO2	M	H	M	H	H						M	H	H	H	M	H
CO3	M	H	H	H	H						M	H	H	H	M	H
CO4	M	H	L	M	H						M	H	H	H	M	H
CO5	M	H	M	H	H						M	H	H	H	M	H
16SPEx14	M	H	M	H	H						M	H	H	H	M	H

L-Low,M-Moderate(Medium), H-High

16SPEx15　　　　**ADVANCED DATA STRUCTURES AND**　　　　CATEGORY: PE
　　　　　　　　　　　　　　　　　APPLICATIONS

　　　　　　　　　　　　　　　　　　　　　　　　　　　　L　T　P　C
PREREQUISITES:　　　　　　　　　　　　　　　　　　　3　0　0　3
1. 16SPC305 - Data Structures

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
　　　∗ Priority Queues
　　　∗ Search Trees
　　　∗ Multi dimensional and Spatial Data Structures
　　　∗ Advanced Data structures such as Tries, Suffix Trees, PQ and PC Trees
　　　∗ Application areas of Data Structures.

UNIT – I　　PRIORITY QUEUSES AND DICTIONARY STRUCTURES　　　　(9)
Leftist Trees– Skew Heaps – Binomial Heap - Fibonacci Heap - Pairing Heap – Double
Ended Priority Queues: Symmetric Min-Max Heap , Interval Heap, Min Max Heaps, Deaps-
Finger Search Trees – Splay Trees – Randomized Dictionary Structures – Trees with
minimum Path Length – B Trees

UNIT – II　　MULTIDIMENSIONAL SPATIAL DATA STRUCTURES　　　　(9)
Multi dimensional spatial data Structures – Planar Straight Line Graphs- Interval , Segment,
Range and Priority Search Trees, Quad and Octrees- Binary space Partitioning Tree-R-Trees

UNIT – III　　SPATIAL STRUCTURES　　　　　　　　　　　　　(9)
Managing Spatial Temporal Data-Kinetic Data Structures-Online Dictionary Structure-
Cuttings- Approximate Geometric Query Structures-Geometric and Spatial Data Structures in
External memory.

UNIT – IV　　MISCELLANEOUS DATA STRUCTURES　　　　　　(9)
Tries – Suffix trees and suffix arrays – String Searching –Persistent Data Structures- PQ
Trees, PC Trees and Planar Graphs- Data Structures for Sets – Randomized Graph Data
Structures for Approximate shortest Path

UNIT – V　　APPLICATIONS　　　　　　　　　　　　　　　(9)
Multi dimensional packet Classification – Web Information Retrieval – Web as dynamic
graph- Computer Graphics- GIS- Collision Detection- Image Data Structures-Data structures
for Databases-Data Mining- Computational Geometry

CONTACT PERIODS:
 Lecture: 45 Periods　　　Tutorial: 0 Periods　　　Practical: 0 Periods　　Total: 45 Periods

Text Books:
 1. Dinesh P. Mehta, Sartaj Sahni "Handbook of Data Structures and Applications, Chapman
　 & Hall/CRC, 2005.

Reference Books:
 1. Thomas H. Cormen, Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "Introduction
　 to Algorithms", Third Edition, PHI learning Pvt. Ltd., 2011.
 2. Peter Brass, "Advanced Data structures",Cambridge University Press, 2008.
 3. Sartaj Sahni, "Data Structures, Algorithms and applications in C++", Second Edition,
　 Universities Press, 2005.

COURSE OUTCOMES:

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

CO1: Explain the data structures used for Prioritization and its application areas[Familiarity]

CO2: Use appropriate Dictionary Structure [Assessment]

CO3: Use appropriate Multidimensional Data Structures [Assessment]

CO4: Identify and use suitable spatial structures[Assessment]

CO5: Explain and Understand the application areas of various data structures[Familiarity]

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	M			M		L	L	H	H	H	H	H
CO2	H	H	H	H	H			M		L	L	H	H	H	H	H
CO3	H	H	H	H	H			M		L	L	H	H	H	H	H
CO4	H	H	H	H	H			M		L	L	H	H	H	H	H
CO5	H	H	H	H	H			M		L	L	H	H	H	H	H
16SPEx15	H	H	H	H	H			M		L	L	H	H	H	H	H

L-Low,M-Moderate(Medium), H-High

16SPEx16 **MULTIMEDIA SYSTEMS** **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: Nil 3 0 0 3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* ∗ Fundamentals of media components such as audio, video and images and Graphics.
* ∗ Basic components of multimedia
* ∗ Different compression principles and multimedia compression standards.
* ∗ Fundamentals of storage mechanisms in multimedia.
* ∗ Multimedia communication across the networks.
* ∗ Need of Multimedia synchronization and Model for Synchronization.
* ∗ Techniques for Multimedia Applications.

UNIT – I   INTRODUCTION   **(9)**
Multimedia: Media and data streams-sound/Audio-Images and Graphics-Video and Animation-Components of multimedia-multimedia software tools.

UNIT – II   DATA COMPRESSION AND STORAGE MEDIA   **(9)**
Storage Space Coding Requirements Source, Entropy and Hybrid Coding Lossy Sequential DCT- based Mode Expanded Lossy DCT-based Mode JPEG and MPEG Optical Storage Media-Basic Technology-Video Disk and other WORMS-Compact Disk Digital Audio-Compact Disk Compact Read only Memory-CD-ROM Extended Architecture- Compact Disk Magneto optical-Computer Technology-Communication Architecture-Multimedia Workstations.

UNIT – III   MULTIMEDIA COMMUNICATION   **(9)**
Basics of Computer and Networks-Layers-Protocols and Services-LAN,WAN,MAN-Application System-Transport subsystem- Quality of Service and Resource Management

UNIT – IV   MULTIMEDIA SYNCHRONIZATION   **(9)**
Introduction-Notion of Synchronization-Presentation Requirements-A Reference Model for Multimedia Synchronization - Synchronization Specifications-Case Studies: HyTime - Multimedia Tele-Orchestra.

UNIT – V   APPLICATIONS   **(9)**
Programs-structures - Media preparation- Media Composition- Media Integration - Media Communication - Media Consumption - Media Entertainment.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *Ralf Steinmetz and Klara Nahrstedt **"Multimedia: Computing Communications & Applications"** Pearson Education,2012*
2. *Ze-Nian Li, Mark S. Drew, Jiangchuan Liu **"Fundamentals of Multimedia"** Springer International Publishing, 2nd Edition, 2014.*

Reference Books:
1. *Tay Vaughan, **"Multimedia - Making it work",** Tata Mc Graw Hill Edition, 8th edition, 2010.*
2. *Fred Halsall, **"Multimedia Communications- Applications, Networks, Protocols and Standards",** Pearson Education, 2007.*
3. *Parag Havaldar, Gerard Medioni,**"Multimedia Systems Design",** PHI, 2003.*

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

        CO1: Design a basic Multimedia system using sound and video **[Usage]**

        CO2: Design and develop multimedia systems by using different compression techniques like lossy and lossless **[Usage]**

        CO3: Apply QoS to multimedia network applications with efficient routing techniques **[Usage]**

        CO4: Use suitable authentication methods for integrity related security issues **[Usage]**

        CO5: Comprises relationships between time-dependent media objects as well as time-independent media objects **[Familiarity]**

        CO6: Apply techniques and tools for creating and editing the interactive multimedia applications **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	M	L					M		M	H	H	M	L
CO2	H	M	H	M	M					M		M	H	H	M	L
CO3	H	M	H	M	M	L	L	L		M		M	H	H	M	L
CO4	H	M	M	M	L	M	M	M		M		H	H	H	H	H
CO5	H	M	L	L	M					M		M	L	L	L	L
CO6	H	L	M	L	H	L	L	L	L	M	L	H	H	L	H	H
16SPEx16	H	M	L	M	M	L	L	L	L	M	L	M	H	H	M	M

L-Low,M-Moderate(Medium), H-High

16SPEx17   **INTERNET OF THINGS**   **CATEGORY: PE**

	L	T	P	C

PREREQUISITES: 3   0   0   3
1. 16SPC503 - Computer Networks

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Applications and enabling technologies of IoT
* Need for Standardization of IoT and related protocols
* Interoperability issues in IoT ecosystem
* Fundamentals of Web of Things [WoT]
* Security issues concerning IoT

UNIT – I   INTRODUCTION   (9)
IoT history and Vision – Physical and Logical Design of IoT- Functional Blocks – Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - Communication models –Enabling Technologies – IoT Levels – Domain Specific IoT - IoT Vs M2M, SDN. IoT Applications – Smart environment, smart energy, smart agriculture and smart health.

UNIT – II   PROTOCOLS AND STANDARDISATION   (9)
Protocol Standardization for IoT – Efforts – Machine to Machine and Wireless Sensor Networks Protocols – SCADA and RFID Protocols. Defining a common architecture, iCore functional architecture, Machine to Machine Service Level standardization – OGC Sensor Web for IoT – IEEE and IETF – ITU -T.

UNIT – III   INTEROPERABILITY   (9)
Physical Vs Virtual World – Types of Interoperability - The Data Interoperability - The Semantic Interoperability - The Organizational Interoperability - The Eternal Interoperability - The Research Roadmap for IoT Testing Methodologies - Semantics as an Interoperability Enabler.

UNIT – IV   WoT Vs IoT AND APPLICATION DEVELOPMENT   (9)
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Application Development - MQTT, REST/HTTP,CoAP, MySQL.

UNIT – V   SECURITY AND FUTURE RESEARCH   (9)
Issues related to Governance - Security, Privacy and Trust in IoT –Platforms for Smart Cities - Big data in IoT, platforms for Big data in IoT - Cloud computing – Issues of incorporating cloud in IoT - Fog computing. Case study – Smarter Classrooms.

CONTACT PERIODS:
 Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. *OvidivVermesan, Peter Friess* **"Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems"** *River publications, 2013*
2. *Adrian McEwen & Hakim Cassimally* **"Designing the Internet of Things"** *Wiley, 2014*

Reference Books:
1. *Dieter Uckelmann, "Architecting the Internet of Things", Springer 2011.*
2. *Charalamposdoucas, "Building the Internet of Things with Arduino", CreateSpace, 2002*
3. *Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.*
4. *Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012.*

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

        CO1: Explain functional building blocks of IoT and its applications. **[Familiarity]**

        CO2: Compare IoT with M2M and SDN. **[Usage]**

        CO3: Explore IoT and its related protocols for heterogeneous communication. **[Familiarity]**

        CO4: Define a common Architecture for IoT. **[Usage]**

        CO5: Compare Data, Semantic, Organizational and Eternal Interoperability to resolve heterogeneity issues. **[Assessment]**

        CO6: Identify middleware for WoT and WoT portals. **[Usage]**

        CO7: Develop applications using MQTT, REST/HTTP, CoAP, MySQL **[Assessment]**

        CO8: Define security principles for IoT and explain futuristic IoT Vision. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	H	M	L	M	M	M				M	H	H	M	L
CO2	H	M	H	M	M	M	M	M				M	H	H	M	L
CO3	H	M	H	M	M	L	L	L				M	H	H	M	L
CO4	H	M	M	M	L	M	M	M				H	H	H	H	H
CO5	H	M	L	L	M	M	M	M				M	L	L	L	L
CO6	H	L	M	L	H	L	L	L				H	H	L	H	H
CO7	H	M	M	M	M	M	M	M	M	M		M	M	M	M	M
CO8	H	M	M	M	M	M	M	M				M	M	M	M	M
16SPEx17	H	M	L	L	M	M	M	M	M	M	L	M	H	H	M	M

L-Low,M-Moderate(Medium), H-High

16SPEx18   **BIG DATA ANALYTICS**   **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES:
1. 16SPC404 - Database Management System

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Evolution of Big Data and its characteristics
* Domain specific analysis of Big data
* Mining larger data streams
* Concepts related to Link analysis and handle large and frequent data sets
* Frameworks for Big Data and its applications.

UNIT – I   INTRODUCTION (9)
Introduction to BigData – Platforms for Big Data – Traits -Challenges - Web Data – Analytic Scalability - Modern Data Analytic Tools - Big data sources – Acquisition –Big Data Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big data Analytics - Data Appliance and Integration tools.

UNIT – II   BIG DATA ANALYSIS (9)
Evolution of analytic scalability – Convergence – parallel processing systems - Cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets - Analysis approaches – Statistical significance - Multivariate analysis, Bayesian modeling, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction.

UNIT – III   MINING DATA STREAMS (9)
The stream data model –Sampling data streams –counting distinct elements in a stream – Estimating moments. Finding similar items – Applications of nearest neighbor search – shingling of documents - similarity preservation – locality sensitive hashing- distance measures– methods for high degree similarity.

UNIT – IV   LINK ANALYSIS AND FREQUENT DATASETS (9)
Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – A-Priori algorithm – handling larger datasets in main memory –limited pass algorithm – counting frequent items in a stream.

UNIT – V   BIG DATA FRAMEWORKS AND APPLICATIONS (9)
Map Reduce Framework - Hadoop – Hive – Sharding – **NoSQL** Databases - S3 - Hadoop Distributed file systems – Hbase – Impala –Big data forECommerce – Big data for blogs – Case Study - Analyzing big data with twitter - Futuristic vision and applications of Big Data.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *Frank J Ohlhors* ***"Big Data Analytics: Turning Big Data into Big Money"*** *Wiley and SAS Business Series, 2012.*
2. *Anand Rajaraman and Jeffrey David Ullman* ***"Mining of Massive Datasets"*** *Cambridge University Press, 2012.*

Reference Books:

1. *Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.*

2. *Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.*

3. *Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.*

4. *Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, "Harness the Power of Big data – The big data platform", McGraw Hill, 2012.*

COURSE OUTCOMES:

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

CO1: Explain platforms, traits and best practices of Big Data. **[Familiarity]**

CO2: Use Map Reduce to explore the analytic scalability of Big Data **[Usage]**

CO3: Use statistical techniques to analyze Big Data. **[Usage]**

CO4: Identify sample and mine larger data streams. **[Usage]**

CO5: Apply nearest neighbor search to calculate degree similarity between data. **[Assessment]**

CO6: Compare frameworks for Big Data and list their performance. **[Usage]**

CO7: Explain futuristic vision and applications of Big Data. **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	H	H				H	H	H	H	M	H	H	M
CO2	H	H	H	H	H				H	H	H	H	M	H	H	M
CO3	M	H	L	L	H				L	L	L	H	M	H	H	M
CO4	M	H	M	M	H				H	M	L	H	L	H	H	L
CO5	H	H	H	M	H				H	H	M	H	M	H	H	M
CO6	H	H	H	M	H				H	M	L	H	M	H	H	M
CO7	H	H	H	H	H				H	H	M	H	M	H	H	M
16SPEx18	H	H	H	M	H				H	M	M	H	M	H	H	M

L-Low, M-Moderate(Medium), H-High

16SPEx19　　　　　　**ADHOC NETWORKS**　　　　　　CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with,

* The basic concepts of Ad Hoc networks. Model of operation, commercial applications and factors affecting Ad Hoc networking
* Finding the path between source and destination using various routing protocols.
* Acquire knowledge about Multicast routing protocols.
* Design issues, goals and classification of transport layer protocol, issues and challenges in   security provisioning and quality of service.
* Acquire knowledge about QoS and Energy Management in Ad hoc Wireless Networks

UNIT – I   FUNDAMENTALS   (9)

Introduction – Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio Propagation Mechanisms – Characteristics of the Wireless Channel – IEEE 802.11a–b Standard – Origin of Ad hoc Packet Radio Networks – Technical Challenges – Architecture of PRNETs – Components of Packet Radios – Ad hoc Wireless Networks – What is an Ad Hoc Network? Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet.

UNIT – II   AD HOC ROUTING PROTOCOLS   (9)

Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) –Location–Aided Routing (LAR) – Power–Aware Routing (PAR) – Zone Routing Protocol (ZRP).

UNIT – III   MULTICAST ROUTING IN ADHOC NETWORKS   (9)

Introduction – Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols – Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols.

UNIT – IV   TRANSPORT LAYER– SECURITY PROTOCOLS   (9)

Introduction – Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks –Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements – Issues and Challenges in Security Provisioning – Network Security Attacks – Key Management – Secure Routing in Ad hoc Wireless Networks.

UNIT – V   QoS AND ENERGY MANAGEMENT **(9)**

Introduction – Issues and Challenges in Providing QoS in Ad hoc Wireless Networks – Classifications of QoS Solutions – MAC Layer Solutions – Network Layer Solutions – QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks – Introduction – Need for Energy Management in Ad hoc Wireless Networks – Classification of Energy Management Schemes – Battery Management Schemes – Transmission Power Management Schemes – System Power Management Schemes.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj *"Ad Hoc Wireless Networks Architectures and Protocols"* *Prentice Hall, PTR, 2008.*

Reference Books:

1 C. K. Toh, *"Ad Hoc Mobile Wireless Networks Protocols and Systems"*, *PrenticeHall, PTR, 2001.*

2 Charles E. Perkins, *"Ad Hoc Networking"*, *Addison Wesley, 2000.*

3 Matthew Gast, *"802.11 Wireless Networks: The Definitive Guide"*, *2nd Edition, O'ReillyMedia, April 2005.*

4 Mohammad Ilyas, *"The handbook of Adhoc Wireless Networks"*, *CRC Press, 2002.*

COURSE OUTCOMES:

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

CO1: Identify technical and market factors affecting Ad Hoc networks **[Familiarity]**

CO2 : Find the path between source and destination using unicast routing protocol. **[Usage]**

CO3 : Find the path between source and destination using multicast routing protocol. **[Usage]**

CO4 : Describe the working principles of transport layer protocol and analyze its Quality of service **[Familiarity]**

CO5 : Describe Security in Ad Hoc Wireless Networks and its issues **[Familiarity]**

CO6 : Describe QoS and Energy Management in Ad hoc networks **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	H	H		M					M	H	M	H	L
CO2	H	H	H	H	H		M					M	H	M	H	L
CO3	H	H	H	H	H		M					M	H	M	H	L
CO4	H	H	H	H	H		M					M	H	M	H	L
CO5	H	H	H	H	H		M					M	H	M	H	L
CO6	H	H	H	H	H		M					M	H	M	H	L
16SPEx19	H	H	H	H	H		M					M	H	M	H	L

L-Low,M-Moderate(Medium), H-High

16SPEx20 **INFORMATION SECURITY** CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil | 3 | 0 | 0 | 3 |

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,

* Threats, attacks and issues in a security model.
* Cryptography to secure data.
* Firewalls, wireless security and intrusions.
* Security of operating systems, servers and mobile devices.
* Ensuring availability of data.

UNIT – I   INTRODUCTION   (9)

The History of Information Security - CNSS Security Model -Components of an Information System - Security Professionals and the Organization – the need for security – threats – attacks – Secure software development – Legal, Ethical, and Professional Issues in Information Security- Risk Analysis.

UNIT – II   DATA SECURITY   (9)

Securing Unstructured Data – Overview of Information Rights Management – Encryption – Symmetric key cryptography – Public key cryptography – Public key Infrastructure - Modern Storage Security – Database security.

UNIT – III   NETWORK SECURITY   (9)

Secure Network Design - Network Device Security – Firewalls – Virtual Private Network – Wireless Network Security - Intrusion Detection and Prevention Systems - Voice Over IP (Voip) And PBX Security.

UNIT – IV   COMPUTER SECURITY   (9)

Operating System Security Models – Unix Security – Windows Security – Securing E-mail, Web servers, DNS servers, Proxy Servers – Protecting Virtual Storage and Networks - Securing Mobile Devices.

UNIT – V   SECURITY OPERATIONS AND PHYSICAL SECURITY   (9)

Security Operations Management - Disaster Recovery - Business Continuity – Backups - High Availability - Incident Response - Forensic Analysis. Physical security: Physical Vulnerability Assessment - Choosing Site Location for Security - Locks and Entry Controls - Physical Intrusion Detection.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Mark Rhodes-Ousley **"Information Security The Complete Reference"** 2nd edition, McGraw Hill   Professional, 2013.

Reference Books:
1. Michael E. Whitman, Herbert J. Mattord, **"Principles of Information Security"** , 4th edition, Cengage Learning, 2011.
2. Jason Andress, Steven Winterfeld, **"The Basics of Information Security – Understanding The Fundamentals Of Infosec In Theory And Practice",** 2nd edition, Syngress, 2014.
3. Michael Whitman, Herbert Mattord, **"Management of Information Security",** 3rd edition, Nelson Education, 2013.
4. Richard E.Smith, **"Elementary Information Security",** 2nd edition, Jones & Bartlett Publishers, 2015.

COURSE OUTCOMES:

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

CO1: Identify threats and attacks to the information within systems. **[Familiarity]**

CO2: Secure information stored in servers, storage networks and databases using cryptography. **[Usage]**

CO3: Secure the network using proper design, firewalls and intrusion detection and prevention systems. **[Usage]**

CO4: Apply proper access control mechanism to protect operating system, e-mail, servers and mobile devices. **[Usage]**

CO5: Apply appropriate disaster recovery plan and backup to ensure high availability of data. **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	L	L		H		M				M	H	H	L	L
CO2	H	H	L	M		H		M				M	H	H	M	L
CO3	H	H	L	H		H		M				M	H	H	M	L
CO4	H	H	L	H		H		M				M	H	H	M	L
CO5	H	H	L	H		H		M				M	H	H	M	L
16SPEx20	H	H	L	H		H		M				M	H	H	M	L

L-Low,M-Moderate(Medium), H-High

16AOEX01   **NANOSCIENCE AND TECHNOLOGY**   **CATEGORY: OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

* To Understand and analyze the concepts of Quantum confinement, Dimensional structures and Properties of nano systems.
* To be familiar with various methods of synthesis of nano materials.
* To analyze and understand the mechanical and electrical properties of nonmaterial and its applications.
* To realize the importance of Nonporous materials and its applications.
* To make the students to understand the fundamental aspects of properties leading to technology.

UNIT I   NANO SYSTEMS   (9)
Size effect and properties of nanoparticles - particle size - particle shape - particle density - melting point, surface tension, wettability - specific surface area and pore size – Properties of Individual nanoparticles. Quantum confinement in 3D, 2D, 1D and zero dimensional structures - Size effect and properties of nanostructures- Top down and Bottom up approach.

UNIT II   SYNTHESIS OF NANOMATERIALS   (9)
Sol-Gel Process - Self assembly – Electro deposition - Spray Pyrolysis - Flame Pyrolysis – Metal Nanocrystals by Reduction – Solvothermal Synthesis - Chemical Vapor Deposition (CVD) – Metal Orgonic Chemical Vapor Deposition (MOCVD).Ball Milling - Inert Gas Condensation Technique (IGCT) – Thermal evaporation – Pulsed Laser Deposition (PLD) – DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE) – Melt Spinning process.

UNIT III   MECHANICAL AND ELECTRICAL PROPERTIES   (9)
Nanoscale Mechanics - Introduction – Mechanical properties – Density Considered as an Example Property – The Elasticity of Nanomaterials – Elasticity of Bulk Nanomaterials –Plastic Deformation of Nanomaterials - The Physical Basis of Yield Strength – Crystals and Crystal Plasticity – From Crystal Plasticity to Polycrystal Plasticity.
Introduction - Energy Storage Basics - General Information: Electrical Energy Storage Devices and Impact of Nanomaterials – Batteries – Capacitors - Electrochemical Properties of Nanoscale Materials - Aerogels and Structure-Directed Mesoporous and Macroporous Solids - Nanoparticles - Nanotubes, Nanowires, and Nanorolls.

UNIT IV   NANOPOROUS MATERIALS   (9)
Nanoporous Materials – Silicon - Zeolites, mesoporous materials – nano membranes and carbon nanotubes - AgX photography, smart sunglasses and transparent conducting oxides- Hydrophobic & Hydrophilic materials – molecular sieves – nanosponges.

UNIT V   NANOTECHNOLOGY APPLICATIONS   (9)
Applications of nanoparticles, quantum dots, Nanotubes and nanowires for nanodevice fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions – nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors – principle of Dip Pen Lithography.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Reference books:

1. G. Timp. Editor, **"Nanotechnology"** AIP press, Springer-Verlag, New York, 1999
2. Hari Singh Nalwa, Editor, **"Nanostructured materials and Nanotechnology''**, Concise Edition, Academic Press, USA (2002).
3. Guozhong Gao, **"Nanostructures & Nanomaterials: Synthesis, Properties & Applications",** Imperial College Press (2004).
4. K. T. Ramesh, **"Nanomaterials : Mechanics and Mechanisms",** Springer 2009.
5. Kenneth J. Klabunde, **"Nanoscale materials in chemistry",** John Wiley & Sons, 2001.
6. Hari Singh Nalwa, Editor, **"Hand book of Nanostructured Materials and Technology''**, Vol.1-5, Academic Press, USA (2000).
7. **"Hand book of Nanoscience, Engineering and Technology"** (The Electrical Engineering handbook series), Kluwer Publishers, 2002
8. N John Dinardo, Weinheim, **"Nanoscale characterization of surfaces & interfaces",** Cambridge: Wiley-VCH, 2nd ed., 2000
9. G. Cao, **"Nanostructures & Nanomaterials: Synthesis, Properties &Applications",** Imperial College Press, 2004.
10. J.George, **"Preparation of Thin Films",** Marcel Dekker, Inc., New York. 2005.

COURSE OUTCOMES:

CO1 : Analyze the particle size, particle shape, particle density, Size effect and properties of nanostructures. **[Familiarity]**

CO2 : Acquire knowledge in various methods of synthesis of Nano materials. **[Application]**

CO3 : Analyze the Elasticity of Nanomaterials , Electrical Energy Storage Devices and Aerogels. **[Assessment]**

CO4: Acquire knowledge in Zeolites, mesoporous materials, nano membranes and carbon nanotubes. **[Familiarity]**

CO5: Apply various nano materials to the LED, Transistor Applications. **[Usage and Assessment]**

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		H		M		L										L
CO2	M			L	H											L
CO3		H			L		M						H			L
CO4	H			M		L								H		L
CO5	L		H				M					M			H	L
16AOEX01	L	L	L	L	L	L	L					L	L	L	L	L

L-Low, M-Moderate(Medium), H-High

16AOEX02   **MATERIAL CHARACTERIZATIONS**   **CATEGORY: OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:
* To Understand and analyze the concepts of Thermo gravimetric analysis and Differential thermal analysis.
* To be familiar with various methods of microscope
* To analyze and understand the working principle of SEM, FESEM, EDAX, and HRTEM
* To realize the importance of Electrical methods and its limitations
* To understand the fundamental aspects and properties of spectroscopy techniques

UNIT I   THERMAL ANALYSIS   (9)

Introduction – thermo gravimetric analysis (TGA) – instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves - differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermo mechanical parameters .

UNIT II   MICROSCOPIC METHODS   (9)

Optical Microscopy: optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy - phase contrast microscopy - fluorescence microscopy - confocal microscopy - - digital holographic microscopy - oil immersion objectives - quantitative metallography - image analyzer.

UNIT III   ELECTRON MICROSCOPY AND OPTICAL CHARACTERISATION   (9)

SEM - FESEM - EDAX - HRTEM: working principle and Instrumentation – sample preparation – Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

UNIT IV   ELECTRICAL METHODS(9)

Two probe and four probe methods- van der Pauw method – Hall probe and measurement – scattering mechanism – C-V, I-V characteristics – Schottky barrier capacitance – impurity concentration – electrochemical C-V profiling – limitations.

UNIT V   SPECTROSCOPY   (9)

Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy, Raman spectroscopy, ESR, NMR, NQR, ESCA and SIMS- proton induced X-ray Emission spectroscopy (PIXE) – application – mass spectroscopy.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Reference books:
1. Stradling, R.A; Klipstain, P.C; "Growth and Characterization of semiconductors", Adam Hilger, Bristol, 1990.
2. Belk, J.A; "Electron microscopy and microanalysis of crystalline materials", Applied Science Publishers, London, 1979.
3. Lawrence E.Murr, "Electron and Ion microscopy and Microanalysis principles and Applications", Marcel Dekker Inc., New York, 1991
4. D.Kealey & P.J.Haines, "Analytical Chemistry", Viva Books Private Limited, New Delhi, 2002.
5. G. Gao, "Nanostructures and Nanomaterials", Imperial College Press, London, 2006
6. Y. Gogotsi, "Nanomaterials Handbook", CRC Taylor and Francis, New York, 2006
7. Banwell, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill, 1994.

COURSE OUTCOMES:

CO1: Analyze the properties of TGA,DTA and DSC. **[Assessment]**
CO2: Acquire knowledge in various types of microscopes. **[Familiarity]**
CO3: Analyze the working principle and Instrumentation of SEM, FESEM, EDAX, and HRTEM [**Familiarity]**
CO4: Acquire knowledge in I-V and C-V characteristics**. [Application]**
CO5: Analyze the Principles and instrumentation of Spectroscopy methods. **[Familiarity]**

 COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		H			M	M	L						H			L
CO2	H	M	M				L					L				L
CO3		H	M	M	L									H		L
CO4	M	H		L	M										H	L
CO5		M	H		L	M						L				L
16AOEX02	L	H	L	L	L	L	L					L	L	L	L	L

L-Low, M-Moderate(Medium), H-High

16AOEX03   **ELECTROCHEMICAL TECHNOLOGY**   **CATEGORY: OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

∗ This course aims at making Mechanical Engineers know about Electrochemical principles applied in manufacturing of Chemical products, fabrication of metals, metallurgy and corrosion studies

UNIT – I   **(9)**

Fundamental concepts, electron transfer, mass transfer, adsorption, electro-catalysis, phase formation in electrode reaction, assessment of cell voltage, costing of electrolytic process, performance and figure of merit. Typical cell designs. Laboratory data and scale-up.

UNIT – II   **(9)**

Chlor-alkali industry-concept of brine electrolysis, chlorine cell technology, the production of NaOH. Water electrolysis, sodium chlorate, hydrogen peroxide, ozone, cuprous oxide, and synthesis of metal salt via anodic dissolution, Organic electro synthesis-dimerization of acrylonitrile, indirect electrosynthesis.

UNIT – III   **(9)**

The extraction, refining and production of metal–electro-winning, cementation, electro-refining, Electro-deposition of metal powders. Corrosion and its control-thermodynamics and kinetics of corrosion reactions, corrosion problems in practice, corrosion prevention and control, corrosion problems in electrolytic processing, corrosion measurement and monitoring.

UNIT – IV   **(9)**

Metal finishing-electroplating, electroless plating, conversion coatings, electroforming, electrochemical etching. Batteries and fuel cells-battery characteristics, battery specifications, evaluation of battery performance, battery components. Fuel cells.

UNIT – V   **(9)**

Water purification, effluent treatment and recycling of industrial process stream- metal ion removal and recovery, treatment of liquors containing dissolved chromium, electrolytic method of phase separation, flue gas desulphurization, electrodialysis. Electrochemical sensor and monitoring techniques, polarographic to anodic stripping voltammetry, ion selective electrode, electrochemical biosensors.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Derek Pletcher and Frank C Walsh, "Industrial Electrochemistry", 2nd edition, Chapman & Hall, UK, 1990.
2. A.T.Kuhn, "Industrial Electrochemistry", Elsevier Publishers, 1972.

Reference books:
1. C.L. Mantell, "Chemical Engineering Series – Industrial Electrochemistry", McGraw Hill Co., Inc. London, 1958
2. Ullmann's "Encyclopedia of Industrial Chemistry", John Wiley & Sons, Vol.6, pp: 399 - 481, 2003.
3. Krik–"Othmer Encyclopedia of Chemical Technology", 4th edition, Vol: I., Pp938 –1025 (1991)
4. N.M.Proutand J.S.Moorhouse, "Modern Chlo-Alkali Technology", Vol. IV, Elsevier Applied Science, London, 1990

COURSE OUTCOMES:

Students after the completion of this course:

CO1: Students will be able to understand the electrodic processes and design cell requirements

CO2: Students can apply the electrolysis principle in manufacture of materials required for regular use.

CO3: Students will be able to apply their technical skill in metallurgy.

CO4: Students will be able to acquire knowledge in all metal finishing techniques.

CO5: Students will gain knowledge in solving the problems of corrosion of equipment and battery systems.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1													H			L
CO2														M		L
CO3														M		L
CO4													M	L		L
CO5														M	L	L
16AOEX03													L	L	L	L

L-Low, M-Moderate(Medium), H-High

16AOEX04   **POLYMER TECHNOLOGY**   **CATEGORY: OE**
                     (Common to All Branches)
                                                              L   T   P   C
PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVE:

∗ This course is aimed to make Mechanical Engineers apply their skills in identifying the types of polymers and their properties applicable to plastics and rubber processing

UNIT – I   CHEMISTRY OF HIGH POLYMERS   **(9)**
Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, polymerization methods: addition and condensation; metallocene polymers and other newer techniques of polymerization, copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension and emulsion.

UNIT – II   SYNTHESIS AND PROPERTIES   **(9)**
Commodity and general purpose thermoplastics: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers. Engineering Plastics: Nylon, PC, ABS, Fluoropolymers - Thermosetting polymers: PF, MF, UF, Epoxy, Unsaturated polyester. Natural and synthetic rubbers: Recovery of NR hydrocarbon from latex, SBR, Nitrile, CR, CSM, EPDM, IIR, BR, Silicone, TPE.

UNIT – III   POLYMER TECHNOLOGY   **(9)**
Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, cross-linking and vulcanization. Compression molding, transfer molding, injection molding, blow molding, reaction, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

UNIT – IV   POLYMER BLENDS AND COMPOSITES   **(9)**
Difference between blends and composites, their significance, choice of polymers for blending, blend miscibility-miscible and immiscible blends, FRP, particulate, long and short fibre reinforced composites.

UNIT – V   POLYMER TESTING   **(9)**
Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Reference Books:
1. F.W. Billmeyer, Jr., "Textbook of polymer science", Wiley - Interscience, N.Y.(1971)
2. G.Odian , "Principles of polymerization", , Wiley – Interscience (1981)
3. Gowarikar V.R. and others , "Polymer science", Wiley Eastern (1986).
4. Fenner R.T., "Principles of polymer processing", Chemical publishing N.Y. (1979)

COURSE OUTCOMES:

Students after the completion of this course:

CO1: Will be able to identify different types of polymers by structure and behaviour, properties and their method of polymerisation.

CO2: Will be able to apply various processes of fabrication of plastics and rubber.

**CO3:** Will be able to distinguish polymer blends and composites and understand their specific applications.

CO4: Will be able to test the polymer specimens for mechanical properties applicable for various end uses.

CO5: Will be able to test the polymer specimens for electrical properties applicable for various end uses.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1													M			L
CO2													H	L		L
CO3														M		L
CO4														M	L	L
CO5														H		L
16AOEX04													L	M	L	L

L-Low, M-Moderate(Medium), H-High
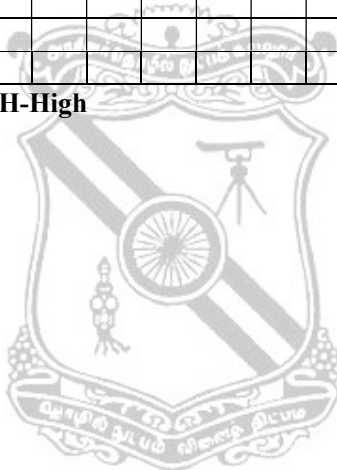
16COEX05   **DISASTER MANAGEMENT AND MITIGATION**   **CATEGORY: OE**
(Common to All Branches)

```
L  T  P  C
3  0  0  3
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PREREQUISITES: Nil

COURSE OBJECTIVE:

* To give knowledge about basics of Disaster Management.
* To impart knowledge about Hazards and Vulnerability.
* To give knowledge about mitigation and preparedness.
* To teach about Response and Recovery.
* To impart knowledge about the participants involved in the disaster management activity.

UNIT - I INTRODUCTION (08)
Disaster throughout history, History of disaster management, Capacity by demand, UN International strategy for disaster reduction, the Hyogo framework for action, Post 2015 framework, Disaster trends.

UNIT – II HAZARDS AND RISK VULNERABILITY (10)
Hazard Identification and Hazard Profiling, hazard analysis, Types of hazards- Natural and technological Components of Risk- likelihood and Consequence, Trends and Computation of likelihood and Consequence. Risk Evaluation – purpose, Risk Acceptability, Alternatives, Personnel. Political / social, Economic. Vulnerability - Physical Profile, Social Profile, Environmental Profile, Economic Profile. Factors Influencing Vulnerability, risk Perception.

UNIT - III MITIGATION AND PREPAREDNESS (08)
Mitigation - types of mitigation, Obstacles in mitigation, Assessment and selection of Mitigation options, Emergency response capacity as Incorporating Mitigation into development and relief projects Preparedness - Government Preparedness, Public Preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT - IV RESPONSE AND RECOVERY (09)
Response the Emergency- Pre disaster, post disaster, Provision of water, food and shelter, volunteer management, command, control and coordination
Recovery - short term and long term recovery. Components of recovery - planning, coordination, information, money and supplies, allocation of relief funds, personnel. Types of recovery - Government, Infrastructure, Debris removal disposal and processing, environment, housing, economic and livelihood, individual, family and social recovery- special considerations in recovery.

UNIT – V PARTICIPANTS (10)
Governmental Disaster management agencies - Fire, law, emergency management, Emergency medical service, Military and other resources. Structures - local, regional, national. Bilateral assistance and its types. Types of national agencies involved in international disaster management. Political implications of bilateral assistance.
Non Governmental Organizations – operations, NGO/ Military coordination, standard of conduct. The role of Private sector and academia.
Multilateral organizations - UN agencies and progammes, Regional & Inernational organizations. International Financial Institutions- the world bank, IMF, ADB, IADB. Special considerations.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Book:

1. Damon P. Coppola, **"Introduction to International Disaster management"**, Elsevier publication, 2015.

Reference Books:

1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., "Natural Disaster Management in the Asia-Pacific", Policy and Governance.
2. "Disaster Management", Global Challenges and Local Solutions, Universities Press, 2009.
3. Jack Pinkowski, "Disaster Management Handbook", CRC Press,January 22, 2008.
4. Disaster Management Guidelines, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

COURSE OUTCOMES:
- **CO1:** Able to get knowledge about basics of Disaster management.
- **CO2:** Able to impact knowledge about Hazards and vulnerability
- **CO3:** Able to know about Mitigation and preparedness.
- **CO4:** Able to attain knowledge about response and recovery.
- **CO5:** Able to learn about the participants involved in the disaster management activity.

COURSE ARTICULATION MATRIX:

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		L			L	L		L								L
CO2	L	H		M	L	M						L	L			L
CO3	L	L			H	M						L	L			L
CO4	L	M		L	L	M	M									L
CO5		M		L	L	M										L
16COEX05	L	M		L	L	M	L					L	L			L

L-Low, M-Moderate(Medium), H-High

16COEX06 **ENVIRONMENTAL MANAGEMENT** **CATEGORY: OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES:
16SHS2Z4-Environmental Science And Engineering

COURSE OBJECTIVES:
∗ To understand the importance of nature and study about the water, air and soil pollution control as well as solid waste management.

UNIT – I   NATURE AND SCOPE OF ENVIRONMENTAL PROBLEMS   (9)
Environment and sustainable development – Natural and human environmental disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol – India's efforts for Environmental protection – Public policy and role of NGO's.

UNIT – II   WATER POLLUTION AND CONTROL   (9)
Fresh water and its pollution – Natural processes – sources and pollutants – pollution due to industrial, agricultural and municipal wastes – effects on streams - limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management – Marine environment and its management – Water acts.

UNIT – III   AIR AND NOISE POLLUTION   (9)
Pollutant emissions - sources and sink – effects of air pollution on human health, vegetation and climate– Global effects – prevention and control of air pollution – Control of particulates – Air pollution surveys and sampling – Air quality monitoring - Air Act – Management of air pollution – Sound level – Effect of noise on people – Environmental noise control- noise pollution rules, 2000.

UNIT – IV   SOLID WASTE MANAGEMENT AND SOIL POLLUTION   (9)
Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques – Onsite Handling, storage and processing – sanitary landfill – Incineration and pyrolysis – Composting – aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes – Definition – Sources & types only – Integrated system for waste management – The Basel convention Land use and degradation – Management problems – strategies for sustainable land management – soil pollution –wetland conservation.

UNIT – V   ENVIRONMENTAL MANAGEMENT SYSTEM   (9)
Terminology – installation and common motives of EMS – Environmental standards – ISO 14000 (Series) – basic principles – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices for Waste Minimisation and Cleaner Production.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books

1. N.K.Uberoi, "Environmental Management", Excel Books, New Delhi (2006).
2. Rao, "Air Pollution", Tata McGraw-Hill Education, 01-Jun-1988.

Reference Books:

1. S.Vigneahwaran,M.Sundaravadivel and D.S.Chaudhary , "Environmental Management", SCITECH. Publications (India) Pvt.Ltd, Chennai & Hyderabad (2004).
2. Technobanoglous, "Environmental Management", McGraw Hill Book Company (2006).

COURSE OUTCOMES:
    CO1: Students exposed to know common issues related with environment.
    CO2: Students able to know the sources, causes and effects of water pollution.
    CO3: Able to attain knowledge related with air and noise pollution.
    CO4: Able to understand the various management techniques of solid waste and soil Pollution.
    CO5: Able to acquire knowledge on Environmental Management Systems.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	L					M						L	H		L
CO2	L	M		L			H					L	H	H	L	L
CO3	L	M		L			H					L	H	H	L	L
CO4	L	M		L			H					L	H	H	L	L
CO5	M	L					M						L	H	L	L
16COEX06	L	M		L			H					L	M	H	L	L

L-Low, M-Moderate(Medium), H-High

16COEX07   **TOWN PLANNING AND ARCHITECTURE**   **CATEGORY: OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:
∗ Students are introduced the basics of Town Planning and Architecture

UNIT – I   TOWN PLANNING   (9)
History of evolution of towns - Town and environment – Planning acts – land use classification – Transportation network - Climate, humidity, wind and radiation - Surveys and Data collection - Residential neighborhoods - Industrial areas - Public Buildings - Housing and Slum clearance.

UNIT – II   BUILDING RULES AND GUIDELINES   (9)
General – Zoning regulations – Regulations regarding layouts or subdivisions – Building regulations – Rules for special types of buildings – Floor space index – minimum plot size and building front age – Open spaces – Minimum standard dimensions of building elements – Provision for lighting and ventilation – Provision for means of access – Provision for urban growth.

UNIT – III   BASIC ELEMENTS OF ARCHITECTURE   (9)
Introduction of Architecture – Definition – Mass and space visual emotional effects of geometric forms and their derivatives– The sphere, the cube, the pyramid, the cylinder and cone – The aesthetic qualities of Architecture – Proportion, scale, balance, symmetry, rhythm and axis – contrast in form – Harmony – Consideration of comfort factors acoustics, lighting, ventilation and thermal aspects.

UNIT – IV PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS   (9)
General – factors affecting orientation – sun – Wind – Rain – Orientation criteria for Indian conditions – Principles governing the theory of Planning – General requirements of site and building – Functional planning of buildings.

UNIT – V   ELEMENTS OF INTERIOR DESIGN   (9)
General – Decorative Materials – Cement Bonded Board (BISON PANEL), Water proof cement paint, Industrial glazing and Roofing, unit masonry, plaster and dry wall, Wall surface materials, Effect of colour on architecture – Home furnishing– plans in rooms.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. S.C.Rangwala, **"Elements of Town Planning",** McGraw Hill, London, 2006.
2. Biswas Hiranmay, **"Principles of Town Planning and Architecture",** VAYU Education of India, 2012.

Reference Books:

1. V.S.Pramar, **"Design fundamentals and architecture"** Lakshmi Publishers, 2003.
2. Hiraskar, **"Fundamentals in town planning"** Khanna Publishers, 2005.

COURSE OUTCOMES:

      CO1: Students will be able to know about the basics of town planning and building rules.

      CO2: Students will be able to gain knowledge on building rules & regulations.

      CO3: Students able to apply the architectural principles in the area of Civil Engineering.
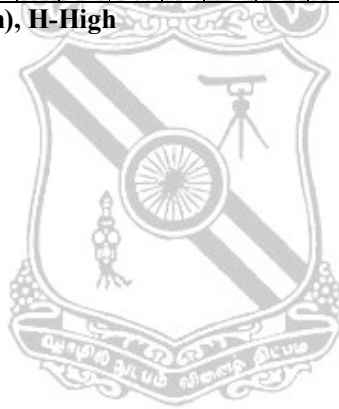
      CO4: Students will be able to do planning of various buildings.

      CO5: Students will be able to understand about interior design of buildings.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1				M								L		L		L
CO2							M				L	L				L
CO3		L		L						M			L			L
CO4		L		L						M						L
CO5		M							L			H				L
16COEX07		L		L			L	L		L	L	L	L	L		L

L-Low, M-Moderate(Medium), H-High

16MOEX08   TOTAL QUALITY MANAGEMENT FOR ENGINEERS   CATEGORY: OE
(Common to All Branches Except Production)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

  *To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards.

UNIT - I QUALITY CONCEPTS   **(9)**
Definition of quality, dimensions of quality, quality planning, quality costs concepts - basic concepts of total quality management, principles of TQM, leadership concepts - quality council, quality statements, strategic planning- steps in strategic planning- Deming philosophy, barriers in TQM implementation, benefits of TQM.

UNIT - II TQM PRINCIPLES   **(9)**
Contribution of TQM Gurus - customer perception of quality - retention, employee involvement - motivation, empowerment, performance appraisal, continuous process improvement – Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnership - supplier rating – performance measures- Malcom Balridge National Quality Award.

UNIT - III STATISTICAL PROCESS CONTROL   **(9)**
Seven old and new tools of quality - statistical fundamentals - population and sample – normal curve - control charts for variables ,attributes and its applications- process capability - concept of six sigma.

UNIT - IV TOOLS AND TECHNIQUES   **(9)**
Benchmarking needs and benefits - benchmarking process - quality function deployment (QFD) - house of quality - Taguchi quality loss function - total productive maintenance (TPM) - pillars of TPM - Failure Mode Effective Analysis (FMEA) - Failure rate- types of FMEA - stages of FMEA-case studies.

UNIT - V QUALITY SYSTEMS   **(9)**
Introduction to ISO 9000 and other quality system - ISO 9001:2015 quality system – elements - implementation of quality system - documentation - quality auditing - QS 9000, ISO 14000 - concept, requirements and benefits- integrating ISO 14000 with ISO 9000 – OSHSAS 18001, Implementation of TQM in manufacturing industry.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, 2008.
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, 2008.
3.Vilas S.Bagad, "Total Quality Management", TECHNICAL PUBLICATIONS, 2017.

Reference Books:
1. James R.Evans & William M.Lidsay, **"The Management and Control of Quality",** Thomson Learning, 2002.
2. Feigenbaum.A.V. **"Total Quality Management",** McGraw-Hill, 1991.
3. Zeiri**, "Total Quality Management for Engineers"** Wood Head Publishers, 1991
4. P.N.Mukherjee **"Total Quality Management",** PHI Publishers, 2006
5. John.L Hradesky **"Total Quality Management Hand book"** McGraw-Hill, 1995.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: apply the principle of strategic planning, Deming philosophy and leadership concepts in industries.

CO2: apply the principle of TQM in industries.

CO3: apply the principle of statistical process control in industries.

CO4: select appropriate quality tools to meet industrial requirements.

CO5: implement appropriate quality standards for industries.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	L	H			M			L	L		L	L	M	L	M	L
CO2	L	H			M			L	L		L	L	M	L	M	L
CO3	L	H			M			L	L		L	L	M	L	M	L
CO4	L	H			M			L	L		L	L	M	L	M	L
CO5	L	H			M		L	L	L		L	L	M	L	M	L
16MOEX08	L	H			M		L	L	L		L	L	M	L	M	L

L-Low, M-Moderate(Medium), H-High

16MOEX09   **COMPOSITE MATERIALS**   **CATEGORY: OE**
(Common to all Branches)

PREREQUISITES:
  16SBS2Z3 - Material Science

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
* To impart the fundamentals of composite materials with different reinforcement, matrix materials and comprehend the types of manufacturing methods for advance composite materials to meet various engineering requirements.

UNIT – I INTRODUCTION TO COMPOSITE MATERIALS   **(9)**
Types and characteristics of composite materials - Mechanical behavior - Basic terminology and Manufacture of laminated fiber - Reinforced composite materials - Current and potential advantages - Applications of composite materials.

UNIT - II REINFORCEMENT AND MATRICES   **(9)**
Different types of fibers - Properties and applications of fibers - Roll of matrix - Matrix materials, Selection of matrix -Thermoset matrix -Thermoplastic matrix, Fiber architecture – Natural Fibers.

UNIT – III DESIGN OF COMPOSITE STRUCTURES   **(9)**
Elements of Design - Steps in design process - Elements of analysis in design - Analysis iterations - Design analysis stages - Material selection - Configuration selection - Laminate joints - Design requirements and design failure criteria.

UNIT – IV MANUFACTURING OF ADVANCED COMPOSITES   **(9)**
Bag-Molding process-Compression molding-Pultrusion-Filament winding-Liquid composite molding processes-Resin film infusion-Elastic reservoir molding-Tube rolling-Forming methods for thermoplastic matrix composites.

UNIT - V METAL, CERAMIC AND CARBON MATRIX COMPOSITES   **(9)**
Metal matrix composites - Manufacturing processes - Ceramic matrix composites- Mechanical properties - Manufacturing processes - Carbon matrix composites - Fabrication methods - Applications.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Krishnan K., Chawla **"Composite Materials Science and Engineering",** Springer (India) Private Limited, 2011
2. P.K. Mallick , **"Fiber Reinforced Composite materials, Manufacturing and Design",** CRC Press, Taylor and Francis Group, Boca Raton, London, Newyork 2010

Reference Books:
1. A.K.Bhargava, **"Engineering Materials: Polymers, ceramics and composites",** Pentice Hall of India Limited, 2010.
2. Hyer M., Stress Analysis of Fiber – **"Reinforced Composite Materials",** Tata McGraw Hill, 1998.

3. Madhujit Mukhopadhyay, **"Mechanics of Composite Materials and Structures",** Universities Press (India) Private Limited, 2009.
4. Robert M.Jones, **"Mechanics of Composite Materials",** Taylor & Francis Group, 2010.
5. Web Portal: Composite Materials {Nptel .Mechanical Engineering}

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: understand the mechanics and behaviour of reinforced composite materials for specific applications and developing composite materials for sustainability

CO2: formulate different types of reinforcement and matrices to develop new composite material for the various application

CO3: design and manufacture post processing methods of composite structures and capable to perform various analysis

CO4: execute different methods of manufacturing advanced composites to meet the innovate demand in engineering.

CO5: fabricate metal matrix, ceramic matrix and carbon matrix composite for various engineering application to meet the societal demand.

COURSE ARTICULATION MATRIX:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H			M	M				L		H		L	
CO2	H	M	M	M	M		L				M		M	M		
CO3	M	M	M	M		L	M				L		L	M		
CO4	M	M	M	L		H	L		L		M		M	L		L
CO5	L	L		L		M	L					L	M	M		
16MOEX09	M	M	M	L	L	M	L		L		L	L	M	L	L	L

L-Low, M-Moderate(Medium), H-High

| 16MOEX10 | **AUTOMOBILE ENGINEERING** | **CATEGORY: OE** |
| | *(Common to all Branches)* | |

16MOEX10   **AUTOMOBILE ENGINEERING**   **CATEGORY: OE**

(Common to all Branches)

       L   T   P   C

PREREQUISITES: Nil   3   0   0   3

COURSE OBJECTIVES:

     ∗ The learners are able to visualize the scope of Automobile Engineering.

UNIT - I   INTRODUCTON TO AUTOMOTIVES   **(9)**

An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Quality standards, Trends in automobile design

UNIT - II   POWER SOURCE FEATURES   **(9)**

Reciprocating Engine systems, Rotary Engine systems, Gas Turbine systems, Hybrid systems - Pollutant emissions and their control; Catalytic converter systems, Electronic Engine management systems

UNIT - III TRANSMISSION, SUSPENSION AND BRAKING SYSTEMS   **(9)**

Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and Preliminaries of suspension systems

UNIT - IV AUXILIARY SYSTEMS   **(9)**

Electrical and electronic systems, safety systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, Vehicle Thermal Management System and vehicle body design features.

UNIT - V   TESTS, SERVICE AND MAINTENANCE   **(9)**

Engine Tuning, vehicle maintenance, engine and Chassis Dynamometry Pollutants and emissions Check, Wind Tunnel Tests, preliminaries of engine and vehicle testing.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Dr. Kirpal Singh, **"Automobile Engineering Vol. I & II",** Standard Distributors Publishers, 2012.
2. R.B.Gupta, **"Automobile Engineering"** Sathya Prakashan, New Delhi, 2006.

Reference Books:

1. William H.Crouse, **"Automotive Mechanics",** McGraw Hill Book Co. 2004.
2. K.K. Ramalingam, **"Automobile Engineering – theory and Practice"** SciTech Publications, 2001.
3. Joseph Heinter **"Automobile Mechanics Principles and Practice"** Affiliated East West Press, 1997.
4. Jain K.K. and Asthana. R.B, **"Automobile Engineering"** Tata McGraw Hill Publishers, New Delhi, 2002.
5. Heinz Heisler, **"Advanced Engine Technology"** SAE International Publications USA, 1998.

COURSE OUTCOMES:

On completion of this course, learners will be able to:

     CO1: Identify the different components in an automobile.

     CO2: Clearly understand different auxiliary and transmission systems.

     CO3: Explain the working of various parts like engine, transmission, clutch, brakes

     CO4: Understand the environmental implications of automobile emissions

     CO5: Develop a strong base for understanding future developments in the automobile industry

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	M	L	H	M	M	M	L	L	L	H	M	M	H	L
CO2	H	M	H	H	M	H	L	L	L	M	M	L	H	M	H	L
CO3	M	M	M	L	M	H	M	L	L	M	H	L	H	H	M	L
CO4	H	M	H	M	H	M	H	H	M	M	H	L	L	L	H	L
CO5	M	L	L	L	M	H	M		L	H	H	H	H	M	H	L
16MOEX10	M	M	M	M	H	H	M	L	L	M	M	M	M	M	H	L

L-Low, M-Moderate(Medium), H-High

16EOEX11 **RENEWABLE ENERGY SOURCES AND TECHNOLOGY**
(Common to all Branches)

CATEGORY: OE

L T P C
3 0 0 3

PREREQUISITES: Nil

COURSE OBJECTIVE:

∗ To elucidate the technologies used for generation and utilization of power from renewable energy resources.

UNIT - I SOLAR ENERGY (9)

Solar radiation, solar spectra-latitude and longitude, Declination angle, solar window, cosine law, seasonal variations, hour angle, calculation of angle of incidence, angstroms equation and constants, Photo voltaic: p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power - Types of solar thermal collectors – Flat and concentrating collectors, solar thermal applications -water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation.

UNIT - II WIND ENERGY (9)

Wind energy - Basic principle of wind energy conversion system, wind data and energy estimation, site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill- merits and limitations- application

UNIT - III BIOMASS ENERGY (9)

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - Pyrolysis, gasification, combustion and fermentation. Gasifiers – Up draft, downdraft and fluidized bed gasifier. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

UNIT - IV OCEAN AND GEOTHERMAL ENERGY (9)

Ocean energy resources - Principles of ocean thermal energy conversion systems - ocean thermal power plants - Principles of ocean wave energy conversion and tidal energy conversion - Difference between tidal and wave power generation, Economics of OTEC.

Definition and classification of Geothermal resources, Utilization for electricity generation and direct heating, Wellhead power generating units. Overview of micro and mini hydel power generation.

UNIT - V RENEWABLE ENERGY POLICIES (9)

Renewable energy policies - Feed-in tariffs, portfolio standards, policy targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Economic analysis and comparisons, Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies versus energy - Efficiency.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Rao. S. and Dr. Pamlekar B.B, **"Energy Technology",** Khanna Publishers, Second Ed. 1997.
2. Pai and Ramaprasad, **"Power Generation through Renewal sources",** Tata McGraw Hill – 1991.

Reference Books:

1. Rai, G.D., **"NonConventional sources of Energy",** Khanna Publishers, IV Ed., 2009
2. Bansal NK, Kleeman and Meliss, M **"Renewable Energy Sources and Conversion Techniques",** Tata McGraw Hill, 1996
3. Roland Wengenmayr, Thomas Buhrke, **"Renewable energy: Sustainable energy concepts for the future",** Wiley-VCH, 1st edition, 2008.

COURSE OUTCOMES:

CO1: Realize the need for utilizing the energy from clean and Sustainable energy resources.

CO2: Describe the principles of operation of the broad spectrum of renewable energy Technologies

CO3: Analyze energy technologies from a systems perspective.

CO4: Articulate the technical challenges for each of the renewable sources

CO5: Create solutions for alternate energy issues

CO6: Discuss economic, technical and sustainability issues involved in the integration of renewable energy systems

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M	M	M	M			L	L	L	H	M	M	M
CO2	H	H	M	M	M	M	M	L		L	L	L	H	H	H	M
CO3	H	M	M	M	M	M	M	M			L	L	M	H	H	M
CO4	M	H	M	L	M	H	M	M		L	L	L	H	H	H	M
CO5	M	H	H	H	M	M	M	M		L	L	L	M	H	M	M
CO6	H	M	M	M	M	M	M		H	H	L	L	M	H	M	M
16EOEX11	H	H	M	M	M	M	M	L	L	L	L	L	H	H	H	M

L-Low, M-Moderate(Medium), H-High

16EOEX12   **SMART GRID TECHNOLOGY**   CATEGORY: OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
* To gain knowledge on the fundamentals of smart grid technologies, its architecture and its managements. Also the students should learn many of the challenges facing the smart grid as part of its evolution.

UNIT - I SMARTGRIDS: MOTIVATION, STAKES AND PERSPECTIVES   (9)
Introduction – Information and Communication technologies serving the electrical system – Integration of advanced technologies – Definitions of SmartGrids – Objectives addressed by the SmartGrid concept – Socio-economic and environmental objectives – Stakeholders involved the implementation of the Smart Grid concept – Research and scientific aspects of the Smart Grid – SmartGrids from the customer's point of view.

UNIT - II INFORMATION AND COMMUNICATION TECHNOLOGY   (9)
 Data Communication, Dedicated and shared communication channels, Layered architecture and protocols, Communication technology for smart grids, standards for information Exchange, Information security for the smart grid - Cyber Security Standards - IEEE1686 - IEC62351.

UNIT - III   SENSING AND MEASUREMENT   (9)
Synchro Phasor Technology – Phasor Measurement Unit, Smart metering and demand side integration - Communication infrastructure and protocol for smart metering – Data Concentrator, Meter Data Management System. Demand side Integration – Services, Implementation and Hardware Support of DSI.

UNIT - IV CONTROL AND AUTOMATION   (9)
Distribution automation equipment – Substation automation equipments: current transformer, potential transformer, Intelligent Electronic Devices, Bay controller, Remote Terminal Unit. Distribution management systems – SCADA: modeling and analysis tools, applications

UNIT- V REGULATION OF SMARTGRIDS AND ENERGY STORAGE SYSTEMS   (9)
Regulation and Economic models – Evolution of the value chain – The emergence of a business model for smart grids – Regulation can assist in the emergence of SmartGrids – The standardization of SmartGrids - Energy Storage Technologies-Methods - Batteries, Flow Battery, Fuel Cell and Hydrogen Electrolyser, Flywheel, Super-Conducting magnetic energy storage system, Super Capacitor.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, **"Smart Grid Technologies and applications",** John Wiley Publishers Ltd., 2012.
2. Nouredine Hadjsaid, JeanClaude Sabonnadiere, **"Smart Grids",** Wiley Publishers Ltd., 2012.
3. Lars T. Berger, Krzysztof Iniewski, **"Smart Grid applications, Communications and Security",** John Wiley Publishers Ltd., 2012.

Reference Books :
1. Yang Xiao, "Communication and Networking in Smart Grids", CRC Press Taylor and Francis Group, 2012.
2. Caitlin G. Elsworth, "The Smart Grid and Electric Power Transmission", Nova Science Publishers Inc, 2010.

COURSE OUTCOMES:

CO1: Develop and demonstrate the various aspects of the smart grid, including Technologies, Components, Architectures, Applications

CO2: Design a smart grid and to meet the needs of a utility, including Meeting a utility's objectives, helping to adopt new technologies into the grid

CO3: Creating a framework for knowledgeable power engineers to operate the grid more effectively

CO4: Transfer the available information from any part of the power system to centralized control centre.

CO5: Handle the smart meter, sensors and intelligent devices to measure the electrical quantity.

CO6: Control the Electrical quantity from remote place

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1				L	L	M	H	L	M	M	M	H	M	H	M	M
CO2	L	L	M	M	M	M	M	L	M	M	M	M	M	M	H	M
CO3				M	M	M	M	M	M	M	M	H	M	M	M	M
CO4	L			M	M	M	H		M	M	M	H	M	H	H	M
CO5	M		L	M	M	M	M		M	M	M	M	M	M	M	M
CO6	L	L	M	L	M	M	L		M	M	M	M	M	M	M	M
16EOEX12	L	L	L	M	M	M	M	L	M	M	M	H	M	M	M	M

L-Low, M-Moderate(Medium), H-High

16LOEX13   **PRINCIPLES OF COMMUNICATION**   **CATEGORY: OE**
(Common to all Branches

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
* To understand the concepts of analog communication
* To gain the fundamental knowledge of digital communication
* To be familiar with the fundamentals of satellite and optical communication
*

UNIT- I   AMPLITUDE MODULATION   **(9)**
Introduction to communication systems - Electromagnetic spectrum Principle of amplitude modulation − AM envelope − frequency spectrum and bandwidth − modulation index and percentage of modulation − AM power distribution –AM generation and-detection – square law modulator- envelope detector.

UNIT - II ANGLE MODULATION   **(9)**
Frequency modulation and phase modulation- FM and PM waveforms − phase deviation and modulation index − frequency deviation and percentage of modulation − Frequency analysis of angle modulated waves- Bandwidth requirements for Angle modulated waves – generation and detection of FM – Armstrong modulator - Foster Seely Discriminator.

UNIT - III   PULSE MODULATION   **(9)**
Sampling and Quantization – Pulse Amplitude modulation- Pulse width modulation – Pulse position modulation - Pulse code modulation - PCM transmitter and receiver - Signal to Quantization noise ratio – Differential Pulse Code Modulation − Delta modulation − Adaptive Delta modulation

UNIT - IV   DIGITAL COMMUNICATION   **(9)**
Introduction – ASK, FSK, PSK- transmitter and receiver – QPSK transmitter and receiver – M ary PSK – Error probability in PSK, FSK.

UNIT -V   SATELLITE AND OPTICAL COMMUNICATION   **(9)**
Satellite Communication Systems-Transmitter and receiver- Kepler's Law – LEO and GEO Orbits – GEO Stationary orbit-–Optical Communication Systems – Transmitter and receiver- Sources and Detectors- Types of Optical Fiber – Losses.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Wayne Tomasi, ***"Advanced Electronic Communication Systems",*** *6/e, Pearson Education, 2007.*
2. Simon Haykin, ***"Communication Systems",*** *4th Edition, John Wiley & Sons., 2008.*

Reference Books:
1. H.Taub,D L Schilling ,G Saha , ***"Principles of Communication"*** *3/e, 2007.*
2. B.P.Lathi, ***"Modern Analog And Digital Communication systems",*** *3/e, Oxford University Press, 2007.*
3. Blake, ***"Electronic Communication Systems",*** *Thomson Delmar Publications, 2002.*
4. B.Sklar, ***"Digital Communication Fundamentals and Applications"***
2/e Pearson Education, 2007.

COURSE OUTCOMES:

Upon completion of this course, the students will have the:

       CO1. Basic knowledge of amplitude modulation systems

       CO2. Basic knowledge of angle modulation systems

       CO3. Fundamental knowledge of digital communication systems

       CO4. Understanding of digital transmission techniques

       CO5. Fundamental knowledge of satellite communication system

       CO6. Fundamental knowledge of optical communication system

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	M									L	M	L	M	M
CO2	M	M	M									L	M	L	M	M
CO3	M	M	M									L	L	L	M	M
CO4	M	M	M									L	M	L	M	M
CO5	M	M	M									L	L	L	M	M
CO6	M	M	M									L	M	M	M	M
16LOEX13	M	M	M									L	M	L	M	M

L-Low, M-Moderate(Medium), H-High
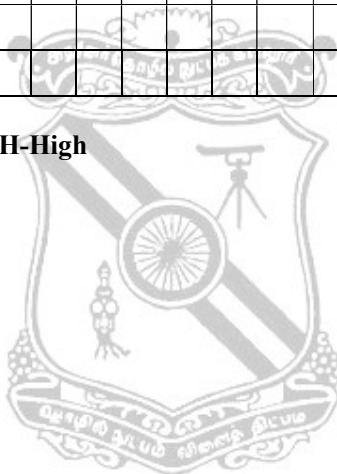
16LOEX14   MICROCONTROLLERS AND ITS APPLICATIONS   CATEGORY: OE
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

∗   To gain knowledge on basics of microcontrollers
∗   To get exposure to programming of microcontroller 8051
∗   To acquire knowledge on interfacing of peripherals with 8051 and PIC microcontrollers
∗   To get exposure on applications of microcontrollers

UNIT - I   INTRODUCTION TO MICROCONTROLLER   (9)
Microprocessors and Microcontrollers – CISC and RISC - Fundamentals of Assembly language Programming – Instruction to Assembler – C Programming for Microcontrollers – Compiler and IDE – Introduction to Embedded systems - Architecture 8051 family - PIC 18FXXX – family – Memory organization.

UNIT - II   PROGRAMMING OF 8051 MICROCONTROLLER   (9)
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication of 8051.

UNIT - III   PROGRAMMING OF PIC18FXXX MICROCONTROLLER   (9)
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT - IV   PERIPHERAL INTERFACING   (9)
Interfacing of Relays, Memory, key board, Displays – Alphanumeric and Graphic, RTC, ADC and DAC, Stepper motors and DC Motors, I^2C, SPI with 8051 and PIC family.

UNIT - V   MICROCONTROLLER APPLICATIONS   (9)
Pulse measurement-measuring frequency, pulse width measurement -Speed control of DC Motor-Speed control of Stepper Motor-Traffic Light Controller and Washing Machine Controller.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
   1.   Kenneth J.Ayala., **"The 8051 Microcontroller"**, 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.
   2. John B. Peatman, **"PIC programming"**, McGraw Hill International, USA, 2005.

Reference Books:
1. *Muhammad Ali Mazidi and Janice GillispicMazdi, **"The 8051 Microcontroller and Embedded Systems"** Pearson Education, Inc 2006.*
2. *John B. Peatman, **"Design with Micro controllers"**, McGraw Hill International, USA, 2005.*
3. *James W. Stewart, **"The 8051 Micro controller hardware, software and interfacing"**, regents Prentice Hall, 2003.*
4. *David Calcutt, Fred Cowan, Hassan Parchizadeh, **"8051 Microcontroller An Application Based Introduction"**, Elsevier Publication, 1st edition, 2004.*
5. *Krishna Kant, **"Microprocessor and Microcontrollers"** Eastern company edition, Prentice Hall of India, New Delhi, 2007.*

COURSE OUTCOMES:

Upon completion of this course the student will:

  CO 1: Acquire knowledge on the basics of microcontroller

  CO 2: Exposure to 8051 microcontroller Programming

  CO 3: Exposure to PIC microcontroller Programming

  CO 4: Able to interface peripherals with microcontrollers

  CO 5: Get exposure to the applications of microcontrollers

  CO 6: Able to design microcontroller based systems

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	M									L	L	L	M	M
CO2	M	H	M									M	M	M	M	M
CO3	M	H	M									M	M	M	M	M
CO4	M	H	M									M	M	M	M	M
CO5	M	H	M									M	M	M	M	M
CO6	H	H	H									M	H	H	M	M
16LOEX14	M	H	M									M	M	M	M	M

L-Low, M-Moderate(Medium), H-High

16NOEX15   **INDUSTRIAL AUTOMATION SYSTEMS**   CATEGORY: OE
                    (Common to all Branches)

	L	T	P	C

3   0   0   3

PREREQUISITES: Nil

COURSE OBJECTIVE:

* ∗ To elaborate the basic concept of automation and the components required for automation.
* ∗ To introduce the concept and programming of programmable logic controllers and distributed control system which is used for process automation.
* ∗ To outline the basic concepts of SCADA technology.

UNIT - I   INTRODUCTION TO AUTOMATION   (9)

Automation overview – requirement of automation systems – architecture of industrial automation system – power supplies and isolators –relays – switches –transducers – sensors –seal-in circuits – industrial bus systems : modbus and profibus.

UNIT - II AUTOMATION COMPONENTS   (9)

Sensors for temperature – pressure – force – displacement - speed – flow- level – humidity and pH measurement. Actuators – process control valves – power electronic drives DIAC- TRIAC – power MOSFET – IGBT. Introduction to DC and AC servo drives for motion control.

UNIT- III PROGRAMMABLE LOGIC CONTROLLERS   (9)

PLC Hardware – PLC programming – ladder diagram – sequential flow chart – PLC communication and networking – PLC selection – PLC installation – Advantages – Application of PLC to process control industries and Robotics.

UNIT - IV DISTRIBUTED CONTROL SYSTEM (DCS)   (9)

Overview of DCS – DCS hardware – DCS software configuration – DCS communication – DCS supervisory computer tasks – DCS integration with PLC and Computers.

UNIT - V SCADA   (9)

Introduction - Supervisory Control and Data Acquisition Systems (SCADA) – SCADA HMI Essentials – SCADA Components – SCADA Configuration and Software – HMI hardware and software.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. *John.W. Webb Ronald A Reis, "Programmable Logic Controllers - Principles and Applications", Prentice Hall Inc., 5th Edition, 2003.*
2. *M. P. Lukcas, "Distributed Control Systems", Van Nostrand Reinhold Co., 1986.*

Reference Books:
1. *Bela G Liptak, "Process software and digital networks – Volume 3", 4th Edition, CRC press,2012.*
2. *Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw Hill, 2016.*
3. *Huges T, "Programmable Logic Controllers", ISA press, 1994.*
4. *Romily Bowden, "HART application guide and the OSI communication foundation", 1999.*
5. *Krishna Kant, "Computer Based Industrial Control" Second edition, Prentice Hall of India, New Delhi, 2010.*

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1: Elaborate the basic architecture of automation systems

CO2: Describe the various sensors and actuators involved in industrial automation

CO3: Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications

CO4: Illustrate the functionary components and supervisory control of DCS with relevant Diagrams .

CO5: Describe the basics of SCADA technology

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L	L
CO2	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L	L
CO3	H	H	M	M	L	L	M	H	L	M	L	L	H	L	L	L
CO4	H	H	H	H	L	L	L	H	L	M	L	L	H	L	L	L
CO5	H	H	M	M	M	L	L	H	L	M	L	L	H	L	L	L
16NOEX15	H	H	M	M	L	L	L	H	L	M	L	L	H	L	L	L

L-Low, M-Moderate(Medium), H-High

16NOEX16 **MEASUREMENTS AND INSTRUMENTATION** **CATEGORY: OE**
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
* To study about the electrical parameter measuring instruments.
* To familiarize about the measurement techniques for power and energy.
* To gain knowledge about potentiometer and instrument transformers.
* To learn about the working of different analog and digital instruments.
* To study about display and recording devices.

UNIT - I MEASUREMENT OF ELECTRICAL PARAMETERS (9)
Types of ammeters and voltmeters: PMMC Instruments, Moving Iron Instruments, Dynamometer type Instruments – Resistance measurement: Wheatstone bridge, Kelvin double bridge and Direct deflection methods. Measurement of Inductance: Maxwell-Wien Bridge, Hay's bridge and Anderson Bridge - Measurement of Capacitance: Schering Bridge.

UNIT - II POWER AND ENERGY MEASUREMENTS (9)
Electro-dynamic type wattmeter: Theory and its errors – LPF wattmeter – Phantom loading – Single phase Induction type energy meter – 3 phase induction energy meter and phase measurement– Calibration of wattmeter and Energy meters – Synchroscope.

UNIT - III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS (9)
D.C. Potentiometers: Student type potentiometer, Precision potentiometer – A.C. Potentiometers: Polar and Coordinate types – Applications – Instrument Transformer: Construction and theory of Current Transformers and Potential Transformers.

UNIT - IV ANALOG AND DIGITAL INSTRUMENTS (9)
Wave analyzers – Signal and function generators – Distortion factor meter – Q meter – Digital voltmeter and multi-meter – Microprocessor based DMM with auto ranging and self diagnostic features – Frequency measurement.

UNIT - V DISPLAY AND RECORDING DEVICES (9)
Cathode ray oscilloscope: Classification, Sampling and storage scopes – LED, LCD and dot matrix displays – X-Y recorders – Magnetic tape recorders –Digital Data Recording –Digital memory waveform recorder – Data loggers.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Kalsi. H.S, "Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2010
2. Sawhney.A.K, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co., New Delhi, 2010

Reference Books:
1. Northrop. R.B, "Introduction to Instrumentation and Measurements", Taylor & Francis, New Delhi, 2008.
2. Carr.J.J, "Elements of Electronic Instrumentation and Measurement", Pearson Education India, New Delhi, 2011.
3. David A.Bell, "Electronic Instrumentation and Measurements", PHI, New Delhi.
4. Copper. W.D and Hlefrick.. A.D, "Modern Electronic Instrumentation and Measurement Technique" 5th Edition, Prentice Hall of India, 2002.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1: Compare the working principles, merits and demerits of different types of
electrical Instruments and can understand about different instruments that are used
for Measurement purpose.

CO2: Understand how different bridge networks are constructed and balanced for
finding the values of resistance, capacitance and inductance.

CO3: Apply knowledge of electronic instrumentation for measurement of electrical
quantities.

CO4: Apply the principles and practices for instrument design and development to real
world problems.

CO5: Select a suitable measuring instrument for a given application.

CO6: Pursue higher studies and do research activities in the field of measurement and
instrumentation.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H	M
CO2	H	M	M	M	H	H	H	M	H	L	H	H	H	H	M	M
CO3	H	H	M	H	M	H	M	L	H	M	H	H	H	H	H	M
CO4	H	H	M	H	M	H	M	L	H	M	H	H	H	M	H	M
CO5	H	H	M	H	M	H	M	L	H	M	H	H	H	M	M	M
CO6	H	H	M	H	M	H	M	L	H	M	H	H	M	H	M	M
16NOEX16	H	H	M	H	M	H	M	L	H	M	H	H	H	H	H	M

L-Low, M-Moderate(Medium), H-High

16SOEX17   **ENTERPRISE JAVA**
(Common to All Branches)   **CATEGORY: OE**

PREREQUISITES: Nil   L   T   P   C

                                                            3   0   0   3

COURSE OBJECTIVE:

Upon completion of this course, the students will be familiar with:

* Basic programming constructs in java to develop simple object oriented programs
* Enterprise Architecture types and features of Java EE platform
* JEE foundation concepts like Enterprise java bean,JSP and JSF
* Distributed Programs and methods to connect with database.
* Java Web services

UNIT – I   INTRODUCTION TO JAVA   (9)

Introduction to object oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling – Networking –Applet class – Event Handling.

UNIT – II   INTRODUCTION TO ENTERPRISE JAVA   (9)

Challenges of Enterprise application Development - Platform for enterprise Solutions – J2EE Application Scenario - J2EE Platform Technologies –J2EE Multi-Tier Architecture - J2EE Architecture Approaches - Model-View-Controller Architecture - J2EE Design Patterns - Designing the Sample Application - Choosing Application Tiers - Choosing Local or Distributed Architecture - Architecture of the Sample Application.

UNIT – III   ENTERPRISE JAVA FOUNDATION   (9)

Enterprise Java Beans -Business Logic and Business Objects. - Enterprise Beans as J2EE Business Objects - Entity Beans - Session Beans - Message-Driven Beans -Transaction support in EJB-Security support in EJB –Java Server Pages - Directive Elements - Scripting Elements - Action Elements-Expression Language-JSP Standard Tag Library - Java Server Page Online Store – JavaServer Faces - Life Cycle - Resource Management.

UNIT – IV   INTERCONNECTIVITY   (9)

Concept of JDBC – JDBC Driver types- Database Connection – Associating JDBC Bridge with the database – Statement Objects –Result set – Transaction Processing – RMI- Network File-Locking Server -Java Mail API and Java Activation Framework – send ,receive, retrieve and delete email message - Java Message Service – JMS Fundamentals –Components of a JMS program -JMS architecture –JMS-Based Alarm System - JNDI – Naming and Directories – Naming Operations.

UNIT – V   WEB SERVICES   (9)

SOAP Basics – Java API for XML Messaging – Creating a SOAP Attachment – Accessing a SOAP Attachment – Universal Description, Discovery and Integration (UDDI)- UDDI Architecture – UDDI Application Programming Interface – Inquiry Application Programming Interface – Publishing Application Programming Interface –JAXR – JAXR client – Publishing a service to an XML Registry – Removing a published service from an XML Registry- WSDL – Inside WSDL- WSDL and SOAP - RESTFul Web services – REST Approach - Java API for RESTful Web service.

CONTACT PERIODS:

Lecture: 45 Periods   **Tutorial: 0 Periods**   **Practical: 0 Periods**   **Total: 45 Periods**

Text Books:
1. Herbert Schildt "Java The Complete Reference" Tata McGraw- Hill Edition. 2014.
2. Stephen Asbury and Scott R. Weiner "Developing Java Enterprise Applications" second edition Wiley Publishing.1999.
3. Antonio Goncalves "Beginning Java™ EE 6 Platform with GlassFish™ 3From Novice to Professional" Apress 2009.
4. Jim Keogh "The Complete Reference J2EE" Tata McGraw –Hill 2002.

Reference Books:

1. John Brock,Arun Gupta,GeertjanWielenga "Java Server Programming Java EE 7 (J2EE 1.7) - Black Book" McGraw Hill, 2015.
2. Inderjeet Singh, Beth Stearns, Mark Johnson, and the Enterprise Team "Designing Enterprise Applications with the J2EETM Platform", Second EditionAddison Wesley, 2002.

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

CO1 : Write simple java programs using fundamental concepts of java like control structures, inheritance, packages,interfaces, multithreaded programming and exception. **[Usage]**

CO2 : Write java program for Networking using applets.**[Usage]**

CO3 : Describe and use the client/server and distributed architectures in a programming environment.**[Usage]**

CO4 : Use EJB, JSP and JFC technology in developing enterprise applications**[Usage]**

CO5 : Apply Java interconnectivity techniques like JDBC, RMI, Java Mail, JMS and JNDI in developing enterprise applications.**[Usage]**

CO6 : Explain the roles XML, JAXR, SOAP, WSDL and UDDI in the architecture of Web services**[Familiarity]**

CO7 : Develop applications using RESTful web services **[Assessment].**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	H	L	H		L					M	L	H	L	H
CO2	H	M	H	M	H		L					M	M	H	L	H
CO3	H	L	H	L	H		L					M	L	H	H	H
CO4	M	L	M	L	H		L					M	M	H	H	H
CO5	H	L	H	L	H		M					M	L	H	H	H
CO6	M	L	M	L	H		L					L	M	H	H	H
CO7	H	L	H	L	H		M					M	M	H	H	H
16SOEX17	H	L	H	L	H		L					M	M	H	H	H

L-Low, M-Moderate(Medium), H-High

16SOEX18　　　　　　　**CYBER SECURITY**　　　　　**CATEGORY: OE**
(Common to All Branches)

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with:
* Cybercrime and cyber offenses.
* Cybercrime using mobile devices.
* Tools and methods used in cybercrime.
* Legal perspectives of cybercrime.
* Fundamentals of computer forensics.

UNIT – I   INTRODUCTION TO CYBERCRIME AND CYBEROFFENSES　　　　(9)
Cybercrime and Information Security - Classifications of Cybercrimes - The Legal Perspectives - Cybercrime and the Indian ITA 2000 - A Global Perspective on Cybercrimes - Plan of Attacks - Social Engineering – Cyberstalking - Cybercafe and Cybercrimes – Botnets - Attack Vector.

UNIT – II   CYBERCRIME: MOBILE AND WIRELESS DEVICES　　　　(9)
Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Frauds in Mobile and Wireless Computing Era – Security challenges posed by mobile devices – registry setting for mobile devices – authentication service security – attacks on mobile/cell phones – Organizational measures for handling mobiles.

UNIT – III   TOOLS AND METHODS USED IN CYBERCRIME　　　　(9)
Proxy Servers and Anonymizers – Phishing - Password Cracking – Keyloggers – Spywares -Virus and Worms - Trojan Horses and Backdoors – Steganography - DoS and DDoS Attacks - SQL Injection - Attacks on Wireless Networks.

UNIT – IV   CYBERCRIMES AND CYBERSECURITY: THE LEGAL PERSPECTIVES　(9)
Cyberlaws- The Indian Context - The Indian IT Act - Challenges to Indian Law and Cybercrime Scenario in India - Consequences of Not Addressing the Weakness in Information Technology Act - Digital Signatures and the Indian IT Act - Amendments to the Indian IT Act - Cybercrime and Punishment.

UNIT – V   UNDERSTANDING COMPUTER FORENSICS　　　　(9)
Digital Forensics - Forensics Analysis of E-Mail - Network Forensics - Forensics and Steganography - Forensics and Social Networking Sites - Challenges in Computer Forensics - Data Privacy Issues – Forensics Auditing – Antiforensics.

CONTACT PERIODS:
Lecture: 45 Periods　　　**Tutorial: 0 Periods**　　　**Practical: 0 Periods**　　　**Total: 45 Periods**

Text Books:

1. *Nina Godbole and Sunit Belapur* **"Cyber Security Understanding Cyber Crimes, Compute Forensics and Legal Perspectives"** *Wiley India Publications, April, 2011*

　Reference Books:
　　1. *Robert Jones,* **"Internet Forensics: Using Digital Evidence to Solve Computer Crime",** *O'Reilly Media, October, 2005.*
　　2. *Chad Steel,* **"Windows Forensics: The field guide for conducting corporate computer investigations",** *Wiley India Publications, December, 2006.*

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

CO1: Explain the fundamental concepts of cybercrime and cyberoffenses. **[Familiarity]**
CO2: Describe the cybercrimes occurred in mobile and wireless devices. **[Familiarity]**
CO3: Elaborate the methods used in cybercrime. **[Familiarity]**
CO4: Explain the laws for cybercrime and its respective punishments. **[Familiarity]**
CO5: Explain the forensics Analysis of E-Mail, Network and Social Networking Sites **[Familiarity]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	M	M	L	H	L	M				H	H	L	M	M
CO2	M	M	M	M	M	H	M	M				M	H	H	M	M
CO3	H	L	L	L	L	H	H	L				H	H	H	L	L
CO4	H	M	M	M	M	H	H	H				M	H	H	L	L
CO5	H	M	M	M	M	L	H	L				H	H	H	M	M
16SOEX18	H	M	M	M	M	H	H	M				H	H	H	M	M

L-Low, M-Moderate(Medium), H-High

16SOEX19   **NETWORK ESSENTIALS**   **CATEGORY: OE**
                                  (Common to All Branches)

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Basic taxonomy and terminology of the computer networking
* Wireless networking
* Addressing and Routing
* Routing protocols
* Troubleshooting and security issues.

UNIT – I   INTRODUCTION   (9)
Introduction to Computer Networks - Goals and advantages of Computer Networks - Network Topologies – Basic networking devices – Protocols – the need for a layered architecture - The OSI Model and the TCP/IP reference model – the Ethernet LAN – Home Networking – Assembling an office LAN – Testing and Troubleshooting a LAN – Physical layer cabling: Twisted pair and Fiber optics.

UNIT – II   WIRELESS NETWORKING   (9)
Importance of Wireless Networking – IEEE 802.11 Wireless LANs – Bluetooth- WIMAX – RFIDs – Securing the Wireless LANs – Configuring a Point to Multipoint Wireless LAN – Interconnecting network LANs – Switch, Bridges and Routers. Interconnecting LANs with the router, Configuring the network interface-Auto negotiation.

UNIT – III   ADDRESSING AND ROUTING FUNDAMENTALS   (9)
IPv4 and IPv6 addressing – Subnet masks – CIDR blocks – configuration of a router – Console port connection - user EXEC mode – Privileged EXEC mode - Configuration of a switch – Static VLAN configuration - Spanning Tree protocol – Network Management – Power over Ethernet.

UNIT – IV   ROUTING PROTOCOLS   (9)
Static Vs Dynamic Routing Protocols – Distance vector Routing – Link State Routing – Hybrid Routing – Configuring RIP - Network Services – DHCP, DNS - Analyzing Internet Traffic.

UNIT – V   TROUBLESHOOTING AND NETWORK SECURITY   (9)
Analyzing Computer Networks – FTP data packets – Analyzing Campus Network data traffic – Troubleshooting the router and switch interface, Troubleshooting fiber optics – Intrusion – DOS – Security software and hardware.

CONTACT PERIODS:

Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. Jeffrey S.Beasley Piyasat Nilkaew *"Network Essentials"* 3rd Edition, Pearson, 2012.
2. Larry L. Peterson and Bruce S. Davie *"Computer Networks, A Systems Approach"* Morgan Kaufmann Publishers Inc, 5th edition 2011.

Reference Books:
1. Behrouz A.Ferouzan, *"Data Communications and Networking",* 5th edition, Tata McGraw-Hill, 2012.
2. Andrew S. Tanenbaum, *"Computer networks"* PHI, 5th edition 2011.

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

       CO1: Identify topologies and types of Computer Networks **[Familiarity]**

       CO2: Enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer   **[Familiarity]**

       CO3: Identify and Compare types of cabling for data communication **[Usage]**

       CO4: Explain the significance of wireless networks **[Familiarity]**

       CO5: Configure a Wireless LAN **[Assessment]**

       CO6: Configure router and a switch **[Assessment]**

       CO7: Describe basic routing algorithms and network services. **[Usage]**

       CO8: Troubleshoot the router and switch interface **[Usage]**

       CO9: Analyze Campus Network data traffic **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	H	H	H	L	L	H	H	H	H	H	M	H	H	M
CO2	H	H	H	H	H	L	L	H	H	H	H	H	M	H	H	M
CO3	L	L	L	L	H	L	L	H	L	L	L	H	M	H	H	M
CO4	L	H	M	M	H	L	L	H	H	M	L	H	L	H	H	L
CO5	H	H	H	M	H	L	L	H	H	H	M	H	M	H	H	M
CO6	H	H	H	M	H	L	L	H	H	M	L	H	M	H	H	M
CO7	H	H	H	H	H	L	L	H	H	H	M	H	M	H	H	M
CO8	H	H	H	H	H	L	L	H	H	M	L	H	M	H	H	M
CO9	H	H	H	H	H	L	L	H	H	H	M	H	M	H	H	M
16SOEX19	M	H	H	M	H	L	L	H	H	L	M	H	M	H	H	M

L-Low, M-Moderate(Medium), H-High

16IOEX20   **PROGRAMMING IN PYTHON**   **CATEGORY: OE**
                               (Common to all Branches)

                                                                      L   T   P   C
                                                                      3   0   0   3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course the students will be Familiar with:
*   ∗ Data types and variables declaration.
*   ∗ Control statements and Functions.
*   ∗ Operations on List and dictionary.
*   ∗ Files and Exception handling.
*   ∗ Object oriented programming and GUI development.
*   ∗

UNIT - I INTRODUCTION   **(9)**
Introduction to Python - Setting up Python in OS – Python IDLE(write- edit- run- and save programs) – Strings - Numbers – Variables – simple I/O - Getting user input– Using String method–Converting values.

UNIT -II CONTROL STATEMENTS AND FUNCTIONS   **(9)**
Control statements – Random number generator- Branching and loops – Range functions- Functions –User defined functions- passing parameters- return function- working with global variables and constants.

UNIT -III LISTS AND DICTIONARIES   **(9)**
Lists – create- index- slice a list- Add and delete elements from a list- Append- Sort and reverse a list- nested sequences- Dictionaries – Create- add- delete from a Dictionary- Operations associated with pairs of data.

UNIT -IV FILES AND EXCEPTIONS   **(9)**
Files – Read from text files- Write to text files- Read and write more complex data- Exceptions – Intercept and handle errors during program's execution.

UNIT -V OBJECT ORIENTED PROGRAMMING AND GUI   **(9)**
Object oriented programming – Create objects of different classes in the same program- objects communication- complex object creation- derive new classes- existing class extension- override method- GUI – GUI toolkit- create and fill frames- create buttons- text entries and text boxes- create check buttons and radio buttons - case study – create a web page using GUI functionality.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

1. *Y. Daniel Liang* **"Introduction to Programming Using Python"**, *Pearson, 2013.*
2. *Charles Dierbach* **"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus"**, *Wiley Publications, 2012.*

Reference Book:
1.*Michael Dawson* **"Python Programming for the Absolute Beginner"**, *Premier Press, 2003.*

COURSE OUTCOMES:

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

        CO1: Use various data types.[**Understand**]

        CO2: Use control statements and functions. [**Understand**]

        CO3: Analyze the arrangement of data elements in Lists and Dictionary

            structures.[**Analyze**]

        CO4: Handle exceptions and perform file operations**. [Understand]**

        CO5: Develop application using object oriented programming and GUI. [**Analyze**]

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M		M	M		M	M			M		M	H	H	H
CO2	H	M		M	M		M	M			M		M	H	H	H
CO3	H	H	M	H	M		M	M			M		H	H	H	H
CO4	H	H	M	H	M		H	H			M		H	H	H	H
CO5	H	H	M	H	M		H	H			H	M	H	H	H	H
16IOEX20	H	H	M	H	M		M	M			M	M	H	H	H	H

L-Low, M-Moderate(Medium), H-High

16IOEX21　　　　　　　　　**BIG DATA SCIENCE**　　　　　　**CATEGORY: OE**
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Big Data and its characteristics
* Technologies used for Big Data Storage and Analysis
* Mining larger data streams
* Concepts related to Link analysis and handle frequent data sets

UNIT- I THE FUNDAMENTALS OF BIG DATA　　　　　　　　　　　**(9)**
Understanding Big Data-Concepts and Technology-Big Data Characteristics-Types of data-Case Study-Business Motivation and Drivers for Big Data Adoption- Planning Considerations-Enterprise Technologies and Big Data Business Intelligence- OLTP-OLAP-Extract Transform Load-Data Warehouses-Data Mart-Traditional and Big Data BI-Case Study.

UNIT - II BIG DATA STORAGE AND PROCESSING　　　　　　　　　**(9)**
Big Data Storage Concepts- Clusters-File systems and Distributed File Systems-NoSQL- Sharding -Replication -Sharding and Replication-CAP Theorem-ACID-BASE-Case Study- Big Data Processing Concepts- Parallel Data Processing-Distributed Data Processing-Hadoop-Processing Workloads-Cluster-Processing in Batch mode-Processing in RealTime mode-Case study.

UNIT - III BIG DATA STORAGE AND ANALYSIS TECHNOLOGY　　　　　**(9)**
Big Data Storage Technology: On-Disk Storage devices-NoSQL Databases-In-Memory Storage Devices-Case study, Big Data Analysis Techniques: Quantitative Analysis-Qualitative Analysis-Data Mining-Statistical Analysis-Machine Learning-Semantic Analysis-Visual Analysis-Case Study

UNIT - IV MINING DATA STREAMS　　　　　　　　　　　　　　**(9)**
The stream data model – Sampling data streams – counting distinct elements in a stream – Estimating moments. Finding similar items – Applications of nearest neighbor search – shingling of documents - similarity preservation – locality sensitive hashing- distance measures – methods for high degree similarity.

UNIT – V LINK ANALYSIS AND FREQUENT ITEMSETS　　　　　　　　**(9)**
Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – A-Priori algorithm – handling larger datasets in main memory –limited pass algorithm – counting frequent items in a stream.

CONTACT PERIODS:
Lecture: 45 Periods　　　Tutorial: 0 Periods　　　Practical: 0 Periods　　　Total: 45 Periods

Text Books:
1. *Thomas Erl, WajidKhattak, and Paul Buhler,* ***"Big Data Fundamentals Concepts, Drivers & Techniques",*** *Prentice Hall, 2015.*
2. *AnandRajaraman and Jeffrey David Ullman,* ***"Mining of Massive Datasets",*** *Cambridge University Press, 2012.*

Reference Books:

1. *Paul Zikopoulos, Chris Eaton,* **"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data",** *McGraw Hill, 2011.*
2. *Frank J Ohlhorst,* **"Big Data Analytics: Turning Big Data into Big Money",** *Wiley and SAS Business Series, 2012.*

COURSE OUTCOMES:

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

    CO1: Understand the Big Data and usage in Enterprise Technologies. [Understand]
    CO2: Store and Process Big Data using suitable Processing Methods [Understand]
    CO3: Handle Big Data using appropriate analysis Techniques. [Analyse]
    CO4: Mine larger data streams using suitable algorithms. [Understand]
    CO5: Rank pages and handle large data sets efficiently [Analyse]

<u>COURSE ARTICULATION MATRIX:</u>

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	L	M	L	H	L						M	H	M	H	H
CO2	M				H			L				M	M	M	H	H
CO3		H			H							M	H	M	H	H
CO4	M	H	M		M							M	H	M	H	H
CO5	L	M	H									M	H	M	H	H
16IOEX21	M	M	L	L	M	L		L				M	H	M	H	H

    L-Low, M-Moderate(Medium), H-High

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16IOEX22   **OBJECT ORIENTED PROGRAMMING USING C++**   **CATEGORY: OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* Fundamentals of object oriented programming
* Classes and objects
* Concepts of overloading and type conversions
* Inheritance and Polymorphisms
* Files, templates and exception handling

UNIT - I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING   **(9)**
Basic concepts- benefits – applications of object oriented programming – beginning with C++ - tokens – expressions and control structures – C++ stream classes – Formatted and Unformatted I/O operations. Managing output with manipulators.

UNIT - II CLASSES AND OBJECTS   **(9)**
Introduction – specifying class – defining member functions – memory allocation constructors and destructors:- parameterized- copy – default -dynamic and multiple constructors – destructors.

UNIT - III FUNCTIONS AND TYPE CONVERSIONS   **(9)**
Introduction – function prototyping call by reference – return by reference – inline function – recursion – friend function – function overloading – operator overloading – manipulation of strings using operators – type conversions.

UNIT - IV INHERITANCE AND POLYMORPHISM   **(9)**
Defining derived classes – single, multiple, multilevel, hierarchical and hybrid inheritance – virtual base classes – abstract base classes – nesting of classes - pointers – pointers to objects – this pointer – pointers to derived classes – virtual functions – pure virtual functions virtual constructors and destructors.

UNIT - V FILES AND TEMPLATES   **(9)**
Classes for file stream operations – opening and closing a file – detecting EOF – open file modes – file pointers and their manipulations – sequential I/O operations – updating and error handling of file. Class and function template – template with multiple parameters – overloading, member function and non-type template arguments-Exception handling.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Book:
1. E.Balagurusamy **"Object oriented Programming with C++"** McGraw Hill Education Ltd, 6[th] Edition 2013.

Reference Books:
1. R.Rajaram **"Object Oriented Programming and C++"** New Age International 2[nd] edition , 2013.
2. K.R. Venugopal,Rajkumar,T. Ravishankar **"Mastering C++" ,** Tata McGraw Hill Education, 2[nd] edition, 2013.
3. Yashavant P. Kanetkar **"Let us C++"** BPB Publications, 2nd edition 2003.

COURSE OUTCOMES:

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

CO1:Understand the principles of object oriented programming. **[Understand]**
CO2: Develop programs using classes and objects.**[Analyze]**
CO3: Use functions and type conversions in programs. **[Understand]**
CO4: Apply inheritance and polymorphism to develop applications. **[Analyze]**
 CO5: Program with files, templates and exception handling. **[Understand]**

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H	M	M		M	M			M		M	M	H	L
CO2	M	H	H	H	M		M	M			M		H	M	H	L
CO3	M	H	H	H	M		M	M			M		H	M	H	L
CO4	M	H	H	H	M	L	M	M			M		H	M	H	L
CO5	M	H	H	H	M		M	M			M		H	M	H	L
16IOEX22	M	H	H	H	M	L	M	M			M		H	M	H	L

L-Low, M-Moderate(Medium), H-High

16BOEX23　　　　　　　**COMPUTATIONAL BIOLOGY**　　　　　**CATEGORY: OE**
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
* Understand the basic concepts and role of computation in biological analysis
* Familiarize with sequence alignment methods
* Understand the machine learning tools used for biological analysis

UNIT - I BASICS OF BIOLOGY　　　　　　　　　　　　　　　　　**(9)**
Biomolecules of life:Structure and Composition of DNA, RNA & Protein. Protein Structure basics-Primary, Secondary and tertiary Structure of protein.

UNIT - II BIOLOGICAL DATABASES　　　　　　　　　　　　　　　**(9)**
Concept of Relational database, Data archiving, Data mining, Primary databases - NCBI,EMBL,DDBJ; Structure databases-PDB.

UNIT -III SEQUENCE ANALYSIS　　　　　　　　　　　　　　　　**(9)**
Pairwise alignment tools - Dot matrix analysis, Dynamic programming-Smith waterman and Needleman wunsch algorithm, Heuristic methods - BLAST, FASTA;Multiple sequence alignment methods - Progressive alignment(Clustal).

UNIT -IV STRUCTURE ANALYSIS AND DRUG DESIGN　　　　　　　**(9)**
Protein secondary prediction-Chou fasman method, GOR method; Tertiary structure prediction-Homology modelling, Introduction to Computer aided drug design.

UNIT -V MACHINE LEARNING　　　　　　　　　　　　　　　　**(9)**
Genetic Algorithm, Neural networks,Artificial Intelligence, Hidden markov model -application in bioinformatics.

CONTACT PERIODS:
Lecture: 45 Periods　　Tutorial: 0 Periods　　Practical: 0 Periods　　Total: 45 Periods

Text Books:
1. David W. Mount, **"Bioinformatics: Sequence and Genome Analysis",** *Cold Spring Harbor Laboratory Press, Second Edition, 2004.*
2. Arthur M. Lesk, **"Introduction to Bioinformatics",** *Oxford University Press, 2008.*
3. Pierre Baldi, Soren Brunak , **"Bioinformatics: The machine learning approach"** *MIT Press, 2001.*

Reference Books:
1. Andrew R. Leach, **"Molecular Modeling Principles And Applications",** *Second Edition, Prentice Hall, 2001.*
2. Baxevanis A.D. and Oullette, B.F.F, **"A Practical Guide to the Analysis of Genes and Proteins",** *2nd ed., John Wiley, 2002*
3. David L. Nelson, Michael M. Cox, **"Lehninger Principles of Biochemistry",** *Sixth edition, Freeman, W. H. & Co. Publisher, 2012.*

COURSE OUTCOMES:

Upon completion of the Computational Biology course, the students will be able to

CO1:Understand basic structure of Biological macromolecules

CO2:Acquire the knowledge of biological databases

CO3:Ability to perform pair wise and multiple sequence alignment

CO4:Ability to predict the secondary and tertiary structure of proteins.

CO5:Understand the machine learning approaches in computational biology

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	M	L	L		L			M				M		L	L
CO2	M	L	L	L					L			L	L		L	L
CO3	L		L			M			L			L		M	L	L
CO4	M	M	L	M	M								L	L	L	L
CO5		M		H	H	M	L		M				L	M	L	L
16BOEX23	L	L	L	L	L	L	L		L			L	L	L	L	L

L-Low, M-Moderate(Medium), H-High

16BOEX24   **BIOLOGY FOR ENGINEERS**   CATEGORY: OE
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:
To enable the students
* To understand the basic functions of the cell and their mechanisms in transport process
* To get familiarize human anatomy and physiology
* To learn about microbes, immune system and biomolecules
* To know the concepts of applied biology

UNIT - I BASICS OF CELL BIOLOGY   **(9)**
An Overview of cells – Origin and evolution of cells. Cell theory, Classification of cells – prokaryotic cells and eukaryotic cells. Structure of prokaryotic and eukaryotic cells and their organelles. Comparison of prokaryotic and eukaryotic cells, Transport across membranes – diffusion - active and passive diffusion.

UNIT - II BASICS OF MICROBIOLOGY   **(9)**
Classification of microorganism, Microscopic examination of microorganisms, Structural organization and multiplication of bacteria, viruses, algae and fungi, Microorganism used for the production of penicillin, alcohol and vitamin B-12.

UNIT- III HUMAN ANATOMY AND PHYSIOLOGY   **(9)**
Basics of human anatomy, tissues of the human body: epithelial, connective, nervous and muscular, Nervous system, Respiratory System, Circulatory system and Digestive system.

UNIT- IV BIO MOLECULES AND IMMUNE SYSTEM   **(9)**
Introduction to Biochemistry, Classification, structure and properties of carbohydrates, proteins, lipids and nucleic acids. Innate and acquired immunity, Types of immune responses.

UNIT - V APPLIED BIOLOGY FOR ENGINEERS   **(9)**
Overview of biosensors- glucometer applications-medicine, Microarray analysis to diagnose the cancer, Microbial production of biofuels, Applications of stem cells.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:
1. Darnell J, Lodish H, Baltimore D, **"Molecular Cell Biology",** *W.H.Freeman; 8ᵗʰ edition, 2016.*
2. Pelczar MJ, Chan ECS and KreinNR, **"Microbiology",** *Tata McGraw Hill, 5th edition, New Delhi. 2001.*
3. WulfCruger and Anneliese Cruger, **"A Textbook of Industrial Microbiology",** *Panima Publishing Corporation, 2ⁿᵈ Edition, 2000.*

Reference Books:
1. David L. Nelson and Michael M Cox, **"Lehninger's Principles of Biochemistry",** *Macmillan Worth Publisher, 4ᵗʰ edition, 2004.*

2. Brain R.Eggins , **"Chemical Sensors and Biosensors",** *John Wiley & Sons, 2002.*
3. Anton Moser, **"Bioprocess Technology, Kinetics and Reactors"** *Springer, Berlin (Verlag), 1998.*
4. Kuby J, **"Immunology",** *WH Freeman & Co., 2000.*

COURSE OUTCOMES:

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

  CO1: Understand the functions of cell and their structural organization
  CO2: Describe the mechanisms and role of cell in immune system
  CO3: Get familiarized biomolecules and human anatomy system
  CO4: Illustrate the applications of microbes in industrial process
  CO5: Apply the engineering concepts in biology

COURSE ARTICULATION MATRIX:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L	L	L		L	M		L		L	M	L	L	L	L	L
CO2	L		L	L	L	M	M		L	L	L	L	L	L	L	L
CO3	L	L			L	L	L	L	L		L	L	L	L	L	L
CO4	L		L		L			L		L	L	L	L	M	L	L
CO5															L	L
16BOEX24	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

L-Low, M-Moderate(Medium), H-High

16BOEX25   **FUNDAMENTALS OF BIOENGINEERING**   **CATEGORY: OE**
                              (Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

∗ To make the students aware of the overall industrial bioprocess.
∗ To understand the basic configuration and parts of a fermentor.
∗ To study the production of primary and secondary metabolites.
∗ To understand the production of modern biotechnology products.
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UNIT - I   INTRODUCTION TO INDUSTRIAL BIOPROCESS   (9)

Fermentation - Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology - A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess.

UNIT - II   FERMENTATION INDUSTRY   (9)

Overview of fermentation industry, Basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes. Types of fermentation – Solid state, submerged, batch, continuous, fed batch fermentation methods.

UNIT - III   PRODUCTION OF PRIMARY METABOLITES   (9)

A brief outline of processes for the production of some commercially important organic acids - Citric acid, lactic acid ,acetic acid; amino acids - glutamic acid, phenylalanine; ethanol.

UNIT - IV   PRODUCTION OF SECONDARY METABOLITES   (9)

Study of production processes for various classes of secondary metabolites: Antibiotics: beta lactams – penicillin and cephalosporin; aminoglycosides – streptomycin; macrolides - erythromycin, vitamin - B9, B12.

UNIT - V   PRODUCTS THROUGH MODERN BIOTECHNIQUES   (9)

Production of industrial enzymes - proteases, amylases, lipases; Production of single cell protein from wastes; biopreservatives – Bacterosin; biopolymers - xanthan gum and PHA. Industrial uses of enzymes in detergents, beverage and food.

CONTACT PERIODS:
Lecture: 45 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 45 Periods

Text Books:

*1. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, **"Principles of Fermentation Technology"**, Science & Technology Books. 1995.*

*2. Presscott, S.C. and Cecil G. Dunn, **"Industrial Microbiology"**, Agrobios (India), 2005.*

*3.Casida, L.E. **"Industrial Microbiology"**, New Age International (P) Ltd, 1968.*

Reference Books:

*1. Crueger, W and AnnelieseCrueger, Biotechnology: **"A Textbook of Industrial Microbiology"**, Panima Publishing Corporation, Edition 2, 2003*

*2. Sathyanarayana, U., **"Biotechnology"**, Books and Allied (P) Ltd. Kolkata, 2005*

*3. Ratledge C and Kristiansen B. **"Basic Biotechnology"**, Cambridge University Press, second Edition, 2001.*

*4. Michael J. Waites. **"Industrial Microbiology: An Introduction"**, Blackwell Publishing, 2001.*

COURSE OUTCOMES:

CO1: Upon completion of the course in Bioprocess Principles graduates will be able to understand the basics of industrial bioprocess.

CO2: Explain the principle of a fermentation process and the chronological development of fermentation industry.

CO3: Understand the basic configuration of a fermentor and its ancillaries.

CO4: Learn the production of various primary and secondary metabolites.

CO5: Understand the production of biotechnological products.

COURSE ARTICULATION MATRIX:

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M	H	H										M		L	L
CO2	H	M													L	L
CO3	H	H	H	M	M	M		L	H					H	L	L
CO4	H	L	L			L		L						H	L	L
CO5	H	M	H	L	M			L						H	L	L
16BOEX25	H	M	M	L	L	L		L	L				L	M	L	L

L-Low, M-Moderate(Medium), H-High

16SOC1Z1   **HUMAN VALUES I**   **CATEGORY: OC**
                            (Common to All Branches)
                                                                    L   T   P   C
                                                                    1   0   0   1

PREREQUISITES: Nil

COURSE OBJECTIVE:
* ∗ Essential complementarity between 'values' and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
* ∗ The development of a Holistic perspective among students towards life, profession and happiness based on a correct understanding of the Human reality and the rest of existence, which forms the basis of Value based living in a natural way.
* ∗ The plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with nature.

UNIT - I   INTRODUCTION TO VALUE EDUCATION   (5)
Introduction- Need, Basic Guidance, Content and Process for Value Education- Basic human Aspirations – Prosperity and happiness – Methods to fullfill human aspirations - Understanding and living in harmony at various levels.

UNIT- II   HARMONY IN THE HUMAN BEING   (5)
Coexistence – Happiness and convenience – Appraisal of Physical needs – Mental and Physical health – Human relationship – Mutual Trust and Respect.

UNIT- III   ETHICS   (5)
Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue – Caring – Sharing - honesty- Courage – Empathy – Self Confidence -Ethical Human Conduct- Basis for humanistic Education, Constitution and universal order – Competence in professional ethics – Strategy for transition from the present state to Universal human order.

CONTACT PERIODS:
Lecture: 15 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 15 Periods

Text Books:
1. *R.R. Gaur, R. Singal, G.P. Bangaria,* **"Foundation Course in Human Values and Professional Ethics",** *2009, Excel Book Private Ltd., New Delhi.*

Reference Books:
1. *S. K. Chakraborty and Dabangshu Chakraborty,* **"Human Values and Ethics: Achieving Holistic Excellence",** *ICFAI University Press, 2006.*
2. *A.N. Tripathy,* **"Human Values",** *New Age International publishers, 2003.*
3. *M. Govindarajan, S. Natarajan and V.S. Senthil kumar,* **"Engineering Ethics(including human values)",** *Eastern Economy Edition, Printice Hall of India Ltd., 2004.*
4. *E.G. Seebauer and Rober. L. Berry,* **"Fundamentals of Ethics for Scientists an Engineers",** *Oxford University Press, 2000.*

COURSE OUTCOMES:

Upon completion of this course the students will be able to

CO1: Start exploring themselves , get comfortable to each other and to the teacher and start finding the need and relevance for the course.

CO2: See that their practice in living is not in harmony with their natural acceptance most of the time and able to refer to their natural acceptance to remove this disharmony.

CO3: Aware of their activities like understanding, desire, thought and selection and start finding their focus of attention at different moments.

CO4: Able to see that respect is right evaluation and only right evaluation leads to fulfillment in relationship.

CO5: Develop an understanding of the whole existence and inter connectedness in nature.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						H	H	H	M				L			
CO2						H	H	H	M				L			
CO3						H	H	H	M				L			
CO4						H	H	H	M				L			
CO5																
16SOC1Z1						H	H	H	M				L			

L-Low, M-Moderate(Medium), H-High

16SOCx02   **HUMAN VALUES AND PROFESSIONAL ETHICS**   **CATEGORY: OC**
(Common to All Branches)

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

COURSE OBJECTIVE:
  * Engineering Ethics and Human Values.
  * Social responsibility of an Engineer.
  * Ethical dilemma while discharging duties in Professional life.

UNIT – I   ENGINNERING ETHICS   **(5)**
Senses of Engineering Ethics – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's Theory – Gilligen's Theory – Consensus and contraversy – Models of Professional roles – theories about right actions – Self interest – customs and religion – uses of ethical theories – Valuing time – cooperation – commitment.

UNIT- II   ENGINEERING AS SOCIAL EXPERIMENTATION   **(5)**
Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study – engineers as managers – consulting engineers – Moral leadership.

UNIT – III   SAFETY, RESPONSIBILITIES, RIGHTS AND GLOBAL ISSUES   **(5)**
Safety and risk – assessment of safety and risk – risk benefits analysis and reducing risk – the three mile island and chernobyl case studies – Environmental ethics – computer ethics – weapons development – Multinational corporations – engineers as expert witnesses and advisors.

Lecture: 15 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 15 Periods

Text Books:
 1. Mike Martin and Roland Schinzinger, **"Ethics in Engineering"**, *McGraw Hill, New York, 1996.*
 2. M. Govindarajan, S.Natarajan and V.S. Senthil kumar, **"Engineering Ethics(including human values)"**, *Eastern Economy Edition, Printice Hall of India Ltd., 2004.*

Reference Books:

 1. Charles D.Fleddermann, **"Engineeering in Ethics"**, *Pearson Education, 2004.*
 2. Edmund G Seebauer ND Robert L.Berry, **"Fundamentals of Ethics for Scientists and Engineers"**, *2001, Oxford University Press.*
 3. Charles E. Harris, Michael S.Protchard and Michael J. Rabins, **"Engineering Ethics – Concepts and Cases"**, *Thomson Learning, 2000.*
 4. John R. Boatright, **"Ethics and Conduct of Business"**, *Pearson Education, 2003.*

COURSE OUTCOMES:
Upon completion of this course the students will be able to
   CO1: Understand and appreciate Human values, exhibit self confidence and develop
           good character
   CO2: Sense engineering ethics, professional roles and valueing time, co-operation and
           commitment.
   CO3: Understand and practise code of ethics.
   CO4: Assess safety and risk and capable of doing risk benefit analysis.
   CO5: Develop and exhibit moral leadership qualities in excercising Enginnering
          Consultations without compromising environmental, legal, and ethical issues.

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						H	H	H	M				L			
CO2						H	H	H	M				L			
CO3						H	H	H	M				L			
CO4						H	H	H	M				L			
CO5																
16SOCX02						H	H	H	M				L			

L–Low, M–Moderate(Medium), H–High

16SOCX03   **YOGA FOR YOUTH EMPOWERMENT**   **CATEGORY: OC**

PREREQUISITES: Nil

L	T	P	C
1	0	0	1

COURSE OBJECTIVE:
Upon completion of this course, the students will be familiar with,
* ∗ To create awareness and the benefits of yoga and meditation
* ∗ To study and analyze the influential factors, which affect the engineering students' healthy life

UNIT – I   PHYSICAL STRUCTURE AND ITS FUNCTIONS   (5)

Yoga - Purpose of life, philosophy of life, Physical structure, Importance of physical exercise, Rules and regulation of simplified physical exercises, hand exercise, leg exercise, breathing exercise, eye exercise, kapalapathy, maharasana, body massage, acupressure, body relaxation

UNIT – II   YOGASANAS   (5)
Rules & Regulations – asana, pranayama, mudra, bandh

UNIT – III   MIND   (5)

Bio magnetism & mind - imprinting & magnifying – eight essential factors of living beings, Mental frequency and ten stages of mind, benefits of meditation, such as perspicacity, magnanimity, receptivity, adaptability, creativity, Simplified Kundalini yoga: Agna, Santhi, thuriam, thuriyatheetham.

CONTACT PERIODS:
Lecture: 15 Periods   Tutorial: 0 Periods   Practical: 0 Periods   Total: 15 Periods

Text Books:

1. Yoga for Modern Age – Vethathiri Maharashi

Reference Books:

1. Mind – Vethathiri Maharashi

COURSE OUTCOMES:

Upon completion of this course, the students will be able to,
CO 1: YOGA which gives healthy & better living, Physical, Mental mood, Intellectual & spiritual.
CO 2: Work skillfully and perfectly towards the excellence.
CO 3: Achieve meditation practices, which strengthen the mind and increases the will power, concentration, creativity and ultimately to transform the mind to achieve self-realization

COURSE ARTICULATION MATRIX:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						H							L			
CO2									M					L		
CO3							L				L		L		L	
16SOCx03						H	L		M		L		L	L	L	

L-Low, M-Moderate(Medium), H-High