GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

Curriculum and Syllabi For

B.Tech. (INFORMATION TECHNOLOGY)

(Full Time)

2016

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS

GOVERNMENT COLLEGE OF TECHNOLOGY

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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 achieve global standards in quality of Education, Research and Development in Information Technology by adapting to the rapid technological advancement.

MISSION

1. To produce technologically competent and ethically responsible graduates through balanced and dynamic curriculum.
2. To take up creative research in collaboration with Government, Industries and Professional Societies to make the nation as a knowledge-power.
3. To produce successful graduates with personal and professional responsibilities and commitment to lifelong learning.

DEPARTMENT OF INFORMATION TECHNOLOGY
GOVERNMENT COLLEGE OF TECHNOLOGY,
COIMBATORE-641 013

PROGRAMME EDUCATIONAL OBJECTIVES

The Programme Educational Objectives of B.Tech. Information Technology programme are:

PEO1: Graduates will be in IT industries as experts or will have completed or will be pursuing research leading to higher degrees.

PEO2: Graduates will be leaders in providing technically feasible and socially acceptable solutions to complex real life problems by virtue of their core competence and communication skills.

PEO3: Graduates will exhibit entrepreneurial skills and professional ethics to take up new ventures.

PEO4: Graduates will emerge as innovative researchers/developers by engaging in lifelong learning.

DEPARTMENT OF INFORMATION TECHNOLOGY
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COIMBATORE-641 013

PROGRAMME OUTCOMES

Students of B.Tech. Information Technology Programme at the time of graduation 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.

DEPARTMENT OF INFORMATION TECHNOLOGY
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PROGRAMME SPECIFIC OBJECTIVES

The Programme Specific Objectives of B.Tech. Information Technology programme are:

PSO1: Apply engineering knowledge to identify, analyze, assimilate and solve the real time problems with the help of IT enabled latest tools and value based technologies. [PO1, PO2, PO3, PO4, PO5]

PSO2: Work effectively as a team in IT field to make a positive contribution to society. [PO6, PO7, PO8, PO9, PO10, PO11, PO12]

BOARD OF STUDIES IN BASIC SCIENCES 2016-17
B.TECH.INFORMATION TECHNOLOGY
CBCS 2016 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IHS1Z1	Communication Skills in English	HS	50	50	100	2	2	0	3
2	16IBS1Z2	Engineering Mathematics I	BS	50	50	100	3	2	0	4
3	16IBS103	Engineering Physics	BS	50	50	100	3	0	0	3
4	16IBS104	Applied Chemistry	BS	50	50	100	3	0	0	3
5	16IES105	Fundamentals of Electrical and Electronics Engineering	ES	50	50	100	3	0	0	3
		PRACTICAL								
6	16IBS106	Chemistry Lab	BS	50	50	100	0	0	4	2
7	16IES107	Workshop Practice	ES	50	50	100	0	0	4	2
		TOTAL		350	350	700	14	4	8	20

SECOND SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IHS2Z1	Technical English	HS	50	50	100	2	2	0	3
2	16IBS2Z2	Engineering Mathematics II	BS	50	50	100	3	2	0	4
3	16IBS2Z3	Materials Science	BS	50	50	100	3	0	0	3
4	16IHS2Z4	Environmental Science and Engineering	HS	50	50	100	3	0	0	3
5	16IES2Z5	Programming in C	ES	50	50	100	3	0	0	3
		PRACTICAL								
6	16IBS206	Physics Lab	BS	50	50	100	0	0	4	2
7	16IES207	Engineering Graphics	ES	50	50	100	2	0	4	4
8	16IES2Z8	Programming in C Lab	ES	50	50	100	0	0	4	2
		TOTAL		400	400	800	16	4	12	24

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IBS3Z1	Engineering Mathematics III	BS	50	50	100	3	2	0	4
2	16IES302	Engineering Mechanics	ES	50	50	100	3	2	0	4
3	16IES303	Digital Logic Design	ES	50	50	100	3	0	0	3
4	16IES304	Elements of Communication Engineering	ES	50	50	100	3	0	0	3
5	16IPC305	Data Structures and Applications	PC	50	50	100	3	0	0	3
6	16IES306	Computer Organization and Architecture	ES	50	50	100	3	0	0	3
		PRACTICAL								
7	16IES307	Digital logic Design Laboratory	ES	50	50	100	0	0	4	2
8	16IPC308	Data Structures and Applications Laboratory	PC	50	50	100	0	0	4	2
9	16IEE309	Professional English	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	Credits			
							L	T	P	C
		THEORY								
1	16IBS401	Probability, Random processes and Queueing Theory	BS	50	50	100	3	2	0	4
2	16IES402	Elements of Discrete Structures	ES	50	50	100	3	0	0	3
3	16IPC403	Information Coding Techniques	PC	50	50	100	3	0	0	3
4	16IPC404	Database Systems	PC	50	50	100	3	0	0	3
5	16IPC405	Operating Systems	PC	50	50	100	3	0	0	3
6	16IPC406	Analysis and Design of Algorithms	PC	50	50	100	3	0	0	3
		PRACTICAL								
7	16IPC407	Database Systems Laboratory	PC	50	50	100	0	0	4	2
8	16IPC408	Operating Systems Laboratory	PC	50	50	100	0	0	4	2
9	16IEE409	Hardware Troubleshooting Techniques	EEC	50	50	100	0	0	4	2
		TOTAL		450	450	900	18	2	12	25

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IPC501	Embedded System	PC	50	50	100	3	0	0	3
2	16IPC502	Computer Graphics	PC	50	50	100	3	2	0	4
3	16IPC503	Data Communication and Networking	PC	50	50	100	3	0	0	3
4	16IPC504	Software Engineering	PC	50	50	100	3	0	0	3
5	16IPC505	Fundamentals of Digital Signal Processing	PC	50	50	100	3	0	0	3
6	16OEX	Open Elective I	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	16IPC507	Embedded System Laboratory	PC	50	50	100	0	0	4	2
8	16IPC508	Data Communication and Networking Laboratory	PC	50	50	100	0	0	4	2
9	16IEE509	Application Development Tools	EEC	50	50	100	0	0	4	2
		TOTAL		450	450	900	18	4	12	26

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IPC601	Pervasive Computing	PC	50	50	100	3	0	0	3
2	16IPC602	Information Science	PC	50	50	100	3	0	0	3
3	16IPC603	Web Technology	PC	50	50	100	3	0	0	3
4	16IPC604	Cryptography and Network Security	PC	50	50	100	3	0	0	3
5	16OEX	Open Elective-II	OE	50	50	100	3	0	0	3
6	16IPEX	Professional Elective-I	PE	50	50	100	3	0	0	3
		PRACTICAL								
7	16IPC607	Web Technology Laboratory	PC	50	50	100	0	0	4	2
8	16IEE608	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL		400	400	800	18	0	12	24

SEVENTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IHS701	Industrial Management	HS	50	50	100	3	0	0	3
2	16IPC702	Fundamentals of Machine Learning	PC	50	50	100	3	0	0	3
3	16OEX	Open Elective - III	OE	50	50	100	3	0	0	3
4	16IPEX	Professional Elective -II	PE	50	50	100	3	0	0	3
5	16IPEX	Professional Elective -III	PE	50	50	100	3	0	0	3
6	16IPEX	Professional Elective -IV	PE	50	50	100	3	0	0	3
		PRACTICAL								
7	16IEE707	Open Source and Tools Laboratory	EEC	50	50	100	0	0	4	2
8	16IPC708	Machine Learning Laboratory	PC	50	50	100	0	0	4	2
		TOTAL		400	400	800	18	0	8	22

EIGHTH SEMESTER

Sl. No.	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	16IPEX	Professional Elective-V	PE	50	50	100	3	0	0	3
2	16IPEX	Professional Elective-VI	PE	50	50	100	3	0	0	3
3	16IEE803	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; CAT -Category; CA -Cumulative Assessment BS- Basic Science; HS- Humanities and Social Science; ES- Engineering Sciences; PC- Professional Core; PE- Professional Elective; OE-Open Elective; EEC- Employability Enhancement Course

DEPARTMENT OF INFORMATION TECHNOLOGY

LIST OF PROFESSIONAL ELECTIVES (18/180 = 10%)

S. No	Course Code	Course Title	Credit
1.	16IPEX01	Data Mining and Data Warehousing	03
2.	16IPEX02	Management Information System	03
3.	16IPEX03	Software Testing	03
4.	16IPEX04	Software Project Management	03
5.	16IPEX05	Software Quality Assurance	03
6.	16IPEX06	Enterprise Resource Planning	03
7.	16IPEX07	E-Commerce	03
8.	16IPEX08	Information Retrieval	03
9.	16IPEX09	Technologies and use of Internet of Things	03
10.	16IPEX10	Cloud Computing	03
11.	16IPEX11	Advanced Data Structures	03
12.	16IPEX12	Foundations of Information Security	03
13.	16IPEX13	Distributed Systems	03
14.	16IPEX14	Soft Computing	03
15.	16IPEX15	XML and Web Services	03
16.	16IPEX16	Semantic Web	03
17.	16IPEX17	Service Oriented Architecture	03
18.	16IPEX18	Virtualization Techniques	03
19.	16IPEX19	Fundamentals of Automata Theory	03
20.	16IPEX20	Virtual and Augmented Reality	03
21.	16IPEX21	Natural Language Processing	03
22.	16IPEX22	Artificial Intelligence and Applications	03
23.	16IPEX23	Mobile Computing	03
24.	16IPEX24	Human Computer Interface	03
25.	16IPEX25	Social network analysis	03
26.	16IPEX26	Foundations of Image Processing	03

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OPEN ELECTIVES (9/180 = 6.11%)

S. No	Course Code	Course	Credit
1.	16AOEX01	NanoScience and Technology	03
2.	16AOEX02	Material Characterizations	03
3.	16AOEX03	Electrochemical Technology	03
4.	16AOEX04	Polymer Technology	03
5.	16COEX05	Disaster Management and Mitigation	03
6.	16COEX06	Environmental Management	03
7.	16COEX07	Town Planning and Architecture	03
8.	16MOEX08	Total Quality Management for Engineers	03
9.	16MOEX09	Composite Materials	03
10.	16MOEX10	Automobile Engineering	03
11.	16EOEX11	Renewable Energy Sources and Technology	03
12.	16EOEX12	Smart Grid Technology	03
13.	16LOEX13	Principles of Communication	03
14.	16LOEX14	Microcontrollers and its Applications	03
15.	16NOEX15	Industrial Automation Systems	03
16.	16NOEX16	Measurements and Instrumentation	03
17.	16SOEX17	Enterprise Java	03
18.	16SOEX18	Cyber Security	03
19.	16SOEX19	Network Essentials	03
20.	16IOEX20	Programming in Python	03
21.	16IOEX21	Big Data Science	03
22.	16IOEX22	Object Oriented Programming Using C++	03
23.	16BOEX23	Computational Biology	03
24.	16BOEX24	Biology for Engineers	03
25.	16BOEX25	Fundamentals of BioEngineering	03

ONE CREDIT COURSES

S. No	Course Code	Course	Credit
1.	16IOCXZ1	Human Values I	01
2.	16IOCX02	Human Values and Professional Ethics	01
3.	16IOCX03	Yoga for Youth Empowerment	01
4.	16IOCX04	R programming	01
5.	16IOCX05	Ethical hacking	01
6.	16IOCX06	.NET framework	01
7.	16IOCX07	Automated Testing	01
8.	16IOCX08	Game Programming	01
9.	16IOCX09	User Interface Technologies	01
10.	16IOCX10	Unified Modeling Language	01

COURSE - CATEGORY DISTRIBUTION

CATEGORY	CREDITS	PERCENTAGE	SUGGESTED PERCENTAGE
HS	12	6.66%	5-10%
BS	29	16.11%	15-20%
ES	32	17.77%	15-20%
PC	60	33.33%	30-40%
PE	18	10%	10-15%
OE	9	5%	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

16IHS1Z1 COMMUNICATION SKILLS IN ENGLISH CATEGORY : HS

(Common to all Branches)

L T P C
2 2 0 3

PREREQUISITES: Nil

Course Objectives:

- To make the learners understand the usage of basic grammar in English.
- To enhance the learner's speaking skills through appropriate listening practice.
- To instill reading habits to practice communicative tasks and comprehension
- To improve the learner's writing skills through various means
- 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
CO1										H				L
CO2										H				L
CO3										H				L
16IHS1Z1										L				L

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

16IBS1Z2 **ENGINEERING MATHEMATICS I** **CATEGORY : BS**

(Common to all Branches)

L T P C

3 2 0 4

PREREQUISITES: Nil

Course Objectives:

- To familiarize techniques of matrix algebra including properties of eigen values and eigen vectors.
- To gain the knowledge of hyperbolic functions and application problems in differential calculus.
- To familiarize with functions of several variables and Functions of two variables including extremum problems, Jacobian and Leibnitz rule of integration.
- 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 CALCULUS 9+6 Periods

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, Thilagavathy K 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 this 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
CO1	H	H	H	M						H	M	M	H	L
CO2	H	M	M							M			M	M
CO3	H	H	H							L			H	M
CO4	H	H	M	M						M	L	M	L	
CO5	H	M	M							L	L	M	L	
16IBS1Z2	H	H	M	M						M	L	M	H	M

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

16IBS103 **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:

- Concepts, types of lasers and its applications, fibre optic principles and its applications.
- Basics of properties of matter & thermal physics
- Origin of quantum physics, Schrödinger's equation and applications.
- Principles of acoustics, ultrasonics and their industrial applications.
- 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 AND 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
CO1	L	L	L	L	L	L	L				L	L	L	L
CO2	L	L			L	L	L				L	L	L	L
CO3	L	L			L	L	L				L	L	L	L
CO4	L	L	L	L	L	L	L				L	L	L	L
CO5	L	L	L	L	L	L	L				L	L	L	L
16IBS103	L	L	L	L	L	L	L				L	L	L	L

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

16IBS104 **APPLIED CHEMISTRY** **CATEGORY : BS**

(Common to EEE, ECE, EIE, CSE & IT Branches) L T P C

3 0 0 3

PREREQUISITES: Nil

Course Objectives:

- 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
CO1	H	M	L	L	M	L	L	L	L	M	L	M	M	L
CO2	H	M	L	L	M	L	L	L	L	M	L	M	M	L
CO3	H	M	L	L	H	L	L	L	L	M	L	M	M	L
CO4	H	M	L	L	H	L	L	L	L	M	L	M	M	L
CO5	H	M	L	L	H	L	L	L	L	M	L	M	M	L
16IBS104	H	M	L	L	H	L	L	L	L	M	L	M	M	L

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

16IES105 **FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING** **CATEGORY : ES**

(Common to CSE & IT Branches)

L T P C
3 0 0 3

PREREQUISITES: Nil

Course Objectives:

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

9 Periods

UNIT I ELECTRICAL PRINCIPLES AND DC CIRCUITS

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
CO1	H	H	H	H		L					M		M	L
CO2	H	H	H	H		M							M	L
CO3	H	M	H	H		M							M	L
CO4	M	M	M	H	L						M	M	M	L
CO5	H	M	M	M									M	L
CO6	M	M	M	L	L	M	M				M	M	M	L
16IES105	H	M	H	H	L	M	M				M	M	M	L

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

16IBS106 **CHEMISTRY LAB** **CATEGORY : BS**

(Common to EEE, ECE, EIE, CSE & IT Branches) L T P C

0 0 4 2

PREREQUISITES: Nil

Course Objectives:

- 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
CO1	H	M	L	L	M	L	L	L	L	M	L	M	M	L
CO2	H	M	L	L	M	L	L	L	L	M	L	M	M	L
16IBS106	H	M	L	L	M	L	L	L	L	M	L	M	M	L

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

16IES107 **WORKSHOP PRACTICE** **CATEGORY : ES**

(Common to EEE, ECE, EIE, CSE & IT branches) L T P C

0 0 4 2

PREREQUISITES: Nil

Course Objectives:

- 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.
- 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
CO1	M					M	M		M	L		M	M	M
CO2	M	H				M	L		M	L		M	M	M
CO3	M	H				M	L		M	L		M	M	M
CO4	M	H				M	L		M	L		M	M	M
CO5	M	H				M	L		M	L		M	M	M
CO6	M	H				M	L		M	L		M	M	M
16IES107	M	H				M	L		M	L		M	M	M

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

16IHS2Z1 **TECHNICAL ENGLISH** **CATEGORY : HS**

(Common to all Branches)

L T P C

2 2 0 3

PREREQUISITES: Nil

Course Objectives:

- To make learners acquire guided listening and speaking skills in both formal and informal contexts.
- To help them develop reading skills by familiarizing them with different types of reading tasks and strategies
- To make them understand advance level of grammar and equip them with writing skills needed for academic as well as workplace contexts.
- 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 this 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
CO1										H				
CO2										H				
CO3										H				
16IHS2Z1										H				

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

16IBS2Z2 **ENGINEERING MATHEMATICS II** **CATEGORY : BS**

(Common to all branches) L T P C

3 2 0 4

PREREQUISITES: Basics of – trigonometry- differential and integral formulae.

Course Objectives:

- To acquire knowledge of techniques of ordinary differential equations leading to engineering problems.
- To acquire knowledge of vector Calculus with engineering applications.
- To gain standard techniques of complex variable applicable to fluid dynamics, heat conduction, and elasticity.
- 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 , $\sin z$, $\cos z$ 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,Reprint2013.*
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 this 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
CO1	H	H	H	H						M	H	H	H	M
CO2	H	H	M	M						M		M	M	L
CO3	H	H	M	H		M				M	M	M	L	L
CO4	H	H	M	M		M				M	M	M	L	M
CO5	H	H	H	H		H				M	M	H	H	M
16IBS2Z2	H	H	M	H		M				M	M	M	H	M

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

16IBS2Z3 **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:

- The properties of conducting materials.
- The application of magnetic and super conducting materials.
- Application and properties of dielectric and ferro electric materials.
- Applications and properties of Modern engineering materials.
- 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	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
CO1	L	L				L	L						L	L
CO2	L	L	L	L	L	L	L						L	L
CO3	L	L	L	L	L	L	L						L	L
CO4	L	L	L	L	L	L	L						L	L
CO5	L	L	L	L	L	L	L						L	L
16IBS2Z3	L	L	L	L	L	L	L						L	L

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

16IHS2Z4 ENVIRONMENTAL SCIENCE AND ENGINEERING **CATEGORY : HS**

(Common to all Branches) L T P C

3 0 0 3

PREREQUISITES: Nil

Course Objectives:

- 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 the completion of this course, the 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
CO1	M	L	L	L	L	L	L	L	L	L	L	L	M	L
CO2	M	L	H	L	L	L	M	M	L	M	L	L	L	L
CO3	L	L	H	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	M
CO5	M	L	M	L	L	L	H	H	L	L	L	L	M	M
16IHS2Z4	M	L	H	L	L	L	H	H	L	L	L	L	M	L

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

16IES2Z5 **PROGRAMMING IN C** **CATEGORY : ES**

(Common to all Branches)

L T P C
3 0 0 3

PREREQUISITES: Nil

Course Objectives:

Upon completion of the 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, PREPROCESSOR DIRECTIVES **9 Periods**

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
CO1	H	L					L					M	M	L
CO2	H	M	L				M					M	M	L
CO3	H	M					L					M	M	L
CO4	H	M	L				M					M	M	L
CO5	H	M					L					M	M	L
CO6	H	M	L				L					M	M	L
16IES2Z5	H	M	L				L					M	M	L

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

16IBS206 **PHYSICS LAB** **CATEGORY : BS**

(Common to EEE, ECE, EIE, CSE & IT Branches) L T P C

0 0 4 2

PREREQUISITES: Nil

Course Objectives:

- 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
CO1	L	L	L	L	L	L	L						L	L
CO2	L	L	L	L	L	L	L						L	L
16IBS206	L	L	L	L	L	L	L						L	L

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

16IES207 **ENGINEERING GRAPHICS** **CATEGORY : ES**

(Common to EEE, ECE, EIE, CSE & IT Branches)

L T P C
2 0 4 4

PREREQUISITES: Nil

Course Objectives:

- Geometrical constructions
- Orthographic projections.
- Performing section of solids and development of the same.
- Interpretation of solids.
- 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*	*Dhanalakshmi 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
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
16IES207		H	H	L		M		L	H	M		M	M	M

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

16IES2Z8 **PROGRAMMING IN C LAB** **CATEGORY : ES**

(Common to all Branches)

L T P C

0 0 4 2

PREREQUISITES: Nil

Course Objectives:

- Data types in C and Flow control statements
- Functions, Arrays, Pointers And Strings
- Dynamic memory allocation and command line arguments
- Bitwise Operators, Preprocessor Directives, Structures and Unions
- 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
CO1	H	M					L			L			H	L
CO2	H	M	L				L			L			H	L
CO3	H	M	L				L			L			H	L
CO4	H	M	L				L			L			H	L
CO5	H	M	L				L			L			H	L
CO6	H	H	H		M		H			L		H	H	L
16IES2Z8	H	M	L		L		L			L		L	H	L

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

16IBS3Z1 **ENGINEERING MATHEMATICS III** **CATEGORY: BS**

(Common to all Branches)

L	T	P	C
3	2	0	4

PREREQUISITES: Basics of differentiation, Partial differentiation and Integration.

Course Objectives:

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

- 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 Periods**

Dirichlet's conditions-Full range Expansions- Odd and even functions- Half range sine and cosine series –Parseval's identity on a Fourier series- Harmonic analysis.

UNIT- II FOURIER TRANSFORMS **9+6Periods**

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+6Periods**

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 Non-homogeneous types.

UNIT –IV BOUNDARY VALUE PROBLEMS **9+6Periods**

Method of separation of variables and Fourier series solution: One dimensional wave equation, one and two dimensional heat flow.

UNIT –V Z TRANSFORMS **9+6Periods**

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

AUTHOUR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
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 [Understand]

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

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

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

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

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
CO1	H	H	H							H			H	L
CO2	M	H	M							M			M	L
CO3	H	M								L			L	L
CO4	H	H	M			M				M	M		H	M
CO5	M	M	M										M	
16IBS3Z1	H	H	M			L				M	L		M	L

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

16IES302 **ENGINEERING MECHANICS** **CATEGORY: ES**

(Common to CSE & IT Branches)

L	T	P	C
3	2	0	4

PREREQUISITES: Nil

Course Objectives:

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+6Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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:

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
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, 1st 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,

CO 1: Know the concept of mechanics and system of forces. [Familiarize]
CO 2: Calculate the frictional properties at different bodies.[Understand]
CO3: Identify the locations of centre of gravity and moment of inertia for different sections[Understand]
CO4: Understand the basics of dynamics of particles[Understand]
CO5: Know the impulse and momentum principle and impact of elastic bodies.[Familiarize]

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
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	
16IES302	M	M	M	M	L					L			M	L

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

16IES303 **DIGITAL LOGIC DESIGN** **CATEGORY: ES**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Foundations in Number systems and Boolean algebra
- Gate level minimization using map reduction
- Designing simple combinational circuits
- Synchronous sequential circuits
- Asynchronous sequential circuits

UNIT – I BOOLEAN ALGEBRA AND LOGIC GATES (9 Periods)

Binary Numbers, Number Conversions-binary-octal-decimal, Hexadecimal, Complements, Signed Binary Numbers, Introduction to Boolean algebra and Logic Gates –Boolean functions - Canonical and Standard Forms-Digital Logic gates.

UNIT – II GATE LEVEL MINIMIZATION (9 Periods)

Introduction, K Map Method, Four Variable Map, Five Variable Map, Product of Sums, Sum of Product Simplification, Don't Care Conditions, NAND and NOR implementation, Hardware Description Language.

UNIT – III COMBINATIONAL AND PROGRAMMABLE LOGIC (9 Periods)

Combinational circuits- Analysis and Design Procedure- Binary Adder- Subtractor- Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders- Encoders- Multiplexers-De-Multiplexer- RAM-ROM- Programmable Logic Array - Programmable Array Logic. HDL for Combinational Circuits.

UNIT – IV SYNCHRONOUS SEQUENTIAL LOGIC (9 Periods)

Sequential circuits- Latches – Flip flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment- Design Procedure- Shift Registers, Ripple counters, Synchronous Counters, HDL for Synchronous sequential circuits

UNIT – V ASYNCHRONOUS SEQUENTIAL LOGIC (9 Periods)

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

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1.Morris Mano	*Digital Design Introduction to the Verilog HDL*	*Prentice Hall of India Private Ltd, 5th Edition, 2013*

REFERENCE BOOKS

1. Charles H.Roth, "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House, 2003
2. Donald D. Givone "Digital Principles and Design",Tata MCGraw Hill, 2003
3. John F. Wakerly "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007

COURSE OUTCOMES

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

CO1: Perform number conversions and binary arithmetic for singed and unsigned numbers. [**Understand**]

CO2: Simplify Boolean expression using Karnaugh map, Boolean laws and representing POS and SOP using hardware. [**Understand**]

CO3: Design and Analyse the combinational logic circuits [**Analyze**]

CO4: Design and Analyse the Synchronous sequential circuits. [**Analyze**]

CO5: Design and Analyse the Asynchronous sequential circuits [**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
CO1	H	M	M	M	L			L					M	L
CO2	H	M	M	M	L								M	L
CO3	H	H	H	H	M			L					H	L
CO4	H	H	H	H	M			L					H	L
CO5	H	H	H	H	M			L					H	L
16IES303	H	H	H	H	M			L					H	L

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

16IES304	ELEMENTS OF COMMUNICATION ENGINEERING	CATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Mathematical concepts used in analog and digital communication
- modulation techniques and other basic concepts used in analog communication systems
- Various pulse modulation techniques.
- Basic digital modulation techniques and signaling
- Broadband communication and fiber optic technology

UNIT – I FUNDAMENTAL CONCEPTS AND MATHEMATICAL PRELIMINARIES (9 Periods)

Introduction - Elements of an electrical communication system need for modulation - Characteristics of communication channel and their mathematical modeling - Signal models - deterministic and random - signal classification - Convolution Integral and response of LTI system - Fourier series representation - Parseval's theorem - Random Process - mean, correlation and covariance - stationary and ergodic processes - Gaussian Process.

UNIT – II ANALOG COMMUNICATION SYSTEMS (9 Periods)

Analog communication systems -Amplitude modulation theory – Generation of AM – Supression of carrier – Suppression of unwanted sideband – Theory of frequency and phase modulation – Generation of frequency modulation – Receiver types – AM receivers – Communication receivers – FM receivers – internal noise – external noise – noise figure.

UNIT – III PULSE MODULATION (9 Periods)

Pulse Modulation - Sampling process - sampling theorem for band limited signals - pulse amplitude modulation (PAM) - pulse width modulation (PWM) - pulse position modulation (PPM) - pulse code modulation (PCM) - line coding - differential pulse code modulation - delta modulation and adaptive delta modulation - Basics of time division multiplexing

UNIT – IV DIGITAL MODULATION SCHEMES (9 Periods)

Basic digital modulation schemes and signaling - Overview of geometric representation of signals - Gram-Schmidt Orthogonalization procedure - Phase shift keying (PSK) - amplitude shift keying (ASK) - frequency shift keying (FSK) and Quadrature amplitude modulation (QAM) - coherent demodulation and detection

UNIT – V BROADBAND, FIBER OPTIC TECHNOLOGY (9 Periods)

Multiplexing, short, medium and long haul systems – elements of long distance telephony – introduction to fiber optics – optical fiber and fiber cables – fiber optic components and systems.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1.Simon S. Haykin, Michael Moher, Michael Moher	*Communication Systems*	*5th Edition, Wiley publications, 2010.*
2.*G Kennedy, B Davis and S R M Prasanna*	*Electronic communication systems*	*Tata Mc-Graw Hill, Fifth Edition 2011*

REFERENCE BOOKS

1. *B.P.Lathi,Zhi Ding, Modern Analog And Digital Communication systems,4/e, Oxford University Press, 2009*
2. *Wayne Tomasi, Electronic Communication Systems: Fundamentals Through Advanced, Pearson Education, Fifth edition*
3. *H.Taub, D L Schilling, G.Saha, Principles of Communication systems, Tata Mc-Graw Hill, fourth edition,2013*
4. *Martin S.Roden, Analog and Digital Communication System, fifth Edition, Shroff Publishers & Distributors Pvt. Limited, 2006.*
5. *B.Sklar, Digital Communication: Fundamentals and Applications, third edition, Pearson Education 2014.*

COURSE OUTCOMES

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

CO1: Represent the communication system using mathematical models **[Understand]**

CO2: Compare and explain various analog modulation schemes. **[Understand]**

CO3: Compare and explain various pulse modulation schemes. **[Understand]**

CO4: Compare and explain various digital modulation schemes.**[Understand]**

CO5: Explain the functioning of broadband systems and fiber optic technology [**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
CO1	H												L	
CO2	H	L											L	
CO3	H	M		M									M	
CO4	H	L											L	
CO5	H	L											L	
16IES304	H	L	L	L									L	

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

16IPC305 DATA STRUCTURES AND APPLICATIONS CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Representation, operations and the use of basic linear data structures and their variants in diverse applications.
- Representation, operations and the use of basic non-linear data structures in diverse applications.
- Sorting, Searching and Hashing techniques

UNIT – I LINEAR DATA STRUCTURES – ARRAY and LIST (9 Periods)

Abstract Data Types (ADTs) – List ADT – array - based implementation – linked list implementation— singly linked lists - circularly linked lists - doubly - linked lists – applications of lists – Polynomial Manipulation - All operation (Insertion- Deletion- Find)

UNIT – II LINEAR DATA STRUCTURES – STACKS, QUEUES (9 Periods)

Stack ADT – array and linked list implementation- Evaluating arithmetic expressions - Infix to postfix conversion- balancing symbols - Queue ADT – circular queue implementation –Double ended Queues– applications of queues.

UNIT – III NON - LINEAR DATA STRUCTURES – TREES, HEAPS (9 Periods)

Binary Search trees-insertion-deletion-find -Traversal - AVL trees – B - Trees – Red -Black trees –Splay trees - Heaps - Heap creation - Binomial Heaps –Fibonacci Heaps.

UNIT – IV NON - LINEAR DATA STRUCTURES - GRAPHS (9 Periods)

Representation of Graphs – Breadth first search– Depth first search – Topological sort – Minimum Spanning Trees – Kruskal's and Prim's algorithm –Shortest path algorithm – Dijkstra‟s and Bellman Ford algorithm - Graph coloring problem- Biconnected- Articulation point.

UNIT – V SORTING, SEARCHING AND HASH TECHNIQUES (9 Periods)

Sorting algorithms- Insertion sort - Selection sort - Shell sort - Bubble sort - Quick sort - Merge sort - Radix sort – Heap sort – Searching- Linear search – Binary Search.

Hashing - Hash Functions – Separate Chaining – Open Addressing– Rehashing – Extendible Hashing.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1. Mark Allen Weiss	*Data Structures and Algorithm Analysis in C*	*Pearson Education, 2nd Edition, 2011*
2. Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogella	*An Introduction to Data Structures with Applications*	*Tata McGraw Hill Publishing Book Company, 2007.*

REFERENCE BOOKS

1. Jean-Paul Tremblay & Paul G.Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill Publishing Book Company, 2007.

COURSE OUTCOMES

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

CO 1: Analyze the arrangement of data elements in a list.[Analyze]

CO 2: Analyze the arrangement of data elements in stack and queue and study its applications.[Analyze]

CO 3: Use binary tree, binary search tree and AVL tree. [Understand]

CO 4: Apply graph algorithms.[Understand]

CO 5: Perform different sorting, searching and hashing techniques.[Understand]

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
CO1	L		L				L	L			L		L	L
CO2	L		L				L	L			M		L	L
CO3	M	M	M	M	M	M					H		M	L
CO4	M	M	M	M	M	M					H		M	L
CO5	M	M	M	M	M	M					H		M	L
16IPC305	M	M	M	M	M	M	L	L			H		M	L

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

16IES306 COMPUTER ORGANISATION AND ARCHITECTURE CATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Basic structure, operations and addressing modes of computer.
- Representation of Fixed point and floating point operations.
- Basic Organization and operations of data path, control path and pipelining
- Memory organization, Cache Optimization and I/O data transfer.
- Parallel processing architectures.

UNIT – I ARCHITECTURE: AN OVERVIEW (9 Periods)

Functional Units of a Digital Computer – Translation from a High Level Language to Hardware Language – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions: Operations and Operands– Representing instructions – Logical and Control Operations - Addressing modes.

UNIT – II COMPUTER ARITHEMETIC (9 Periods)

Number and Character Representation - Addition/Subtraction Logic Unit – Design of Fast Adder: Ripple-carry adder, carry-look ahead adder – Multiplication: Array and sequential circuit – Booth Algorithm – Fast Multiplication – Division – Restoring and Non-Restoring methods – Floating point numbers and operations.

UNIT – III PROCESSOR DESIGN (9 Periods)

Processor and Register Organization – Instruction Cycle - Logic Design Conventions - Building a Data path and Control - Micro-programming and Hard-wired Control – RISC Vs CISC Characteristics - Pipelining – Pipelining Hazards - Pipelined Data path and Control - Exceptions Handling.

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

Memory Technologies – Basics of Caches – Measuring and Improving Cache Performance –Virtual Machines and Memory - Memory Hierarchy – RAID – Accessing I/O devices – Interrupts – Buses and bus arbitration – DMA - Interface Circuits – Standard I/O interfaces.

UNIT – V PARALLEL PROCESSING (9 Periods)

Classification of Parallel Structures – Challenges and Benefits – SISD, MIMD, SIMD,SPMD and Vector – Hardware Multithreading – Multicore and other Shared memory Multiprocessors – Interconnection Networks – Performance Considerations.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	**TITLE OF THE BOOK**	**PUBLISHER, YEAR OF PUBLICATION**
1. David. A. Patterson and John L. Hennessy	*Computer Organization and Design: The Hardware / Software Interface*	*ARM Edition, Morgan-Kaufmann Publishers Inc. 2016*
***2.** V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky*	*Computer Organisation*	*VI edition, McGraw-Hill Inc, 2012*

REFERENCE BOOKS:

1. *Andrew S. Tenenbaum, "Structured Computer Organization", 6th Edition, Pearson Education, 2012.*
2. *William Stallings,"Computer Organization and Architecture: Designing for Performance", Pearson Education, 8th Edition, 2009.*
3. *Mostafa Abd-El-Barr and Hesham El-Rewini, "Fundamentals of Computer Organization and Architecture", John Wiley & Sons Inc., 2005*
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 the functioning of computer hardware and instruction set. [**Familiarize**]
CO2: Perform fixed point and floating point arithmetic operations.**[Understand**]
CO3: Design data path, control path and pipelining. **[Understand]**
CO4: Evaluate the performance of caches and interface I/O devices. [**Analyze**]
CO5: Elaborate parallel structure classification. [**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
CO1	M	L											H	M
CO2	L		H	M										
CO3	H		H										L	H
CO4	M		H										L	H
CO5	M												H	
16IES306	H	L	H	M									H	H

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

16IES307 DIGITAL LOGIC DESIGN LABORATORY CATEGORY: ES

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Various logic gates and flip-flops.
- Various Combinational and sequential circuits.
- Coding of HDL

LIST OF EXPERIMENTS

1. Boolean laws and truth table Verification using Gates
2. Half/Full Adder/Subtractor
3. Design code convertors
4. Implementation of Multiplexer and de-multiplexer
5. Implementation of Encoder and decoder
6. Two bit magnitude comparator
7. Verification of Flip-flop's truth table
8. Implementation of Shift registers
9. Design of Counters
10. Coding Combinational/Sequential Circuits using HDL

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 and verify the truth tables of different logic gates [**Understand**]
CO2: Identify, analyze and design combinational circuits [**Analyze**]
CO3: Understand the operation of different types of flip-flops [**Understand**]
CO4: Design different types of shift register and counters [**Analyze**]
CO5: Implement combinational/sequential circuits using HDL [**Analyze**]

COURSE ARTICULATION MATRIX

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	H	M	M	M	L			L					M	L
CO2	H	M	M	M	L								M	L
CO3	H	H	H	H	M			L					H	L
CO4	H	H	H	H	M			L					H	L
CO5	H	H	H	H	M			L					H	L
16IES307	H	H	H	H	M			L					H	L

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

16IPC308 **DATA STRUCTURES AND APPLICATIONS LABORATORY** **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- The operations of linear and non-linear data structures.
- Sorting and searching techniques.
- Hashing techniques.

LIST OF EXPERIMENTS

1. Implementation of List (array and linked list)
2. Implementation of Stack and Queue and its applications
3. Implementation of Binary tree operations
4. Implementation of Heaps
5. Implementation of Graph traversal algorithms
6. Implementation of Topological sorting
7. Implementation of Minimum Spanning Tree
8. Implementation of Shortest Path Algorithms
9. Implementation of Sorting and searching techniques
10. Implementation of Hashing 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 linear data structures like stack, queue, linked list and its operations. **[Analyze]**
CO2: Implement non-linear data structures tree, heaps and graph and its operations. **[Analyze]**
CO3: Sort an array's elements using insertion, selection and quick sort algorithms. **[Analyze]**
CO4: Search an element in an array using linear and binary search algorithms. **[Analyze]**
CO5: Index a table using different hashing techniques. **[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
CO1	H	H	M	M	M	M	M	M			M		M	M
CO2	H	H	M	M	M	M	M	M			M		M	M
CO3	H	H	M	M	M	M	M	M			M		M	M
CO4	H	H	M	M	M	M	M	M			M		M	M
CO5	H	H	M	M	M	M	M	M			M		M	M
16IPC308	H	H	M	M	M	M	M	M			M		M	M

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

16IEE309 **PROFESSIONAL ENGLISH** **CATEGORY: EEC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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 for Comprehension.
- Grooming soft skills.
- Appropriacy in nonverbal communication

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 for Comprehension and pleasure
10. Reading technical texts
11. Developing nonverbal communication
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 **[Familiarize]**
CO2: Use correct pronunciation and speak English with proper stress and intonation. **[Familiarize]**
CO3: Do presentation, GD, Debate & Mock interview confidently. **[Familiarize]**
CO4: Write good resume and articles in English. **[Familiarize]**
CO5: Read books in English with confidence. **[Familiarize]**
CO6: Develop body language and soft skills. **[Familiarize]**

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
CO1						H			H	H		H		H
CO2						H			H	H		H		H
CO3						H			H	H	H	H	H	L
CO4						H			H	H	H	H	H	M
CO5						H	H	M	H	H	M	H	H	H
CO6						H			H	H	H	H	H	M
16IEE309						M	H	L	H	H	H	M	H	H

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

16IBS401 **PROBABILITY, RANDOM PROCESSES AND QUEUEING THEORY** **CATEGORY : BS**

(Common to EIE , CSE & IT Branches)

L	T	P	C
3	2	0	4

PREREQUISITES: Nil

Course Objectives:

- 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 Periods**

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 Periods**

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 Periods**

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 Periods**

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 Periods**

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

AUTHOR NAME	TITLE OF BOOK	PUBLISHER, YEAR OF PUBLICATION
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. **[Understand]**

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

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

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

CO5: Understand queuing models. **[Understand]**

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
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
16IBS401	H	H	M	M	L		M			H	M		M	M

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

16IES402 ELEMENTS OF DISCRETE STRUCTURES CATEGORY: ES

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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
- Groups, rings and integral domain structures
- Applications of graph theory
- Concepts of Automata Theory

UNIT – I SETS AND PROPOSITIONS (9 Periods)

Sets-Introduction – Combinations of Sets – Finite and Infinite Sets – Mathematical Induction – Principle of Inclusion and Exclusion –Multisets-Propositions- Logical Connectives – Conditionals and Biconditionals –Well Formed Formulas- Tautologies –Logical Equivalences – Theory of inference for Statement calculus – Predicate Calculus.

UNIT – II RELATION AND FUNCTIONS (9 Periods)

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- Job scheduling problem- Compatible relation

UNIT – III GROUPS AND RINGS (9 Periods)

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 Automorphisms- Homomorphisms and Normal subgroups-Rings- Integral domains and fields-ring homomorphisms-polynomial rings and cyclic codes

UNIT – IV GRAPH THEORY (9 Periods)

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- Traveling Salesperson Problem-Planar Graphs-Graph Coloring

UNIT – V MODELLING COMPUTATION (9 Periods)

Introduction – Ordered Sets –Languages- Phrase Structure grammars – Types of Grammars and Languages –Basic Concepts of Information Processing Machine – Finite State Machines –Finite State Machines as Models of Physical Systems – Equivalent Machines – Finite State Machines as Language Recognizers – Finite State Languages and Type-3 Languages – Turing Machine.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1.C.L. Liu,D.P. Mohapatra	*Elements of Discrete Mathematics: A Computer Oriented Approach*	*Tata McGraw Hill, Third Edition (SIE), 2008.*

REFERENCE BOOKS

1. *Tremblay.J.P and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science ", Tata McGraw Hill Company, 1997, 35th reprint 2008.*
2. *Kenneth H. Rosen, Rosen "Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory",Tata McGraw Hill, Seventh Edition, 2011.*
3. *SatinderBal Gupta, " Discrete Mathematics and Structures", University Science Press, Fifth edition, 2008*
4. *Seymour Lipschutz and Mark larasLipson, "Discrete Mathematics", Schaum's outlines, Tata McGraw Hill Company, New Delhi, Third edition, 2010.*

COURSE OUTCOMES

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

CO1: Verify the correctness of an argument using propositional and predicate logic. **[Analyze]**
CO2: Perform operations on discrete structures such as sets, functions and relations. **[Understand]**
CO3: Apply the concepts of groups and rings in real time applications. **[Understand]**
CO4: Use graph as a powerful modeling tool. **[Understand]**
CO5: Design Turing machine for the given problem **[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
CO1	L	H	M	H	L			M			M		H	L
CO2	M	M	M	H	L			M			M		M	L
CO3	M	M	H	H	L			M			M		H	L
CO4	L	H	M	H	H			M			M		H	L
CO5	M	H	H	M	L			M			M		H	L
16IES402	M	H	M	H	M			M			M		H	L

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

16IPC403 INFORMATION CODING TECHNIQUES CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Information theory and channel capacity.
- Source coding techniques.
- Error control coding techniques like linear block codes, convolution codes.
- Compression and decompression techniques.
- Concepts of multimedia communications.

UNIT – I INFORMATION THEORY (9 Periods)

Introduction- Uncertainty- Information and Entropy- Joint and Conditional Entropy- Mutual Information-Channel capacity theorem-Continuous and Discrete Communication Channels – Discrete Memory less Channels- Channel representations-Noiseless Channel- Lossless Channels- Deterministic- Binary Symmetric Channel (BSC)- Binary Erasure Channel (BEC) and their capacities.

UNIT – II SOURCE CODING TECHNIQUES (9 Periods)

Coding for Discrete memory less sources- Fixed length code words- variable length code words- Kraft Inequality- Prefix Coding- Shannon's First- Second and third theorem- Shannon binary Encoding- Shannon-Fano Encoding- Huffman Coding- Minimum and Maximum Variance Method.

UNIT – III ERROR CONTROL CODING (9 Periods)

Types of Errors- Types of Codes- Linear Block Codes- Error Detection and Error Correction capabilities of Linear Block Codes- Binary Cyclic Codes- Encoding using Shift Register- Syndrome Calculation-Error Detection and Correction- Convolutional Codes-Encoder and Decoders for Convolutional Codes-Viterbi decoding.

UNIT – IV COMPRESSION TECHNIQUES (9 Periods)

Principles – Text compression – Static Huffman Coding – Dynamic Huffman Coding, Arithmetic Coding – Image Compression – Graphics Interchange Format – Digitized Documents – Introduction to JPEG Standards.

UNIT – V AUDIO AND VIDEO CODING (9 Periods)

Linear Predictive Coding- Code excited LPC- Perceptual Coding- MPEG audio coders- Dolby audio coders – Video compression – principles – Introduction to H.261 and MPEG video standards.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1.Simon Haykin	*Communication Systems*	*John Wiley and Sons, fifth edition, 2010.*
2. Ranjan Bose	*Information Theory, Coding and Cryptography*	*Tata McGrew Hill, second Edition, 2008.*

REFERENCE BOOKS

1. *K. Sam Shanmugam,"Digital and Analog Communication Systems", JohnWiley and Sons,2010.*
2. *T. M. Cover and J. A. Thomas, "Elements of Information Theory", John Wiley and Sons, second edition,2006*
3. *Andre Neabauer, "Coding Theory: Algorithms, Architectures & Applications", Wiley Publications, 2010*

COURSE OUTCOMES

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

CO1: Apply the basics of information theory to calculate channel capacity and other measures. **[Understand]**

CO2: Evaluate suitable source coding technique to improve channel utilization.**[Understand]**

CO3: Apply linear block codes, cyclic codes and convolution codes error detection and correction in the communication networks. **[Understand]**

CO4: Use Compression and Decompression techniques. **[Understand]**

CO5: Apply the concepts of multimedia communication. **[Understand]**

COURSE ARTICULATION MATRIX

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	L	L	L		M		L				L		L	L
CO2	M	M	L	L	L		L	M			L		M	L
CO3	H	H	L	L	L		L	M			L		M	L
CO4	H	H	L	L	L		L	M			L		M	L
CO5	H	H	L	L	L		L	M			L		M	L
16IPC403	H	H	L	L	L		L	M			L		M	L

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

16IPC404 **DATABASE SYSTEMS** **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Conceptual data and relational model.
- Principles and efficient use of storage space using normalization techniques.
- Constructing simple and moderately advanced database queries using query language.
- Concept of database and related database facilities including concurrency control, backup and recovery, data object locking protocols.
- Basics of current trends.

UNIT – I INTRODUCTION AND CONCEPTUAL MODELING (9 Periods)

Introduction to File and Database systems – Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.

UNIT – II RELATIONAL MODEL (9 Periods)

SQL – Data definition – Queries in SQL – Updates – Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases.

UNIT – III DATA STORAGE AND QUERY PROCESSING (9 Periods)

Record storage and Primary file organization – Secondary storage Devices – Operations on Files – Heap File – Sorted Files –Hashing Techniques – Index Structure for files –Different types of Indexes – B –Tree –B+ Tree – Query Processing.

UNIT – IV TRANSACTION MANAGEMENT (9 Periods)

Transaction Processing – Introduction – Need for Concurrency control – Desirable properties of Transaction – Schedule and Recoverability – Serializability and Schedules – Concurrency Control – Types of Locks – Two Phases locking – Deadlock –Time stamp based concurrency control – Recovery Techniques – Concepts – Immediate Update – Deferred Update – Shadow Paging.

UNIT – V CURRENT TRENDS (9 Periods)

Object –Relational and Object oriented databases Introduction to NOSQL –Mongo DB –Creating – Updating and Deleting Documents –Querying –Indexing

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1. *RamezElmasri and Shamkant B. Navathe*	*Fundamental Database Systems*	*Sixth Edition, Pearson Education, 2011*
2. *Kristina Chodorow*	*MongoDB: The Definitive Guide*	*Second Edition,O'Reilly Publication, 2013*

REFERENCE BOOKS

1. *Abraham Silberschatz, Henry F. Korth and S. Sudarshan -"Database System Concepts", Sixth Edition, McGraw-Hill, 2011.*
2. *Raghu Ramakrishnan,JohannesGehrke"Database Management System", Tata McGraw-Hill Publishing Company, 3rd edition,2003*
3. *Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- "Database System Implementation"- Pearson Education- 2000.*
4. *Peter Rob and Corlos Coronel- "Database System, Design, Implementation and Management", Thompson Learning Course Technology- Fifth edition, 2003.*

COURSE OUTCOMES

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

CO1: Build a database management system that satisfies relational theory **[Understand]**
CO2: Systematically design appropriate database structure using normalization, data modeling and retrieve the information using SQL. **[Analyze]**
CO3: Illustrate data storage, query processing and optimization techniques such as B Tree, B+ Tree structure. **[Understand]**
CO4: Explain the concepts of transaction managements **[Familiarize]**
CO5: Use open source databases. **[Understand]**

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
CO1	M	M	H	M	H			L			M		M	L
CO2	H	H	H	H	H	L		L			M		H	L
CO3	M	M	M	M	H						M		M	
CO4	M	L	L	L	L						M		L	
CO5	H	H	H	H	H						M		H	
16IPC404	M	M	H	M	H	L		L			M		M	L

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

16IPC405 **OPERATING SYSTEMS** **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Structure and functions of OS
- Processes, Threads and Scheduling algorithms
- Principles of concurrency and Deadlocks
- Memory management schemes
- I/O management and File systems

UNIT – I INTRODUCTION **(9 Periods)**

Computer System Overview-Basic Elements- Instruction Execution- Interrupts- Memory Hierarchy-Cache Memory- Direct Memory Access- Multiprocessor and Multicore Organization- Operating system overview-objectives and functions- Evolution of Operating System.

UNIT – II PROCESSES **(9 Periods)**

Process: States-Process Description and Process Control- IPC- Processes and Threads-Types of Threads-Multicore and Multithreading- Windows 10- Thread and SMP Management.

UNIT – III CONCURRENCY AND SCHEDULING **(9 Periods)**

Principles of Concurrency - Mutual Exclusion- Semaphores- Monitors- Readers/Writers problem. Deadlocks – prevention- avoidance – detection- Scheduling- Types of Scheduling – Scheduling algorithms.

UNIT – IV MEMORY **(9 Periods)**

Memory management requirements-Partitioning-Paging and Segmentation-Virtual memory - Hardware and control structures-operating system software- Linux memory management-Windows memory management.

UNIT – V INPUT/OUTPUT AND FILE SYSTEMS **(9 Periods)**

I/O management and disk scheduling – I/O devices- organization of I/O functions; OS design issues-I/O buffering- disk scheduling-Disk cache. File management – Organization-Directories-File sharing- and Record blocking- secondary storage Management.

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1.Abraham Silberschatz, Peter B. Galvin, Greg Gagne	*Operating System Concepts*	*9th Ed., John Wiley, 2008*
2.AS Tanenbaum	*Modern Operating Systems*	*4th Ed., Pearson, 2009.*

REFERENCE BOOKS

1.William Stallings, "Operating Systems: Internals and Design Principles",Prentice-Hall, 7th Ed., 2008.
2.AS Tanenbaum, AS Woodhull,"Operating Systems Design and Implementation,"3rd Ed., Prentice Hall, 2006.
3.J. Bach,"Design of the Unix Operating System, Prentice Hall of India",1986.

COURSE OUTCOMES

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

CO1: Explain the structure and functions of OS. **[Familiarity]**
CO2: Schedule Processes, Threads and Scheduling algorithms **[Usage]**
CO3: Solve problems related to concurrency and Deadlocks **[Usage]**
CO4: Apply memory management schemes. **[Usage]**
CO5: Explore I/O management and File 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
CO1	H												L	
CO2	H	H	H	M	M						L	L	H	L
CO3	H	H	H	M	M						L	L	H	L
CO4	H	H	H	M	M						L	L	H	L
CO5	H	H	M	M	M						L	L	H	L
16IPC405	H	H	H	M	M						L	L	H	L

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

16IPC406 ANALYSIS AND DESIGN OF ALGORITHMS CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Significance of complexity of the algorithm
- Principles of algorithm design
- Concepts of approximation and randomized algorithms
- Dynamic programming, Greedy technique, Amortized Algorithm
- Analysis of Graph Algorithms

UNIT – I ALGORITHM COMPLEXITY (9 Periods)

Overview of Algorithms -Asymptotic complexity - Principles of Algorithm Design –Probabilistic Analysis and Randomized Algorithms: Indicator random variables-Randomized algorithms, Iterative approach to solve sorting problem : Insertion Sort- divide and conquer approach to solve sorting problem: Quick Sort-Merge Sort- Using Data structure approach : Heap sort , Sorting in Linear time : Counting Sort-Radix Sort-Bucket Sort

UNIT – II ALGORITHM DESIGN FOR DYNAMIC SETS (9 Periods)

Introduction : Elements of a Dynamic set-operations on dynamic sets, Elementary Data Structures : Stack and Queues-Linked lists,Hash tables :Direct-address tables,Hash tables,Hash functions, Open addressing, Binary Search trees: Querying a binary search tree-Insertion and deletion, Red Black Trees:Properties of red-black trees-Rotations-Insertion-Deletion

UNIT – III ALGORITHM DESIGN FOR ADVANCED DYNAMIC SETS (9 Periods)

B Trees : Definition of B Trees –Basic Operations on B trees –Deleting a key from B Tree ,Fibonacci heaps : Structure of Fibonacci heaps-Decreasing a key and deleting a node ,Data Structures for Disjoint sets : Disjoint Set Operations-Linked List Representation of Disjoint sets –Disjoint Set Forests-Tries

UNIT – IV ADVANCE ALGORITHM DESIGN TECHNIQUES (9 Periods)

Dynamic Programming : Elements of dynamic programming -Rod cutting-Matrix chain multiplication – Longest Common subsequence-Greedy Algorithm : Elements of the greedy strategy -An activity selection problem –Huffman codes Amortized Analysis :Aggregate analysis- accounting method-potential method

UNIT – V GRAPH ALGORITHMS AND NP COMPLETENESS (9 Periods)

Introduction - Elementary Graph Algorithms-Representations of graphs-Topological Sort-Strongly connected components, Minimum Spanning Trees: The algorithms of Kruskal and Prim, Single-Source Shortest Paths: The Bellman-Ford algorithm- Single-source shortest paths in directed acyclic graphs-Dijkstra's algorithm-Difference constraints and shortest paths-Proofs of shortest-paths properties,All-Pairs Shortest Paths:Shortest paths and matrix multiplication: The Floyd-Warshall algorithm. NP Complete : Introduction to NP complete –hamiltonian circuit-subset sum and partition

CONTACT PERIODS:

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

TEXT BOOKS

AUTHOR NAME	TITLE OF THE BOOK	PUBLISHER, YEAR OF PUBLICATION
1. Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein	*Introduction to Algorithms*	*Third edition, The MIT press 2009*
2. Michael T. Good rich , Roberto Tamassia	*Algorithm Design: Foundations,Analysis,and Internet Examples*	*Second Edition Wiley India,2006*

REFERENCE BOOKS

1. Anany Levitin , "Introduction to the Design and Analysis of Algorithms", Pearson education , second edition 2015
2. Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson united states edition 2005.

COURSE OUTCOMES

Upon completion of this course, the students will be able to,
CO1: Compare the complexity of algorithms in problem solving process. **[Analyze]**
CO2: Analyze asymptotic runtime complexity of algorithms for dynamic sets.**[Analyze]**
CO3: Analyze asymptotic runtime complexity of algorithms for advanced dynamic sets.**[Analyze]**
CO4: Apply dynamic programming and Greedy algorithms. **[Understand]**
CO5: Apply graph algorithm to deal with network problems.**[Understand]**

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
CO1	H	H	H	H	L				L		L	L	H	M
CO2	H	H	H	H	L			L	L		L	L	H	M
CO3	H	H	H	H	L			L	L		L	L	H	M
CO4	H	H	H	H	L				L		L	L	H	M
CO5	H	H	H	H	L				L		L	L	H	M
16IPC406	H	H	H	H	L			L	L		L	L	H	M

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

16IPC407 **DATABASE SYSTEMS LABORATORY** **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Usage of DDL, DML and TCL commands.
- Querying the database using relational algebra operations.
- Concepts of triggers, functions and stored procedures in PL/SQL and NOSQL.

LIST OF EXPERIMENTS

- DDL, DML, DCL and TCL commands.
- Built in functions and Relational Algebra operations in open source DBMS-MySQL.
- Materialized views.
- Embedded SQL
- Stored Procedures, Functions in PL/SQL
- Cursors, Packages and Triggers in PL/SQL.
- Study of NOSQL Databases
- Mini Project: (Any application development using Oracle/MySQL/ NOSQL/Postgres) Developing applications such as Payroll processing system, Banking system, Inventory control system, Reservation system, College/Library/Hospital/Hotel Management system, Personal Information systems and Timetable management systems 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: Design and implement a database schema for a given problem-domain**.[Analyze]**

CO2: Populate and query a database using SQL DDL/ DML/TCL commands. **[Analyze]**

CO3: Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS. **[Analyze]**

CO4: Programming PL/SQL and NOSQL including stored procedures, stored functions, cursors, packages**.[Analyze]**

CO5: Design and build a GUI application. **[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
CO1	H	H	H	M	H	L		M	M	M	H		H	M
CO2	M	M	H	M	H			M	L	L	H		M	M
CO3	M	M	M	M	H			M	M	M	H		M	M
CO4	H	H	H	H	H			M	M	M	H		H	M
CO5	H	H	H	H	H	M		M	M	M	H		H	M
16IPC407	H	H	H	M	H	L		M	M	M	H		H	M

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

16IPC408 OPERATING SYSTEMS LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Basic structure, operations and addressing modes of computer.
- Representation of Fixed point and floating point operations.
- Basic Organization and operations of data path, control path and pipelining
- Memory organization, Cache Optimization and I/O data transfer.
- Parallel processing architectures.

LIST OF EXPERIMENTS

1. UNIX Commands and Shell Programming
2. Inter Process Communication
3. CPU scheduling algorithms
4. Process Synchronization
5. Deadlock Prevention and Avoidance
6. Paging and Segmentation
7. Page Replacement Algorithms
8. File Organization Techniques
9. File allocation strategies
10. Disk Scheduling Algorithms

CONTACT PERIODS:

LECTURE: 0 TUTORIAL: 0 PRACTICAL:60 Periods TOTAL: 60 Periods

COURSE OUTCOMES

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

CO1: Implement shell scripts and Inter Process Communication.**[Understand]**
CO2: Implement CPU scheduling algorithms and memory management schemes**[Understand]**
CO3: Implement algorithms for deadlock prevention and avoidance **[Understand]**
CO4: Implement file structure and allocation of disk space. **[Understand]**
CO5: Identify the best disk scheduling algorithm to improve the performance. **[Understand]**

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
CO1	L		H				M		H			H	H	H
CO2	M			M			H						M	M
CO3	H				M		H		M			H	H	L
CO4	H						H						M	M
CO5	L								H				L	L
16IPC408	H		H	M	M		H		H			M	H	H

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

16IEE409 HARDWARE TROUBLESHOOTING TECHNIQUES CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Motherboard and its interfacing
- Installing and uninstalling OS and drivers
- Disk partitioning and DOS commands
- Assembling and disassembling of hardware.
- Basic network operations

LIST OF EXPERIMENTS

EXERCISES ILLUSTRATING THE FOLLOWING CONCEPTS:

- Study of Motherboard and its interfacing components
- Study of Booting Process.
- Install, upgrade and configure Windows operating systems.
- Disk formatting, partitioning and Disk operating system commands
- Install and configure computer drivers and system components.
- Study of hubs and switch.
- Configuring LAN, IP address and Domain name system
- Install, upgrade and configure Linux operating systems.
- Installation of printer and scanner software.
- Disassembly and Reassembly of hardware

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: Understand the components of motherboard **[Familiarize]**
CO2: Manage the hard disk drive by formatting and partitioning **[Analyze]**
CO3: Install, upgrade and configure OS, drivers and Network connections. **[Analyze]**
CO4: Assemble and disassemble a computer system. **[Analyze]**
CO5: Perform network operations **[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
CO1	H		L										M	
CO2	H		L		M								M	
CO3	H		L		M								M	
CO4	H		L		M								M	
CO5	H												M	
16IEE409	H		L		L								M	

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

16IPC501 **EMBEDDED SYSTEM** **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,

1. Difference between embedded systems and generic purpose systems.
2. Architecture of embedded systems.
3. Programming concepts of embedded system.
4. Managing the processes in embedded systems.
   - Real time operating systems.

UNIT – I INTRODUCTION TO MICROPROCESSOR AND EMBEDDED SYSTEM (9 Periods)

8085 Architecture – 8086 Architecture, Addressing modes – Embedded systems – Processor embedded into system – embedded hardware and software – examples – Embedded SoC – complex system design – Design process in embedded system and example – Classification of embedded systems.

UNIT – II ARCHITECTURE, MEMORY, INTERFACING AND INTERRUPTS (9 Periods)

8051 architecture – I/O types and examples – serial and parallel communication – wireless devices – Timer, counter and clocks – networked embedded systems – Programmed I/O busy-wait without IS mechanism – ISR concept – interrupt sources – Interrupt servicing mechanism – Multiple interrupts – classification of interrupt servicing mechanisms – DMA

UNIT – III PROGRAMMING CONCEPTS (9 Periods)

Programming in assembly and high level language – 'C' program elements – object oriented programming – embedded programming in C++ and java – Program models – DFG models – state machine programming models for event controlled program flow – Multiprocessor system modeling – UML modeling.

UNIT – IV IPC, PROCESS SYNCHRONIZATION, THREADS AND TASKS (9 Periods)

Multiple processes in an application – Multiple threads in an application – Tasks – task states – task and data – semaphores – shared data – IPC – signal function – semaphore function – message queue function – mailbox function – pipe function – socket function – RPC function

UNIT – V REAL TIME OPERATING SYSTEMS (9 Periods)

OS services – Process management – Timer function – Event function – Memory management – Device– file– I/O subsystem management – Interrupt routines – RTOS systems – design using RTOS – RTOS task scheduling models– interrupt latency and response of tasks – OS security issues.

CONTACT PERIODS:

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

Text Books:

1. RajKamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw Hill, 2nd edition, 2011.

Reference Books:

1. *David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.*
2. *K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design &Programming", Dreamtech press, 2005.*
3. *Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.*
4. *Wayne Wolf, "Computers as Components- Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.*
5. *MykePredko, "Programming and Customizing the 8051 Microcontroller", Tata McGraw Hill, 1999.*

COURSE OUTCOMES:

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

CO1: Compare embedded system with general purpose system. **[Analyze]**
CO2: Explain the functional dependency of components in embedded system. **[Familiarize]**
CO3: Program the embedded systems. **[Understand]**
CO4: Illustrate the communication between processes and task management. **[Understand]**
CO5: Compare RTOS with other OS's. **[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
CO1	H												L	
CO2	H												L	
CO3	H	M	M		M								H	
CO4	H												L	
CO5	H	L											L	
16IPC501	H	L	L		L								M	

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

16IPC502 **COMPUTER GRAPHICS** **CATEGORY: PC**

	L	T	P	C
PREREQUISITES: Nil	3	2	0	4

Course Objectives:

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

- Elements of computer graphics, both hardware and software.
- 2D Viewing and transformations.
- 3D Concepts.
- Multimedia compression and animation.
- Multimedia authoring systems.

UNIT – I INTRODUCTION **(9+6 Periods)**

Elements of pictures created in computer graphics – Graphics input primitives and devices – OpenGL basic Graphics primitives –Output primitives –Line, Circle and Ellipse drawing algorithms –Attributes of output primitives.

UNIT – II 2D GRAPHICS **(9+6 Periods)**

2D Viewing –Window–Viewport Transformation –Two dimensional Geometric transformations –Line, Polygon, Curve and Text clipping algorithms.

UNIT – III 3D CONCEPTS **(9+6 Periods)**

Projections – Three dimensional object representation – Polygons, Curved lines, Splines, Quadric Surfaces –Visualization of data sets – 3D affine transformations – Viewing – Visible surface identification – Color Models – 3D Transformations in OpenGL.

UNIT – IV MULTIMEDIA BASICS **(9+6 Periods)**

Introduction – Applications – Elements – Animations – Compression – Types of Compressions: Lossless – Lossy – Video compression – Image Compression – Audio compression – Data and file format – Multimedia data structures: KD Trees – R trees.

UNIT – V MULTIMEDIA AUTHORING AND APPLICATIONS **(9+6 Periods)**

Creating interactive multimedia – Multimedia Authoring Systems – Applications – Video On demand –Virtual Reality – Augmented Reality – Content based retrieval in digital libraries.

CONTACT PERIODS:

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

Text Books:

1. D. Hearn and M. P. Baker, "Computer Graphics - C version", Pearson Education, 2004.

2. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", Pearson Education, 1st edition, 2007.

Reference Books:

1. F. S. Hill Jr. "Computer Graphics using OpenGL", Pearson Education, 2nd edition, 2003.

2. Prabhat K Andleigh, Kiran Thakrar, "Multimedia systems design", PHI, 1st edition, 2007.

COURSE OUTCOMES:

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

- **CO1:** Demonstrate the understanding of contemporary graphics hardware and output primitives **[Understand]**
- **CO2:** Explain the fundamental principles of line and curve drawing algorithms and 2D transformations **[Understand]**
- **CO3:** Describe the 3D object representation and apply 3D modeling and transformations **[Understand]**
- **CO4:** Differentiate lossy and lossless compression **[Analyze]**
- **CO5:** Create Interactive multimedia **[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
CO1					L		M		L	M			L	M
CO2	H	H	L	M	L					L	L		M	L
CO3	H	H	L	M	L					L	L		M	L
CO4	H	H	L	M	L						L		M	L
CO5	H	H	L	M	H			H		L	L	L	M	M
16IPC502	H	H	L	M	L		M	L	L	M	L	L	M	M

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

16IPC503 DATA COMMUNICATION AND NETWORKING 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 taxonomy and terminology of the computer networks.
- Layering concepts in OSI/ISO and TCP/IP reference models.
- Design issues and functionalities of Physical, data link, network, transport and application layers.

UNIT – I DATA COMMUNICATION AND PHYSICAL LAYER (9 Periods)

Objectives of networking– Types of networks– Network topologies– Protocols and standards– OSI Reference model– TCP/IP reference model– Internet standards. Physical Layer– Transmission media– Wireless transmission– Communication satellites– Telephone network– Switching techniques– Network Components– Hubs – Repeaters – Bridges – Switches – Routers – Gateways.

UNIT – II DATA LINK LAYER (9 Periods)

Error detection and correction – Parity – Longitudinal Redundancy Check – Cyclic Redundancy Check – Hamming code – Elementary data link protocols – Sliding window protocols – HDLC – IEEE Standards – Multiple access protocols – Ethernet – Token ring – Token bus.

UNIT – III NETWORK LAYER (9 Periods)

Network layer design issues– IP addressing methods– Classless and classful addressing– Subnetting– Routing Algorithms– Distance vector algorithm – Link state routing– Congestion control algorithms– Quality of service.

UNIT – IV TRANSPORT LAYER (9 Periods)

Transport layer services – Sockets – User datagram protocol –Transmission control protocol– Connection Establishment– Connection release– Performance issues.

UNIT – V APPLICATION LAYER (9 Periods)

Domain Name Space– World Wide Web– Simple Mail Transfer Protocol– Hyper Text Transfer Protocol– Multiple Internet Mail extensions– File Transfer Protocol– TELNET.

CONTACT PERIODS:

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

Text Books:

1. *Behrouz A Forouzan, "Data Communications and Networking", Tata McGraw Hill, 2010.*
2. *Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, 5th edition, 2011.*

Reference Books:

1. *Andrew S Tanenbaum, "Computer Networks", Prentice Hall, 2010.*
2. *James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Pearson Education, 5th edition, 2009.*
3. *Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall, 2010.*
4. *Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2011.*

COURSE OUTCOMES:

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

CO1: Explain data communication systems and its components. **[Familiarize]**
CO2: Analyze performance of data link layer protocols. **[Analyze]**
CO3: Enumerate the functions of network layer. **[Familiarize]**
CO4: Identify the design issues of transport layer.**[Understand]**
CO5: Describe basic protocols of application layer.**[Understand]**

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
CO1	L	L	L		M		L				L		L	L
CO2	M	M	L	L	L		L	M			L		M	L
CO3	M	M	L	L	L		L	M			L		M	L
CO4	M	M	L	L	L		L	M			L		M	L
CO5	M	M	L	L	L		L	M			L		M	L
16IPC503	M	M	L	L	L		L	M			L		M	L

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

16IPC504 **SOFTWARE ENGINEERING** **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,

- Software life cycle models and system engineering process for developing software system from scratch.
- Requirement engineering process and analysis.
- Design levels of software engineering.
- Software testing fundamentals and testing strategies.
- Software project management concepts.

UNIT – I SOFTWARE PROCESS (9 Periods)

Introduction – Software Process – Process Structure – Process models: Prescriptive and Specialized – Agile Methods – SPI Process – CMMI – Emerging Trends in Software Engineering.

UNIT – II REQUIREMENTS ANALYSIS AND MODELING (9 Periods)

Requirements Engineering – Establishing the ground work – Eliciting requirements – Building the Analysis Model – Validating requirements – Requirements Modeling: Scenario-based, Class-based, Behavioral, Patterns and Web /Mobile Apps.

UNIT – III SOFTWARE DESIGN (9 Periods)

Design process and concepts – Design model – Architectural design – Component level design – User interface design – Pattern Based design – Web /Mobile App design.

UNIT – IV SOFTWARE TESTING (9 Periods)

Software Testing Fundamentals – White box testing – Black box testing – Strategic approach and issues - Unit testing – Integration testing – Testing strategies for Web /Mobile Apps – Validation testing – system testing and debugging – Testing Object Oriented and Web /Mobile Apps.

UNIT – V PROJECT MANAGEMENT (9 Periods)

Project Management Concepts – Software Process and Project Metrics – Estimation – Project Scheduling – Risk Management – Software Quality Assurance – Software Configuration Management – Maintenance and Reengineering.

CONTACT PERIODS:

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

Text Books:

1. *Roger Pressman.S, Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", McGraw Hill, 8th edition, 2015.*
2. *Ian Sommerville , "Software Engineering", Pearson Education Asia, 9th edition, 2011.*

Reference Books:

1. *James F.Peters and Witold Pedrycz, "Software Engineering, Engineering Approach", Wiley India, 2007.*
2. *Richard E. Fairley, "Principles of Software Engineering", IEEE computer society press, 2010.*
3. *Shari Pfleeger, Joanne Atlee, "Software Engineering: Theory and Practice", Pearson Education, 4th edition, 2010.*
4. *Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa publications, 3rd edition, 2011.*

COURSE OUTCOMES:

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

CO1: Understand software process models and recent developments in software engineering. [**Understand**]

CO2: Elicit and model the requirements.**[Understand]**

CO3: Design software using architectural, component, user interface and pattern based models. **[Analyze]**

CO4: Explore software testing strategies. **[Familiarize]**

CO5: Identify the risk involved in the project to ensure software quality. **[Understand]**

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
CO1	H	L	M										M	
CO2		H		H		H							M	L
CO3	H		M		H								M	
CO4	H		L						H		H		L	M
CO5		M		H		H			H				M	L
16IPC504	H	M	M	M	L	M			M		L		M	L

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

16IPC505 FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING CATEGORY: PC

PREREQUISITES:

	L	T	P	C
1. 16IES304 – Principles of Communication Engineering	3	0	0	3

Course Objectives:

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

- Fundamentals of signals and systems.
- Problem Solving using DFT and FFT.
- Designing of IIR and FIR filters.
- Signal conversion and real time applications of DSP.

UNIT – I DISCRETE TIME SIGNALS AND SYSTEMS (9 Periods)

Basic Elements of Digital Signal Processing – classification of signals – Concept of Frequency in Continuous Time and Discrete Time Signals – Discrete time signals – Discrete time systems – Analysis of Discrete Time LTI system – Convolution and Correlation of discrete time signals.

UNIT – II Z AND DISCRETE FOURIER TRANSFORMS (9 Periods)

Z-Transform and its properties – Introduction to DFT – Periodicity, Linearity and Symmetry properties – Circular convolution – Linear filtering method based on DFT.

UNIT – III FAST FOURIER TRANSFORMS (9 Periods)

Efficient Computation of DFT – FFT Algorithms – Radix-2 and Radix-4 FFT Algorithms – Decimation in Time – Decimation in Frequency – Application of FFT algorithms.

UNIT – IV FIR FILTERS (9 Periods)

Structure of FIR system – Design of FIR filters – Symmetric and Anti-symmetric FIR Filters – Linear Phase FIR filters using Windows and frequency sampling method.

UNIT – V IIR FILTERS (9 Periods)

Structure of IIR System – IIR Filter Design by Impulse Invariance – Bilinear Transformation – Approximation Derivatives – Application of DSP – Model of Speech Wave Form – Vocoder.

CONTACT PERIODS:

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

Text Books:

1. *John G Proakis and Dimtris G Manolakis, "Digital Signal Processing Principles – Algorithms and Application", PHI/Pearson Education, 4th edition, 2007.*

Reference Books:

1. *Alan V Oppenheim, Ronald W Schafer and John R Buck, "Discrete Time Signal Processing", PHI/Pearson Education, 2nd edition, 2000.*
2. *Johny R.Johnson, "Introduction to Digital Signal Processing", Prentice Hall of India/Pearson Education, 2002.*
3. *Sanjit K.Mitra, "Digital Signal Processing A Computer – Based Approach", Tata McGraw-Hill, 2nd edition, 2001.*

COURSE OUTCOMES:

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

- **CO1:** Explain the primitives of discrete signals and systems. **[Familiarize]**
- **CO2:** Explain the properties of Z Transform and DFT**. [Understand]**
- **CO3:** Apply FFT for liner filtering and correlation. **[Understand]**
- **CO4:** Design FIR filter. **[Analyze]**
- **CO5:** Design IIR filter. **[Analyze]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	M	H	M				H				M		M	M
CO2	M	M	M				H				M		M	M
CO3	M	M	M				H				M		M	M
CO4	M	H	M				H				M		M	M
CO5	M	H	H		L		H				M		M	M
16IPC505	M	H	M		L		H				M		M	M

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

16IPC507 **EMBEDDED SYSTEM LABORATORY** **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- ARM processor kit and its architecture
- Programming the ARM processor
- Interfacing display module
- Interfacing timer
- Serial transmission of ARM processor

LIST OF EXPERIMENTS

1. Study of ARM processor kit.
2. Simulation of arithmetic operation on arm in assembly.
3. Simulation of assembly level program for soft delay.
4. Simple LED blinking with variable speed in ASM.
5. Seven segment LED display interface in C.
6. Realizing timer peripheral in arm by polling method/Interrupt driven method.
7. Serial transmission and reception of a character in C by polling method/Interrupt method.
8. Displaying alphanumeric characters in 2x16 line LCD module.
9. Number conversion in ARM processor.
10. Accessing internal ADC of the ARM processor and to display in LCD.

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: Explain the functional architecture of ARM processor.**[Familiarize]**
CO2: Write assembly language program to perform operation in ARM processor.**[Understand]**
CO3: Write program to interface ARM processor with the display module.**[Understand]**
CO4: Write program to access the timer.**[Understand]**
CO5: Write program to transmit data in serial with ARM processor. **[Understand]**

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
CO1	H												L	
CO2	H	M	M	M	L								M	
CO3	H				L								L	
CO4	H				L								L	
CO5	H				L								L	
16IPC507	H	L	L	L	M								M	

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

16IPC508 **DATA COMMUNICATION AND NETWORKING LABORATORY** **CATEGORY: PC**

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Configuring different topologies.
- Functions of Network protocols.
- Socket programming.
- Simulation tools used for networking.

LIST OF EXPERIMENTS

1. Study of different LAN devices
2. Send and Receive messages using BUS, STAR, RING topologies.
3. Stop & Wait Protocol and Sliding Window Protocol.
4. Socket Programming (TCP/UDP).
5. ARP, RARP and ICMP protocols.
6. Web page upload and download using HTTP socket.
7. Subnetting.
8. Congestion Control Algorithms using Network Simulator.
9. Routing algorithms using Network Simulator.
10. Packet sniffing using Wireshark / TCPdump.

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: Configure LAN using different network topologies. **[Analyze]**
CO2: Create sockets for client server applications. **[Analyze]**
CO3: Implement network management protocols. **[Analyze]**
CO4: Use simulators to analyze the packets transmitted. **[Analyze]**
CO5: Analyze various routing algorithms. **[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
CO1	H	H	M		L		M	M					M	L
CO2	H	H		L	L		L	L					M	L
CO3	H	H	M	L	L		M	M					M	L
CO4	H	H	M	L	L		L	M					M	L
CO5	H	H	M	M	M		L	L					M	L
16IPC508	H	H	M	M	M		M	M					M	L

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

16IEE509 APPLICATION DEVELOPMENT TOOLS CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Designing User interface of an application.
- Designing Back end of Application.
- Connectivity of front end and back end.
- Mobile application development.
- Web Application Development.

LIST OF EXPERIMENTS

1. IDE using Eclipse, PHP, Net Beans (Database Connectivity)
2. Mobile Application Development Using Android.
3. ActiveX control using Visual studio.
4. Form Design using Android studio.
5. Source Repository check in.
6. Data retrieval using Android Studio.
7. Game App Development using Android Studio.
8. Monitoring your application.
9. JAR file using Eclipse.
10. Web page Design using PHP.

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 User Interface of an Application. **[Analyze]**
CO2: Design Back end of an application. **[Analyze]**
CO3: Connect front end and back end of an application. **[Understand]**
CO4: Develop mobile Application. **[Analyze]**
CO5: Develop Web Application. **[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
CO1	H	H	H	H	H	H					H	H	H	M
CO2	H	H	H	H	H	H					H	H	H	M
CO3	H	H	H	H	H	H					H	H	H	M
CO4	H	H	H	H	H	H					H	H	H	M
CO5	H	H	H	H	H	H					H	H	H	M
16IEE509	H	H	H	H	H	H					H	H	H	M

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

16IPC601 PERVASIVE COMPUTING 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,

- Concept of pervasive computing.
- Devices and technologies used in pervasive computing.
- Device connectivity and web applications in pervasive computing.
- Contribution of WAP and voice technology in pervasive computing.
- PDA and web application architecture in pervasive computing.

UNIT – I INTRODUCTION (9 Periods)

Pervasive Computing– Past, Present and Future – Pervasive Computing Market – m-Business – Application examples– Retail– Airline check-in and booking – Health care – Car information system – E-mail access via WAP and voice.

UNIT – II DEVICE TECHNOLOGY (9 Periods)

Hardware – Human Machine Interfaces – Biometrics – Operating Systems – Java for Pervasive devices – Introduction to RFID – Transponder and reader architecture – Types of tags and readers – Frequencies of operation – Application of RFID technologies

UNIT – III CONNECTIVITY AND WEB APPLICATION (9 Periods)

Protocols – Security – Device Management – Context aware computing – Web Application Concepts: WWW architecture – Protocols – Transcoding – Client Authentication via Internet.

UNIT – IV WAP AND VOICE TECHNOLOGY (9 Periods)

Components of the WAP architecture – WAP infrastructure – WAP security issues – WML – WAP push – Products – i-Mode – Voice Technology: Basics of Speech recognition – Voice Standards – Speech applications – Speech and Pervasive Computing

UNIT – V PDA AND PERVASIVE WEB APPLICATION ARCHITECTURE (9 Periods)

Device Categories – PDA operation Systems – Device Characteristics – Software Components – Standards – Mobile Applications – PDA Browsers – Pervasive Web Application architecture: Background – Development of Pervasive Computing web applications – Pervasive application architecture

CONTACT PERIODS:

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

Text Books:

1. *JochenBurkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, "Pervasive Computing, Technology and Architecture of Mobile Internet Applications", Pearson education, 2012.*

Reference Books:

1. *Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of mobile and pervasive computing", McGraw Hill, 2005.*
2. *AshokeTalukdar and RoopaYavagal, "Mobile Computing", Tata McGraw Hill, 2005.*

COURSE OUTCOMES:

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

CO1: Realize the significance of pervasive computing.**[Understand]**
CO2: Recognize the devices and technologies used in pervasive computing.**[Understand]**
CO3: List out the connectivity and application requirements.**[Understand]**
CO4: Explain the WAP and voice technology applied in pervasive computing.**[Understand]**
CO5: Explain the operation and architecture of Pervasive computing application.**[Understand]**

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
CO1	H	M			L	L							M	L
CO2	M		L		H		L	L					M	L
CO3	H	M		M									M	
CO4	H												L	
CO5	H												L	
16IPC601	H	M	L	L	L	L	L	L					M	L

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

16IPC602 **INFORMATION SCIENCE** **CATEGORY: PC**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Coding theory.
- Economic principles that are combined with technology to invent new information products.
- Secure transmissions, electronic cash, and digital signatures.
- How large data banks are organized, searched, and analyzed.
- How advances in technology provide new services.

UNIT – I ENTROPY **(9 Periods)**

Information definition – A measure of Information – Entropy–Information sources – source combinations – bits as a measure – codes – The Coding Problem – Average code length and entropy – Shannon's First Theorem – Compression – Huffman Coding – Intersymbol Dependency – Lempel-Ziv Coding.

UNIT – II ECONOMICS **(9 Periods)**

Markets – Demand – products – social surplus-competition – Optimality of Marginal Cost Pricing – Copyright and Monopoly – Other Pricing Methods – Oligopoly – Pricing Schemes – Discrimination – Versions – Bundling – Sharing – Value – Conditional Information – Decisions –The Structure of Value – Interaction – Common Knowledge – Information and Decisions – Metcalfe's Law.

UNIT – III ENCRYPTION **(9 Periods)**

Ciphers – Definitions – Example Ciphers Cryptograms – The Vigenère Cipher –The Play fair Cipher, Cryptography Theory – Perfect Security – Entropy Relations – The DES and AES Systems, Public key cryptography – RSA, Security protocols – Digital Signatures.

UNIT – IV EXTRACTION **(9 Periods)**

Data structures – Lists – Trees – Traversal of trees – Binary Search Trees(BST) – Basic Sorting Algorithms – Quicksort – Heapsort – Mergesort, Database Systems – Relational Structure – Keys – Operations – Functional Dependencies – Normalization – Information Retrieval – Inverted Files – Strategies for Indexing – Queries – Data Mining – Overview of Techniques – Classification Trees – Bayesian Methods – Support Vector Machines.

UNIT – V EMISSION **(9 Periods)**

Frequency Concepts – Fourier series and transform – Radio Waves – Hertz oscillator – Spark Radio – Sampling and Capacity – Sampling Theorem – Capacity of a band – Spread Spectrum – Networks – Frames – ALOHA – Routing Algorithms.

CONTACT PERIODS:

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

Text Books:

1. David G. Luenberger, "Information science", Princeton university press, 2nd edition, 2012.

2. David Bawden, Lyn Robinson, "Introduction to Information Science", 2nd edition, 2012.

Reference Books:

1. *Alina vickery, Brian C. Vickery, "Information science in Theory and practice", K.G Saur Verlag, 2004.*
2. *John R.Pierce, "An Introduction to Information Theory symbols, signals and Noise", Dover publication, 2nd edition, 1980.*

COURSE OUTCOMES:

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

- **CO1:** Measure the information using classical information and communication theory, based on bits, bandwidth and codes.**[Analyze]**
- **CO2:** Measure the value of information based on how information is produced, priced, and distributed. **[Analyze]**
- **CO3:** Encrypt the information for secure transmission that enables such advances as digital signatures and digital cash. **[Analyze]**
- **CO4:** Use the appropriate techniques to organize, store, search, filter and modeling of data. **[Understand]**
- **CO5:** Transmit the information electromagnetically, through radio, television, telephones, cell phones or computer networks. **[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
CO1	H	H	M	M	L		M				L		M	M
CO2	H	H	M	M	L		M				L		M	M
CO3	H	H	M	M	L		M	M	L		L	M	M	M
CO4	M	M	L	L	M	H	L				L		M	M
CO5	M	M	M	M	L		L	H	L		L	M	M	M
16IPC602	M	M	M	M	M	L	M	M	L		L	L	M	M

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

16IPC603 **WEB TECHNOLOGY** **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,

- Concepts of Web and basic protocols.
- HTML, DHTML, CSS and JavaScript.
- Server side web components like JSP, PHP and Servlets.
- XML and Web Services.
- Application of web technologies in E-Commerce.

UNIT – I INTRODUCTION **(9 Periods)**

Introduction to Internet – Basic internet protocols– TCP/IP– TELNET– FTP– SMTP– MIME – DNS – HTTP–Request message– Response message – Web clients – Web servers – Client/Server model – Proxy servers.

UNIT – II CLIENT SIDE PROGRAMMING **(9 Periods)**

HTML – HTML Tags– Creating web page – HTML – DHTML – Cascading Style Sheets– Basics of client side programming – Javascript – Introduction to DOM – Document tree – DOM eventhandling – Web2.0 – Blogs – Communities – Browser Debugging.

UNIT – III SERVER SIDE PROGRAMMING **(9 Periods)**

Server Side programming – Servlets – Java Server Pages – Session Management – Cookies – Database Access Through Web – Introduction to PHP – Creating simple web page using PHP.

UNIT – IV XML AND WEB SERVICES **(9 Periods)**

Representing web data – XML – XML Documents and Vocabularies – XML Namespaces – Transforming XML documents – XPATH – Introduction to AJAX – Web services: Concepts – Writing java Web Service and Web Service client – WSDL – XML Schema – Introduction to SOAP and REST.

UNIT – V APPLICATIONS **(9 Periods)**

E-Commerce – Business Models for E-Commerce – Enabling Technologies of the World Wide Web – E-Marketing – E-Security – E-Payment Systems – E-Customer Relationship Management.

CONTACT PERIODS:

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

Text Books:

1. Jeffrey C.Jackson, "Web Technologies: A computer science perspective", Pearson education, 2011.

2. P.T.Joseph, S.J , "E-Commerce, An Indian perspective", PHI learning Private Limited, 5th edition, 2015.

Reference Books:

1. *Kogent solutions, "Web Technologies-HTML, JavaScript, PHP, java, JSP,ASP.NET, XML and AJAX- Black Book", Dreamtech press.*
2. *Robert W. Sebesta," Programming the World Wide Web", Pearson education, 8th edition, 2015.*
3. *Bryan Basham, "Kathy Sierra, Bert Bates, Head First Servlets and JSP", O'Reilly media, 2nd edition, 2008.*

COURSE OUTCOMES:

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

CO1: Conceive the structure of world wide web and communication between client and server. **[Familiarize]**
CO2: Create dynamic web pages using HTML, DHTML and JavaScript. **[Analyze]**
CO3: Develop and Deploy web applications using JSP, Servlets and PHP. **[Analyze]**
CO4: Process XML Documents and access simple web services. **[Analyze]**
CO5: Recognize the importance of web technologies in E-commerce. **[Familiarize]**

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
CO1	H												L	
CO2	H	L	L	H	M	L		L					H	L
CO3	H	L	L	H	M	L		L					H	L
CO4	H	L	L	H		M		M					M	L
CO5	H												L	
16IPC603	H	L	L	H	M	L		L					H	L

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

16IPC604 CRYPTOGRAPHY AND NETWORK SECURITY CATEGORY: PC

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

Course Objectives:

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

- Network security model in OSI Architecture and the basic symmetric and asymmetric cryptographic techniques.
- Concepts of number theory to perform encryption and decryption.
- Principles, algorithms of public key cryptosystem and various authenticating techniques.
- Internet protocol services for key management to provide security in various web services.
- Attacks, malicious software and principles of firewall to develop a trusted system.

UNIT – I INTRODUCTION (9 Periods)

Security goals and attacks – Services, mechanism and Techniques – Integer and Modular Arithmetic – Traditional symmetric key ciphers – Mathematics of cryptography

UNIT – II MODERN SYMMETRIC CIPHER (9 Periods)

Modern block ciphers – Modern stream ciphers – Data Encryption Standard – Advanced Encryption Standard – Encipherment using modern symmetric key cipher.

UNIT – III ASYMMETRIC KEY ENCRYPTION (9 Periods)

Mathematics of cryptography – RSA cryptosystem – ElGamal cryptosystem – Elliptic curve Cryptosystem – Message Integrity and Authentication.

UNIT – IV AUTHENTICATION AND KEY MANAGEMENT (9 Periods)

Cryptography hash functions – Digital Signatures – Entity Authentications – Symmetric key distribution – Kerberos – Symmetric key agreement – Public key distribution.

UNIT – V NETWORK AND SYSTEM SECURITY (9 Periods)

Electronic Mail Security: Pretty Good Privacy– S/MIME– SSL Architecture – Four Protocols – SSL message format – Transport layer security – Network layer security – IPSec – System Security.

CONTACT PERIODS:

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

Text Books:

1. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata-McGraw-Hill, 2008.

Reference Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practice", Prentice Hall, 6th edition, 2014.

2. Wenbo Mao,"Modern Cryptography: Theory and practice", Pearson Education, 1st edition, 2004.

3. Douglas R. Stinson, "Cryptography: Theory and Practice", CRC Press, 3rd edition, 2006.

COURSE OUTCOMES:

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

CO1: Convert plain text into cipher text using substitution and transposition techniques. **[Understand]**

CO2: Utilize the concepts of number theory such as Euclidean theorem to perform encryption and decryption. **[Understand]**

CO3: Apply the principles, algorithms of public key cryptosystems like RSA and hash functions like SHA for authentication. **[Understand]**

CO4: Apply the concepts of hash functions, Authentication and key management schemes [**Understand**]

CO5: Explain concepts, protocols and Architectures used in mail security, IP Security and web security [**Familiarize**]

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
CO1	M	H	H	H	M	M		M			L		H	M
CO2	M	H	H	H	M	M		M			L		H	M
CO3	M	H	H	H	M	M		M			L		H	M
CO4	M	H	H	H	M	M		M			L		H	M
CO5	M	H	H	H	M	M		M			L		H	M
16IPC604	M	H	H	H	M	M		M			L		H	M

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

16IPC607 WEB TECHNOLOGY LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- HTML web pages and Client side scripting.
- Development of web components like JSP, PHP and servlet.
- Database technologies used in web applications
- Representation and manipulation of data in web applications using XML documents.

LIST OF EXPERIMENTS

1. Image mapping and cascading style sheets
2. Client side scripting using JavaScript
3. Simple web application using Servlet
4. Simple web application using PHP
5. Simple web application using JSP
6. Application to demonstrate cookies and session management.
7. Database connectivity using Servlet and JSP/PHP
8. Form validation using AJAX.
9. Displaying an XML document from server in the form of HTML table in client side.
10. Programs using XML- Schema and XSLT/XSL

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 and validate web pages. **[Analyze]**
CO2: Develop web applications using JSP, PHP and Servlet.**[Analyze]**
CO3: Develop a web application to retain data across multiple requests.**[Analyze]**
CO4: Create a web page that will communicate with the server using AJAX.**[Analyze]**
CO5: Write java programs to process XML documents. **[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
CO1	H				M								L	
CO2	H	M	M		M						L		H	L
CO3	H	M	M		M						L		H	L
CO4	H	L			L								M	
CO5	H		M		M								M	
16IPC607	H	M	M		M						L		M	L

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

16IEE608 **MINI PROJECT** **CATEGORY: EEC**

	L	T	P	C
PREREQUISITES: Nil	0	0	8	4

Course Objectives:

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

- Hardware and software infrastructure required to build a solution for the chosen problem.
- Building a mathematical/logical model and develop IT solutions.
- Writing clear, precise and technical document along with team management.

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
CO1	H	H	H	H	H	M	M	M	M	M	M	M	H	M
CO2	H	H	H	H	H	M	M	M	M	M	M	M	H	M
CO3	H	H	H	H	H	M	M	M	M	M	M	M	H	M
CO4	H	H	H	H	H	M	M	M	M	M	M	M	H	M
CO5	H	H	H	H	H	M	M	M	M	M	M	M	H	M
16IEE608	H	H	H	H	H	M	M	M	M	M	M	M	H	M

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

16IHS701 **INDUSTRIAL MANAGEMENT** **CATEGORY: HS**

(Com mon to CSE and 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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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", Tata McGraw Hill, 2010.

2. Tripathy,P.C and Reddy,P.N, "Principles of Management", Tata McGraw Hill, 2010.

Reference Books:

1. *Joseph Massie, "Essentials of Management", Prentice Hall of India, 2007.*
2. *Prasad, L.M., "Principles and Practice of Management", Sultan Chand and Sons, 2010*
3. *Maxwell, C. John, "The 21 Irrefutable Laws of Leadership", Thomas Nelson Publishers, 1999.*
4. *Chandrani Singh, "Principles and Practice of management and Organizational Behaviour", Jain Books, 2016.*
5. *Templar Richard, "The Rules of Management", Pearson Education, 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. **[Analyze]**

CO2: Work as an effective team player utilizing the knowledge of the functions of Management. **[Understand]**

CO3: Take a strategically informed position in making and implementing high risk decisions. **[Understand]**

CO4: Effectively manage the intricacies of diversity of individuals in organizations. **[Understand]**

CO5: Practice a harmonious and interpersonally sound style of communication suitable to the situation and individuals involved. **[Understand]**

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
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
16IHS701					M	H		M	H	H	M	H	L	M

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

16IPC702 FUNDAMENTALS OF MACHINE LEARNING CATEGORY: PC

L	T	P	C
3	0	0	3

PREREQUISITE:

1. 16IBS3Z1 Engineering Mathematics –III
2. 16IBS401 Probability Random Processes and Queuing Theory

Course Objectives:

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

- Concepts of machine learning.
- Supervised and unsupervised learning and their applications.
- Theoretical and practical aspects of Probabilistic Graphical Models.
- Concepts and algorithms of reinforcement learning.
- Aspects of computational learning theory.

UNIT – I INTRODUCTION (9 Periods)

Machine Learning Overview – Examples of Machine Learning Applications – Mathematical foundations of machine learning – random variables and probabilities – Probability Theory –Bayesian Decision Theory.

UNIT – II SUPERVISED LEARNING (9 Periods)

Learning a Class from Example – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning-Noise – Learning Multiple classes – Regression – Model Selection and Generalization – Dimensions of a Supervised Machine Learning Algorithm.

UNIT – III UNSUPERVISED LEARNING (9 Periods)

Clustering – K-means – EM Algorithm – Mixtures of Latent Variable models – Supervised learning after clustering – Hierarchical Clustering – Choosing the number of clusters – The Curse of Dimensionality – Dimensionality Reduction – Factor analysis – Principal Component Analysis – Linear Discriminant analysis.

UNIT – IV MLP AND HIDDEN MARKOV MODELS (9 Periods)

Introduction – The Perceptron – Training a perceptron – Multilayer Perceptron – MLP as a universal approximator – Back propagation algorithm – Training procedures – tuning the network size – Introduction to HMM – Discrete Markov Processes – Hidden Markov Models – Three basic problems of HMM – Evaluation problem – Finding the state sequence –Learning model parameters – Continuous observations – HMM with input – Model selection in HMM.

UNIT – V ADVANCED LEARNING (9 Periods)

Combining multiple learners – Generating Diverse learners – Model Combination Schemes – voting – error correcting output codes – Bagging – Boosting – Stacked generalization Fine tuning an ensemble – Sampling – Basic sampling methods – Monte Carlo. Reinforcement Learning – K-Armed Bandit – Elements – Model-Based Learning – Value Iteration – Policy Iteration – Temporal Difference Learning – Exploration Strategies – Deterministic and Non-deterministic Rewards and Actions – Eligibility traces – Generalization – Partially Observable states.

CONTACT PERIODS:

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

Text Books:

1. *EthemAlpaydin,"Introduction to Machine Learning", Third Edition, MIT Press,2014.*
2. *Kevin P. Murphy, "Machine Learning A Probabilistic Perspective", First Edition, The MIT Press, 2012.*

Reference Books:

1. *Christopher Bishop,"Pattern Recognition and Machine Learning", Springer, 2007.*
2. *Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.*

COURSE OUTCOMES:

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

- **CO1:** Design a neural network for an application.**[Analyze]**
- **CO2:** Implement supervised learning algorithms for an application.**[Analyze]**
- **CO3:** Use a tool to implement typical clustering algorithms for different types of applications. **[Understand]**
- **CO4:** Design and implement an HMM for a sequence model type of application.**[Analyze]**
- **CO5:** Identify applications suitable for different types of machine learning with suitable justification.**[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
CO1	H	H	H	H	M		L	L	L	L	L	L	M	M
CO2	M	M	M	H			L	L	L	L	L	L	M	M
CO3	H	H	H	H	H								M	M
CO4	M	M	H	M			L	L	L	L	L	L	M	M
CO5	M	M	M	M		L	L		L		L	L	M	M
16IPC702	H	H	H	H	L	L	L	L	L	L	L	L	M	M

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

16IEE707 OPEN SOURCE AND TOOLS LABORATORY CATEGORY: EEC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Kernel installation and Virtualization
- Shell commands and Package management system
- GUI programming and Version control system
- Apache tomcat server and PHP
- Python programming and Network Interfacing

LIST OF EXPERIMENTS

1. Kernel configuration, compilation and installation
2. Virtualization environment
3. Compiling from source (auto, make)
4. Packet management system (RPM/DEB)
5. GUI programming (GTK / QT)
6. Version Control System (RCS / CVS / SVN)
7. Apache Tomcat Server
8. Running PHP (LAMP stack)
9. Running Python (Connecting MySQL)
10. Network interface (*ifconfig* command)

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: Configure Kernel and Create Virtual Environment **[Understand]**
CO2: Compile from source and configure packet repository **[Understand]**
CO3: Perform GUI programming and Version Controlling **[Understand]**
CO4: Develop a Web Application using Apache tomcat server and PHP **[Understand]**
CO5: Perform Database connectivity and network interfacing **[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
CO1		L	H			H	M	H					M	M
CO2	M	L	M		M								M	
CO3			M				M	M			M		L	M
CO4	L		H	L		L							M	L
CO5	L		M	L		L							M	L
16IEE707	L	L	M	L	L	L	L	M			L		M	L

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

16IPC708 MACHINE LEARNING LABORATORY CATEGORY: PC

L	T	P	C
0	0	4	2

PREREQUISITES: Nil

Course Objectives:

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

- Linear Regression
- Probabilistic Model
- Evolutionary algorithms, Genetic algorithms and Genetic Programming
- Neural Network and Support vector machines
- Ensemble methods, Clustering and Reinforcement Learning

LIST OF EXPERIMENTS

1. Linear Regression
2. Probabilistic Model
3. Evolutionary algorithms
4. Genetic algorithms
5. Genetic Programming
6. Neural Network
7. Support vector machines
8. Ensemble methods
9. Clustering
10. Reinforcement Learning

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: Classify using Linear Regression **[Understand]**

CO2: Implement probabilistic discriminative and generative algorithms for an application and analyze the results **[Analyze]**

CO3: Implement Genetic algorithms **[Understand]**

CO4: Implement Genetic Programming [**Understand]**

CO5: Identify applications suitable for different types of machine learning with suitable justification **[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
CO1	H	M	M	M	M	L	L	L	L	L	L	L	M	L
CO2	M	M	H	M	M	L	L	L	L	L	L	L	M	L
CO3	M	M	M	M	H	L	L	L	L	L	L	L	M	L
CO4	M	M	M	M	M	L	L	L	L	L	L	L	M	L
CO5	M	M	M	M	H	L	L	L	L	L	L	L	M	L
16IPC708	H	M	M	M	M	L	L	L	L	L	L	L	M	L

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

16IEE803 **PROJECT WORK** **CATEGORY: EEC**

	L	T	P	C
PREREQUISITES: Nil	0	0	16	8

Course Objectives:

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

- Real time problems related with IT industry.
- Consolidation of knowledge earned to build a better solution for identified problems.
- Presentation, documentation and demonstration of IT project/product.

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
CO1	H	H	H	H	H	M	H	M	M	H	H	M	H	H
CO2	H	H	H	H	H	M	H	M	M	H	H	M	H	H
CO3	H	H	H	H	H	M	H	M	M	H	H	M	H	H
CO4	H	H	H	H	H	M	H	M	H	H	H	M	H	H
CO5	H	H	H	H	H	M	H	M	M	H	H	M	H	H
16IEE803	H	H	H	H	H	M	H	M	M	H	H	M	H	H

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

16IPEX01 DATA MINING AND DATA WAREHOUSING CATEGORY: PE

L	T	P	C
3	0	0	3

PRE-REQUISITE:

1. 16IPC404 – Database systems

Course Objectives:

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

- Data preprocessing techniques.
- Data warehouse modeling.
- Classification and prediction methods.
- Clustering and outlier analysis.
- Concept of graph mining and multimedia data mining.

UNIT – I INTRODUCTION (9 Periods)

Data Objects and Attribute Types – Basic Statistical Descriptions of Data – Data Visualization – Measuring Data Similarity and Dissimilarity – Data Preprocessing – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization.

UNIT – II DATA WAREHOUSING (9 Periods)

Basic Concepts – Data Warehouse Modeling – Design and Usage – Implementation and Data Generalization – Data Cube Technology Concepts – Computation Methods – Sampling Cubes – Ranking Cubes – Multidimensional Data Analysis in Cube Space.

UNIT – III CLASSIFICATION AND PREDICTION (9 Periods)

Basic Concepts – Frequent Item Set Mining Methods – Classification – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Model Evaluation and Selection – Classification by Back Propagation – Other Classification Methods – Prediction – Accuracy and Error Measures– Evaluating the Accuracy.

UNIT – IV CLUSTER AND OUTLIER ANALYSIS (9 Periods)

Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering – Outlier Analysis – Outlier Detection Methods - Statistical Approach – Proximity based Approach.

UNIT – V GRAPH MINING AND MULTIMEDIA MINING (9 Periods)

Graph Mining – Mining Complex Data Types – Spatial Data Mining – Multimedia Data Mining– Text Mining – Mining the World Wide Web – Data Mining Applications.

CONTACT PERIODS:

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

Text Books:

1. *JieweiHan, MichelineKamber, "Data mining concepts and techniques", Morgan Kaufmann Publication, 3rd Edition, 2012.*

Reference Books:

1. *William H. Inmon, "Building the data ware house", Wiley Dreamtech Pvt Ltd., 4th edition, 2005.*
2. *Ian H.Witten, Eibe Frank, "Data Mining: Practical M/c Learning tools and techniques with Java implementation", Morgan Kaufmann Publication, 3rd edition, 2011.*
3. *K.P.Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining, theory and practice", PHI Pvt Ltd,1st edition, 2006.*
4. *Ronen Feldman, James Sangee, "The Text Mining Handbook: Advanced Approaches in analyzing unstructured data", Cambridge University Press, 2007.*

COURSE OUTCOMES:

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

CO1: Apply the preprocessing techniques. **[Understand]**
CO2: Model the data warehouse. **[Analyze]**
CO3: Classify and predict data for mining. **[Understand]**
CO4: Apply clustering methods and remove the irrelevant data using outlier analysis. **[Understand]**
CO5: Analyze graph mining, Multi relational data mining, spatial data mining and text mining and its applications. **[Analyze]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	M	H	H	M	H		L						H	L
CO2	M	H	H	M	H	L	L						H	L
CO3	M	H	H	L	M		L						H	L
CO4	M	H	H	M	H		L						H	L
CO5	M	M	H	H	H		L						H	L
16IPEX01	M	H	H	M	H	L	L						H	L

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

16IPEX02 MANAGEMENT INFORMATION SYSTEM CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Managing the information.
- Database design and modeling.
- Information governance and information integration.
- Information architecture.
- Information lifecycle management.

UNIT – I DATABASE MODELLING, MANAGEMENT AND DEVELOPMENT (9 Periods)

Database design and modeling – Business Rules and Relationship – Java Database Connectivity (JDBC) – Database connection Manager – Stored Procedures – Trends in Big Data systems – NoSQL – Hadoop HDFS – MapReduce – Hive and enhancements.

UNIT – II DATA SECURITY AND PRIVACY (9 Periods)

Program Security – Malicious code and controls against threats – OS level protection – Security – Firewalls – Network Security – Intrusion Detection Systems – Data Privacy principles, Laws and compliance.

UNIT – III INFORMATION GOVERNANCE (9 Periods)

Master Data Management (MDM) – Need for MDM – Privacy – Regulatory requirements and compliance – Data Governance – Synchronization and data quality management.

UNIT – IV INFORMATION ARCHITECTURE (9 Periods)

Principles of Information architecture and framework – Organizing information – Navigation systems and Labelling systems – Conceptual design – Granularity of Content.

UNIT – V INFORMATION LIFECYCLE MANAGEMENT (9 Periods)

Data retention policies – Confidential and Sensitive data handling – Lifecycle management costs – Archive data using Hadoop – Testing and delivering Big data applications – Data administration challenges.

CONTACT PERIODS:

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

Text Books:

1. *Alex Berson, Larry Dubov, "Master Data Management and Data Governance", Tata McGraw Hill, 2nd edition, 2011.*
2. *Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Prentice Hall, 4th edition 2006.*
3. *Peter Morville, Louis Rosenfeld, "Information Architecture for the World Wide Web", O'Reilly Media, 4th edition, 1998.*

Reference Books:

1. *Jeffrey A. Hoffer, Heikkitopi,V Ramesh, "Modern database management", Pearson education, 10th edition, 2012.*

COURSE OUTCOMES:

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

CO1: Design complex information system that meets regulatory requirements. **[Analyze]**
CO2: Analyze security and privacy aspects of information.**[Analyze]**
CO3: Define and manage organizational information. **[Understand]**
CO4: Identify the principles of information architecture**. [Familiarize]**
CO5: Use information life cycle management. **[Understand]**

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
CO1	L	L	M	H	H	M	L	M				L	M	L
CO2	L	L	M	M	M	H	L	M				L	M	L
CO3	L	L	M	L	L	L	L	M				L	L	L
CO4	L	L	M	L	L	L	L	M				L	L	L
CO5	L	L	L			L	L	M			H	H	L	M
16IPEX02	L	L	M	L	L	L	L	M			L	L	L	L

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

16IPEX03 **SOFTWARE TESTING** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Significance of software testing.
- Test case design.
- Types and levels of Software testing.
- Test management.
- Monitoring and controlling.

UNIT – I TESTING BASICS **(9 Periods)**

Purpose of Testing–Principles of Testing– Testing as an Engineering Activity– Role of Process in Software Quality– Testing as a Process– Basic Definitions–Software Testing Principles– The Tester's Role in a Software Development Organization– Origins of Defects– Defect Classes– The Defect Repository and Test Design– Defect Examples– Developer/Tester Support for Developing a Defect Repository.

UNIT – II TEST CASE DESIGN **(9 Periods)**

Introduction to Testing Design Strategies – The Smart Tester– Test Case Design Strategies–Using Black Box Approach to Test Case Design – Random Testing– Requirements based testing– Positive and Negative testing– Boundary Value Analysis– Decision Tables– Equivalence Class Partitioning – state based testing– cause and effect graphing – error guessing– compatibility testing – user documentation testing – Domain testing – Using the White Box Approach to Test case design– Test Adequacy Criteria– Static Testing vs Structural Testing– Code functional testing– Coverage and Control Flow Graphs–Covering Code Logic– Paths– Their Role in White box Based Test Design– Code complexity testing– Evaluating Test Adequacy Criteria.

UNIT – III LEVELS OF TESTING **(9 Periods)**

The Need for Levels of Testing– Unit Test– Unit Test Planning– Designing the Unit Tests– The Test Harness– Running the Unit tests and Recording results– Integration test– Designing Integration Tests– Integration Test Planning– Scenario testing– Defect base elimination – System Testing– Types of system Testing– Acceptance testing– Performance testing– Regression Testing– Internationalization testing– Ad-hoc testing– Alpha Beta Tests– Testing OO systems– Usability and accessibility testing.

UNIT – IV TEST MANAGEMENT **(9 Periods)**

People and organizational issues in testing– Organization structures for testing teams– Testing services– Test Planning– Test Plan Components– Test Plan Attachments– Locating Test Items– Test management– Test process–Reporting Test Results–The role of three groups in Test Planning and Policy Development–Introducing the test specialist–Skills needed by a test specialist– Building a Testing Group.

UNIT – V CONTROLLING AND MONITORING **(9 Periods)**

Software Test Automation– skills needed for automation–Scope of automation–Design and architecture for automation–Requirements for a test tool–Challenges in automation–Test metrics and measurements– Project– Progress and Productivity Metrics–Status Meetings– Reports and Control Issues– Criteria for Test Completion-SCM– Types of reviews – Developing a review program– Components of Review Plans-Reporting Review Results.

CONTACT PERIODS:

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

Text Books:

1. *Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.*
2. *Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson education, 2009.*

Reference Books:

1. *Borris Benzer, "Software Testing Techniques", International Thomson Computer Press, USA,2nd edition,2006.*
2. *RenuRajani, Pradeep Oak, "Software Testing: Effective Methods, Tools and Techniques", Tata McGraw Hill, 2003.*
3. *Sandeep Desai, AbhisekSrivastava, "Software testing: A Practical approach", Prentice Hall of India,2nd edition, 2012.*
4. *Ron Patton, "Software Testing", Sams Publishing, Pearson Education, 2nd edition, 2004.*
5. *Aditya P. Mathur, "Foundations of Software Testing: Fundamental algorithms and techniques", Dorling Kindersley Pvt. Ltd., Pearson Education,1st edition, 2011.*

COURSE OUTCOMES:

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

CO1: Apply the testing process to identify the defects in the software. **[Understand]**
CO2: Design the test case for black box and white box testing. **[Analyze]**
CO3: Perform the testing at various levels. **[Understand]**
CO4: Manage the testing Process. **[Familiarize]**
CO5: Automate, Control and Monitor the testing Process. **[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
CO1	L	H	M		H								H	
CO2	M	M	H	L	H								M	
CO3	L	M	M	L	H								M	
CO4	L	M	M	L							L		M	L
CO5	M	H	H	M	M	L		L		M	H		M	M
16IPEX03	M	M	M	L	H	L		L		L	L		M	L

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

16IPEX04 SOFTWARE PROJECT MANAGEMENT CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Project Management.
- Process Models and Effort estimation.
- Activity Planning.
- Project Management and Control.
- Establishing team work.

UNIT – I INTRODUCTION (9 Periods)

Conventional software management – Evolution of software economics – Improving software economics – Conventional vs Modern software project management.

UNIT – II PROCESS MODELS AND EFFORT ESTIMATION (9 Periods)

Software process and Process Models – Choice of Process models – Mental delivery – Rapid Application Development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II: A Parametric Productivity Model

UNIT – III ACTIVITY PLANNING (9 Periods)

Objectives – Project schedules – Sequencing and Scheduling Activities – Network Planning models – Forward Pass and Backward Pass techniques – Critical path method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules

UNIT – IV PROJECT MANAGEMENT AND CONTROL (9 Periods)

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis – Project tracking – Change control – Software Configuration Management – Contract Management.

UNIT – V STAFFING IN SOFTWARE PROJECTS (9 Periods)

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hack man job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Leadership – Team structures – Virtual teams – Stress – Health and Safety.

CONTACT PERIODS:

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

Text Books:

1. *Bob Hughes and Mikecotterell, "Software Project Management", Tata McGraw Hill, 5th edition, 2011.*
2. *Walker Royce, "Software Project Management-A Unified Framework", Pearson Education, 2004.*

Reference Books:

1. *Gopalaswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill,1st edition, 2006.*
2. *Rishabh Anand , "Software Project Management", S.K. Kataria & Sons, 2013.*
3. *Ashfaque Ahmed, "Software Project Management Process Driven Approach", Auerbach Publications, 2011.*
4. *PankajJalote, "Software Project Management in Practice", Pearson Education, 2002*.

COURSE OUTCOMES:

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

CO1: Differentiate conventional and modern software project. **[Familiarize]**
CO2: Describe process model and cost estimation.**[Understand]**
CO3: Categorize and prioritize actions for risk elimination.**[Analyze]**
CO4: Monitor the progress of a project and control changes to project requirements.**[Analyze]**
CO5: Explain the factors that influence people behavior in a project environment. **[Understand]**

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
CO1	M		H			H							M	L
CO2		M		H									M	
CO3	H		H	H					H				H	L
CO4		L								H	H		L	M
CO5	H		L	M									M	
16IPEX04	H	M	H	H		L			L	L	L		H	L

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

16IPEX05 **SOFTWARE QUALITY ASSURANCE** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Basic tenets of software quality and quality factors.
- Details of SQA Components.
- Software Quality infrastructure.
- Management Components of Software Quality.
- Software Quality Standards.

UNIT – I INTRODUCTION **(9 Periods)**

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors – McCalls quality model – SQA system – SQA architecture – Software Project life cycle Components – Pre-project quality components .

UNIT – II SQA COMPONENTS IN PROJECT LIFE CYCLE **(9 Periods)**

Integrating quality activities in the Project Life cycle– Reviews – Software Testing – Pre-maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT – III SOFTWARE QUALITY INFRASTRUCTURE **(9 Periods)**

Procedures and work instructions – Templates – Checklists – Staff training and certification – Corrective and preventive actions – Configuration management – Software change control – Configuration management audits – Documentation control – Storage and retrieval.

UNIT – IV SOFTWARE QUALITY MANAGEMENT & METRICS **(9 Periods)**

Project process control – Computerized tools – Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

UNIT – V STANDARDS, CERTIFICATIONS & ASSESSMENTS **(9 Periods)**

Quality management standards – ISO 9001 and ISO 9000-3 – Capability Maturity Models – CMM and CMMI assessment methodologies – Bootstrap methodology – SPICE Project – SQA project process standards – IEEE std 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.

CONTACT PERIODS:

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

Text Books:

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

Reference Books:

1. *Watts S Humphrey, "Managing the Software Process", Pearson Education Inc., 1999.*
2. *Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2nd edition, 1997.*
3. *Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Artech House Publishers, 3rd edition, 2007.*
4. Jeff Tian, "*Software Quality Engineering", John Wiley & Sons Publications, 2005.*

COURSE OUTCOMES:

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

CO1: Utilize SQA concepts in software development life cycle. **[Understand]**
CO2: Integrate SQA components into project life cycle. **[Analyze]**
CO3: Analyze the quality of software projects. **[Analyze]**
CO4: Analyze the concepts in preparing the quality plan and documents.**[Analyze]**
CO5: Adopt quality standards for software development. **[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
CO1	M		H		H								H	
CO2	H	H	H		H			L			H		H	M
CO3	M	M	M	M									M	
CO4	M		H						H				M	L
CO5	H		M	M						H			M	L
16IPEX05	M	H	H	M	H			L	L	L	L		M	L

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

16IPEX06 ENTERPRISE RESOURCE PLANNING CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Basics of ERP along with its benefits and risk.
- ERP technologies.
- Various business modules of ERP.
- ERP market and future trends in ERP.

UNIT – I INTRODUCTION (9 Periods)

Basic ERP Concepts – Justifying ERP Investments – Risks of ERP – Benefits of ERP.

UNIT – II RELATED TECHNOLOGIES (9 Periods)

Business Intelligence – e-Commerce and e-Business – Business Process Reengineering– Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM.

UNIT – III IMPLEMENTATION (9 Periods)

ERP Challenges – Transition Strategies – Life Cycle – Pre-implementation Tasks – Implementation Methodologies – Package selection – Project Teams – Vendors and Consultants – Data Migration – Training and Education – Project Management and Monitoring – Post Implementation Activities.

UNIT – IV ERP BUSINESS MODULES (9 Periods)

Success and Failure factors – Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing– Human Resources – Plant maintenance – Materials and Quality management – Marketing – Sales, Distribution and service.

UNIT – V ERP MARKET (9 Periods)

Marketplace Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Turbo Charge – Application Integration – ERP and E-Business – ERP II – Total quality management– Future Directions and Trends in ERP.

CONTACT PERIODS:

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

Text Books:

1. *Alexis Leon, "ERP DEMYSTIFIED", Tata McGraw Hill, 2nd edition, 2008.*

Reference Books:

1. *Vinod Kumar Garg, N. K. Venkitakrishnan, "Enterprise Resource Planning: Concepts and Practice", PHI Learning private limited, 2nd edition, 2011.*
2. *Rahul V.Altekar, "Enterprise wide Resource Planning, Theory and practice", PHI Learning private limited, 2009.*
3. *Mary Sumner, "Enterprise Resource Planning", Pearson Education, 2007.*
4. *Jim Mazzullo, "SAP R/3 for Everyone", Pearson, 2007.*

COURSE OUTCOMES:

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

CO1: Apply ERP Concepts and identify the benefits and risks. **[Understand]**

CO2: Apply ERP technologies like supply chain management, advanced planning systems, product data management in e-business. **[Understand]**

CO3: Describe project management for ERP implementation. **[Understand]**

CO4: Integrate business modules using manufacturing, sales and marketing. **[Analyze]**

CO5: Analyze ERP market and Future trends of ERP. **[Analyze]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1			H		M	H							M	L
CO2	M		H	M	H			L			H		M	M
CO3		H			H								M	
CO4	M		H		H								M	
CO5	H	H	H		H								H	
16IPEX06	M	H	H	M	H	L		L			L		M	L

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

16IPEX07 **E-COMMERCE** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Basics and e-commerce infrastructure.
- Business strategies used in e-commerce.
- Software used in e-commerce and security requirements.
- Payment systems and legal, ethical and other issues in e-commerce.

UNIT – I INTRODUCTION **(9 Periods)**

Introduction to E-Commerce – Evolution of E-Commerce –Development and growth of E-Commerce – E-Commerce framework – Anatomy of E-Commerce applications – E-Commerce consumer application – E-Commerce organization applications – Market forces influencing I-way – components of I-way – Technology infrastructure – Packet switched networks – Internet protocols and Internet connection options.

UNIT – II BUSINESS STRATEGIES FOR E-COMMERCE **(9 Periods)**

Revenue models for online businesses – Revenue models in transition – revenue strategy issues for online businesses – website usability – Web marketing strategies – market segmentation - market segmentation on the web – advertising on the web – E-mail marketing – branding on the web.

UNIT – III BUSINESS TO BUSINESS ACTIVITIES **(9 Periods)**

Purchasing – logistics and support activities in E-Commerce – EDI – EDI on the internet – Supply chain management using internet technologies – Electronic marketplaces and portals – Online auctions and related businesses – Virtual communities and web portals.

UNIT – IV E-COMMERCE SOFTWARE AND SECURITY **(9 Periods)**

Basic and advanced functions of Electronic commerce software – Electronic Commerce Software for small, midsize and large businesses – E-Commerce security: online security issues overview – Security for client computers – Communication channel security – Security for server computers.

UNIT – V PAYMENT SYSTEMS AND ENVIRONMENT FOR E-COMMERCE **(9 Periods)**

Online payment basics – Card payments – Electronic cash – Electronic wallets – Stored value cards – Internet technologies and the banking industry – The Legal Environment of Electronic Commerce – Use and Protection of Intellectual Property in Online Business – Online Crime –Terrorism and Warfare – Ethical Issues.

CONTACT PERIODS:

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

Text Books:

1. Gary P. Schneider, "Electronic commerce", Cengage learning, 11th edition, 2014.

Reference Books:

1. *Ravi Kalakota and Andrew B.Whinston, "Frontiers of Electronic Commerce", Pearson Education Asia, 1st edition, 2002.*
2. *Efraim Turban,* David*King,* Jae Kyu Lee, "*Electronic Commerce: A Managerial and Social Networks Perspective*", S*pringer, 8th edition, 2015.*
3. *Marilyn Greenstein,* Miklos A. Vasarhelyi, ecremmoC cinortcelE": Security, Risk Management and Control", *McGraw-Hill, 2nd edition, 2002.*

COURSE OUTCOMES:

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

CO1: Explain the basics of E-Commerce and its networking infrastructure. **[Familiarize]**

CO2: Recognize suitable E-Commerce business strategies for marketing, branding, advertising and market segmentation. **[Analyze]**

CO3: Apply business to business activities like EDI, supply chain management, e-auctions and e-market place. **[Analyze]**

CO4: Identify software, hardware and security requirements for e-business. **[Analyze]**

CO5: Incorporate right payment systems and satisfy all legal and ethical requirements for business. **[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
CO1	H												L	
CO2	H	M				L				L			M	L
CO3	H					M				L			M	L
CO4	H		L	L	L								M	
CO5	H					H	H	H					M	H
16IPEX07	H	L	L	L	L	M	L	L		L			M	L

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

16IPEX08 **INFORMATION RETRIEVAL** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Basic knowledge of information retrieval.
- Querying.
- Text operations and User Interface.
- Multimedia Information retrieval.
- Applications of Information Retrieval.

UNIT – I INTRODUCTION **(9 Periods)**

Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models – Structured Text Retrieval Models – Retrieval Evaluation.

UNIT – II QUERYING **(9 Periods)**

Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis – Text and Multimedia languages.

UNIT – III TEXT OPERATIONS AND USER INTERFACE **(9 Periods)**

Document Preprocessing – Clustering – Text Compression – Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching – User Interface and Visualization – Human Computer Interaction– Access Process – Starting Points –Query Specification – Context – User relevance Judgement – Interface support for the Search.

UNIT – IV MULTIMEDIA INFORMATION RETRIEVAL **(9 Periods)**

Data Models – Query Languages – Spatial Access Models – Generic Approach – One Dimensional Time Series– Two Dimensional Color Images – Feature Extraction.

UNIT – V APPLICATIONS **(9 Periods)**

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers –Online IR systems – Online Public Access Catalogs – Digital Libraries – Architectural Issues – Document Models – Representations and Access – Prototypes and Standards.

CONTACT PERIODS:

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

Text Books:

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval", Pearson Education Asia, 2nd edition, 2005.

Reference Books:

1. Chowdhury. G.G, "Introduction to Modern Information Retrieval", Neal-Schuman Publishers, 2nd edition, 2003.

2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Pearson Education,2nd edition, 2000.

3. David A. Grossman, Ophir Frieder, "Information Retrieval: Algorithms and Heuristics", Academic Press, 2nd edition, 2000.

4. Charles T. Meadow, Bert R. Boyce, Donald H. Kraft, "Text Information Retrieval Systems", Academic Press, 3rd edition, 2000.

COURSE OUTCOMES:

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

CO1: Explain the basics of information retrieval. **[Understand]**
CO2: Analyze query operation. **[Analyze]**
CO3: Analyze text operations and user interface. **[Analyze]**
CO4: Retrieve the information in multimedia system. **[Understand]**
CO5: Design efficient search engine to retrieve web related information. **[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
CO1	H					L							L	L
CO2	H	H	H	H		L							H	L
CO3	H	H	H	H		L							H	L
CO4	H	H	H	H	H	M			H	H			H	M
CO5	H	H	H	H	H	M			H	H			H	M
16IPEX08	H	H	H	H	M	L			M	M			H	M

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

16IPEX09 TECHNOLOGIES AND USE OF INTERNET OF THINGS **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Vision of IoT from a global context.
- Basics of Internet of Things.
- IoT protocols.
- IoT in Cloud and Hadoop Environment.

UNIT – I INTRODUCTION **(9 Periods)**

Introduction–Physical Design of IoT–Logical Design of IoT–IoT Enabling Technologies–IoT Levels and Deployment Templates–Domain specific IoTs: Home Automation–Cities–Environment–Energy–Retail–Logistics–Agriculture–Industry–Health and Lifestyle.

UNIT–II M2M AND IoT SYSTEM MANAGEMENT WITH NETCONF-YANG **(9 Periods)**

M2M Introduction – Difference between IoT and M2M – SDN and NFV for IoT – IoT System Management with NETCONF-YANG – Need for IoT Systems Management – Simple Network Management Protocol – Network Operator Requirements – NETCONF-YANG – IoT Design Methodology.

UNIT – III PREPARING OUR IoT PROJECTS **(9 Periods)**

Creating the sensor project – Creating the actuator project – Creating a controller – Creating a camera.

UNIT – IV PROTOCOL **(9 Periods)**

HTTP–HTTP support to the sensor, actuator and controller –CoAP Protocol – Making HTTP binary – Adding CoAP to our Sensors, actuator and controller – MQTT Protocol – Publishing and subscribing – Adding MQTT support to the Sensors, actuator and controller – XMPP Protocol.

UNIT – V IOT IN CLOUD AND HADOOP ENVIRONMENT **(9 Periods)**

WAMP – AutoBahn for IoT – Xively Cloud for IoT – Python Web Application Framework – Django – Designing a RESTful Web API – AWS for IoT – SkyNet IoT Messaging Platform – Data Analytics for IoT – Apache Hadoop –Map Reduce for Batch Data Analysis – Apache Oozie – Apache Spark –Apache Storm – Using Apache Storm for Real – Time Data Analysis.

CONTACT PERIODS:

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

Text Books:

1. *Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", VPT, 1st edition, 2014.*
2. *Peter Waher, "Learning Internet of Things", PACKT Publishing, 2015.*

Reference Books:

1. *Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st edition, 2013.*
2. *Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Academic Press, 1st edition, 2014.*

COURSE OUTCOMES:

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

CO1: Explain the basics of IoT. **[Understand]**
CO2: Differentiate M2M between IoT. **[Understand]**
CO3: Develop projects based on IoT**. [Analyze]**
CO4: Explore the IoT Protocols**. [Understand]**
CO5: Use IoT in Cloud and Hadoop Environment. **[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
CO1	H	H	H							L	L	L	M	L
CO2	H	H	H							L	L	L	M	L
CO3	H	H	H							L	L	L	M	L
CO4	H	H	H							L	L	L	M	L
CO5	H	H	H							L	L	L	M	L
16IPEX09	H	H	H							L	L	L	M	L

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

16IPEX10 **CLOUD COMPUTING** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Overview of computing paradigm.
- Cloud computing architecture and its service models.
- Representation of different virtualization techniques.
- Service Management in cloud computing.
- Applications related to cloud computing.

UNIT – I INTRODUCTION **(9 Periods)**

Principles of Parallel and Distributed Computing – Eras of Computing – Parallel vs Distributed Computing – Hardware Architecture for Parallel Processing – Approaches to Parallel Programming – Levels of Parallelism– Distributed System – Technologies for Distributed Computing – Remote Procedure Call – Distributed Object Frameworks –Service Oriented Computing – Cloud Computing Reference Model – Historical Developments – Building Cloud Computing Environment– Application Development – Infrastructure and System Development – Computing Platforms and Technologies.

UNIT – II CLOUD COMPUTING ARCHITECTURE **(9 Periods)**

Introduction – Cloud Reference Model – Architecture– Infrastructure / Hardware as a Service – Platform as a Service – Software as a Service– Types of Clouds – Public Clouds – Private Clouds – Hybrid Clouds – Community Clouds– Open Challenges – Cloud Definition – Cloud Interoperability and Standards – Scalability and Fault Tolerance – Security – Trust and Privacy – Organizational aspects.

UNIT – III VIRTUALIZATION **(9 Periods)**

Introduction – Characteristics of Virtualized Environments – Taxonomy of Virtualization Techniques – Execution Virtualization – Other Types of Virtualization – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Xen Paravirtualization – VMware Full Virtualization– Microsoft Hyper-V.

UNIT – IV DATA INTENSIVE COMPUTING AND CLOUD PLATFORMS **(9 Periods)**

Characterizing Data – Intensive Computations – Challenges – Technologies for Data – Intensive Computing – Storage Systems – Programming – Introducing the Map Reduce Programming Model – Cloud Platforms in Industry – Amazon Web Services – Compute Services – Storage Services – Communication Services – Google App Engine – Microsoft Azure.

UNIT – V APPLICATIONS AND MANAGEMENT OF CLOUD **(9 Periods)**

Scientific Applications – Business and Consumer Applications – Energy Efficiency in Clouds – Energy – Efficient and Green Cloud Computing Architecture – Market Based Management of Clouds – Market Oriented Cloud Computing – Reference Model for MOCC – Federated Clouds / Inter Cloud – Characterization and Definition – Cloud Federation Stack – Aspects of Interest – Technologies for Cloud Federations – Third Party Cloud Services.

CONTACT PERIODS:

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

Text Books:

1. *RajkumarBuyya, Christian Vecchiola, S ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, 1st edition, 2013.*
2. *Nikos Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications" Springer, 2012.*

Reference Books:

1. *Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley - India, 1st edition, 2011.*
2. *Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley- India, 1st edition, 2010.*

COURSE OUTCOMES:

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

CO1: Identify the characteristics and properties of Cloud computing. **[Familiarize]**
CO2: Analyze the architecture of Cloud computing stack. **[Analyze]**
CO3: Differentiate between service and deployment model. **[Understand]**
CO4: Represent the construction of Service Level Agreement in Cloud computing. **[Understand]**
CO5: Understand different application of cloud. **[Understand]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	M	L	M	M	L	L	M				M		M	L
CO2	M	L	M	M	L	L	M				M		M	L
CO3	M	L	M	M	L	L	M				M		M	L
CO4	M	L	M	M	L	L	M				M		M	L
CO5	M	L	M	M	L	L	M				M		M	L
16IPEX10	M	L	M	M	L	L	M				M		M	L

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

16IPEX11 **ADVANCED DATA STRUCTURES** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Use of advanced data structures
- Space and time requirements of a given algorithm
- Different algorithmic techniques

UNIT – I BASIC ALGORITHMS (9 Periods)

Asymptotic Notation– Recursion– Divide and Conquer Paradigm– Basic Data Structures – Fast Fourier Transform.

UNIT – II SORTING AND SEARCHING (9 Periods)

Sorting – Merge Sort – Bucket and Radix Sort– Medians and Order Statistics – Searching – Priority Queues and Heaps– Dictionaries– Hash Tables– Bloom Filters– Binary Search Trees– Interval Trees.

UNIT – III PATTERN MATCHING AND UNION (9 Periods)

Pattern Matching Algorithms – Brute Force – Boyer-Moore Algorithm – Knuth Morris Pratt Algorithm – Standard Tries – Compressed Tries and Suffix Tries – Union – Find – Range Trees – Fractional Cascading.

UNIT – IV GRAPH ALGORITHMS (9 Periods)

DFS – BFS – Topological Sorting – Shortest Path Algorithms – Network Flow Problems – Graph Coloring Problems – Bi-Connected Graphs – Articulation Point.

UNIT – V ALGORITHM DESIGN (9 Periods)

Design Techniques – Divide and Conquer – Dynamic Programming – Greedy Algorithm – Backtracking – Local Search Algorithms – Lower Bound Theory – NP Completeness – Approximation Algorithms.

CONTACT PERIODS:

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

Text Books:

1. *S.Sahni, "Data structures- Algorithms and Applications in C++", Universities Press Orient Longman Pvt. Ltd, 4th edition, 2014.*
2. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein , "Introduction to Algorithms", MIT Press and PHI, 3rd edition, 2010.*

Reference Books:

1. *Tanenbaum A.S, Langram Y, Augestien M.J., "Data Structures using C & C++", Prentice Hall of India, second edition, 2002.*
2. *A.V. Aho, J.E. Hopcroft, and J.D. Ullman, "Data Structures and Algorithms", Addison Wesley, USA, 1983.*
3. *Michael T.Goodrich, R.Tamassia and Mount, "Data structures and Algorithms in C++", John Wiley and Sons, 2nd edition, 2011.*

COURSE OUTCOMES:

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

- **CO1:** Implement basic algorithm techniques. **[Analyze]**
- **CO2:** Analyze sorting and searching techniques. **[Analyze]**
- **CO3:** Understand pattern matching and union sets. **[Understand]**
- **CO4:** Implement different graph algorithm. **[Analyze]**
- **CO5:** Apply appropriate design techniques for solving real time applications. **[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
CO1	H	M	L	M			L	L			L		M	L
CO2	H	H	L	M			L	L			L		H	L
CO3	H	M	L	M									M	
CO4	H	H	L	M	L		M	L			M		H	M
CO5	H	H	H	H	L		M	L			M	L	H	M
16IPEX11	H	H	L	M	L		M	L			M	L	H	M

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

16IPEX12 FOUNDATIONS OF INFORMATION SECURITY CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Basics of Information Security.
- Legal, ethical and professional issues in Information Security.
- Risk management.
- Various standards in information security.
- Technological aspects of Information Security.

UNIT – I INTRODUCTION (9 Periods)

History – Critical Characteristics of Information – CNSS Security Model – Components of an Information System – Balancing Security and Access – Security SDLC – Security Professionals and Organization – Communities of Interest.

UNIT – II SECURITY INVESTIGATION (9 Periods)

Need for Security – Business Needs – Threats – Attacks – Secure Software Development – Legal, Ethical and Professional Issues – Law and Ethics in Information Security – Relevant U.S. Laws – International Laws and Legal Bodies – Ethics and Information Security – Codes of Ethics and Professional Organizations.

UNIT – III RISK MANAGEMENT (9 Periods)

An Overview of Risk Management – Risk Identification – Risk Assessment – Risk Control Strategies – Quantitative Versus Qualitative Risk Control Practices – Risk Management Discussion Points.

UNIT – IV PLANNING FOR SECURITY (9 Periods)

Information Security Planning and Governance – Blueprint for Security – Information Security Policy – Standards and Practices – ISO 17799/BS 7799 – NIST Models –VISA International Security Model – Design of Security Architecture – Planning for Continuity.

UNIT – V SECURITY TECHNOLOGY (9 Periods)

Access control – Firewalls – Protecting Remote connections – Intrusion Detection and Prevention Systems – Other Security Tools – Honeypots – Honeynets – Padded Cell Systems – IDPS – Scanning and Analysis Tools – Cryptography – Access Control Devices – Physical Security – Security and Personnel.

CONTACT PERIODS:

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

Text Books:

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 6th edition, 2012*

Reference Books:

1. *Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 6th edition, 200.4*
2. *Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 5th edition, 2003.*
3. *Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.*

COURSE OUTCOMES:

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

CO1: Gain some basic knowledge about information security.**[Familiarize]**
CO2: Solve the legal, ethical and professional issues in information security.**[Analyze]**
CO3: Understand Risk Management.**[Familiarize]**
CO4: Construct Security architecture and understand various standards. [**Understand]**
CO5: Understand the technological aspects of information security.**[Familiarize]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	H	H	H										H	
CO2	H	H	H										H	
CO3	H	H	H										H	
CO4	H	H	H										H	
CO5	H	H	H										H	
16IPEX12	H	H	H										H	

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

16IPEX13 **DISTRIBUTED SYSTEMS** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PRE-REQUISITE:

1. 16IPC405 Operating Systems
2. 16IPC503 Data Communication and Networking

Course Objectives:

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

- Characteristics of distributed system
- Synchronizing physical and logical clock, debugging and mutual exclusion in distributed environment
- Working principles of distributed transaction and concurrency protocols, Name Services concept of replication.

UNIT – I CHARACTERIZATION OF DISTRIBUTED SYSTEMS (9 Periods)

Basic concepts – Computer architecture – CISC – RISC – Multicore – Computer networking – ISO/OSI Model – Evolution of Operating Systems – Introduction to Distributed Computing Systems (DCS) – DCS design goals – Transparencies – Fundamental issues – Distributed Coordination – Temporal ordering of events – Lamport's logical clocks –Vector clocks – Ordering of messages – Physical clocks – Global state detection.

UNIT – II PROCESS SYNCHRONIZATION (9 Periods)

Process synchronization – Distributed mutual exclusion algorithms – Performance matrix – Interprocess communication – Message passing communication – Remote procedure call – Indirect Communication – Group communication – publish – subscribe systems – Message Queues – Shared memory approaches.

UNIT – III NAME SERVICES (9 Periods)

Introduction – Name Services and DNS – Directory and Discovery services – Distributed Debugging – Coordination and Agreement – Distributed Mutual Exclusion – Elections – Multicast Communication.

UNIT – IV TRANSACTION AND CONCURRENCY CONTROL (9 Periods)

Transactions and concurrency control – Transactions – Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Distributed Transactions – Flat and nested distributed transactions – Atomic commit protocols – Concurrency control in distributed transactions – Distributed deadlocks – Transaction recovery.

UNIT – V REPLICATION (9 Periods)

Replication – System model – Group communication – Fault tolerant services – Transactions with replicate data – Distributed Shared Memory – Design and Implementation Issues – Sequential Consistency and Ivy – Release Consistency and Munin.

CONTACT PERIODS:

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

Text Books:

1. *G. Coulouris, J. Dollimore,Tim Kindberg,Gordon Blair , "Distributed Systems Concepts and Design", Pearson Education, fifth edition, 2011.*
2. *M. Singhal, N.G. Shivaratr , "Advanced Operating Systems", McGraw Hill, 2001.*

Reference Books:

1. *Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms" , Pearson Education, 2nd edition, 200.7*
2. *Liu M.L, "Distributed Computing, Principles and Applications", Pearson Education, 1st edition, 2004.*

COURSE OUTCOMES:

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

CO1: Describe the characteristics of distributed systems.**[Understand]**
CO2: Illustrate inter process communication using RPC, Process and Threads.**[Understand]**
CO3: Name and discover the services in Distributed systems. **[Analyze]**
CO4: Show how the ACID properties are satisfied in Distributed transactions. **[Analyze]**
CO5: Describe the issues related to the high availability of the services in Distributed systems. **[Understand]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	H	H	H	H	L				L		L	L	H	L
CO2	H	H	H	H	L			L	L		L	L	H	L
CO3	H	H	H	H	L			L	L		L	L	H	L
CO4	H	H	H	H	L				L		L	L	H	L
CO5	H	H	H	H	L				L		L	L	H	L
16IPEX13	H	H	H	H	L			L	L		L	L	H	L

L–Low, M–Moderate (Medium) and H–High

16IPEX14 **SOFT COMPUTING** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Introduction to Genetic Algorithms.
- Advances in Genetic Algorithms.
- Basic concepts of Neural networks.
- Artificial Neural networks.
- Fuzzy set and Fuzzy logic.

UNIT – I GENETIC ALGORITHMS **(9 Periods)**

Creation of Offsprings – Working Principle – Encoding – Fitness Function – Reproduction – Genetic Modeling – Inheritance operators – Crossover – Inversion and Deletion – Mutation operator – Bitwise Operators – Generational Cycle – Convergence of Genetic Algorithm – Applications – Multilevel Optimization – Real life problem – Differences and similarities between GA and other traditional methods.

UNIT – II ADVANCES IN GENETIC ALGORITHMS **(9 Periods)**

Traditional Optimization and Search Methods – Schemata – Schema Theorem– Two and K–Arm Bandit Problem–Improvement in Basic Techniques – Selection Schemes– Scaling Mechanism– Ranking Procedures– Advances in GA– Theoretical Foundations of Genetic Algorithms–Genetic Algorithms in Engineering and Optimization–Genetic Algorithms in Natural Evolution– Applications.

UNIT – III FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS **(9 Periods)**

Structure and Function of a single neuron: Biological neuron, artificial neuron– Linear separability– Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA— Supervised Learning of Neural Networks – Unsupervised Learning

UNIT – IV TYPES AND APPLICATION OF NEURAL NETWORKS **(9 Periods)**

Perception Networks – AI versus ANN–Introduction of MLP – Feed Forward Networks – Feedback Networks – Adaptive Resonance theory — Reinforcement Learning – Application of Artificial neural network – Probabilistic Reasoning–Applications of Neural Networks– Pattern Recognition–Image Compression–Communication–Control systems.

UNIT – V FUZZY LOGIC **(9 Periods)**

Fuzzy set theory – Fuzzy set versus crisp set – Crisp relation & fuzzy relations – Fuzzy systems: crisp logic – fuzzy logic – Introduction & features of membership functions – Fuzzy rule base system: fuzzy propositions – formation – decomposition & aggregation of fuzzy rules – fuzzy reasoning – fuzzy inference systems– fuzzy decision making – Defuzzification methods – Applications of fuzzy logic.

CONTACT PERIODS:

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

Text Books:

1. *S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.*
2. *J.A.Freeman and B.M.Skapura, "Neural Networks, Algorithms applications and Programming Techniques", Pearson Wesley, 1990.*

Reference Books:

1. *James J. Buckley and Esfandiar Eslami, "Advances in Soft Computing–An Introduction to Fuzzy Logic and Fuzzy Sets", Springer International Edition, New Delhi, 2011.*
2. *Zurada J.M. "Introduction to Artificial Neural Systems", Jaico Publishing House,Bombay, 1994.*
3. *Zimmermann.H.J, "Fuzzy Set Theory and its Applications", Kluwer Academic Publishers, Dordrecht, Germany, 1st edition, 1991.*
4. *Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education India, 2004.*
5. *Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, second edition, 1997.*

COURSE OUTCOMES:

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

CO1: Explain the concepts of Genetic algorithms. **[Familiarize]**

CO2: Illustrate the Advancements in GA Applications. **[Analyze]**

CO3: Describe Neural networks and pattern recognition. **[Understand]**

CO4: Explain the concepts of Artificial neural networks. **[Familiarize]**

CO5: Apply Fuzzy set and Fuzzy logic for Decision making. **[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
CO1	L	H	M		H								H	
CO2	M	M	H	L	H								M	
CO3	L	M	M	L	H								M	
CO4	L	M	M	L							L		M	L
CO5	M	H	H	M	M	L		L		M	H		M	M
16IPEX14	M	M	M	L	H	L		L		L	L		M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX15 **XML AND WEB SERVICES** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PRE–REQUISITES:

1. 16IPC603 Web Technology

Course Objectives:

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

- Basics of XML, creating XML schemas and validating XML.
- Parsing, Transformation and Integration of XML for WEB.
- XML visualization and content management.
- Web services using SOAP, WSDL and UDDI.
- Architecture of semantic web and RDF

UNIT – I ESSENTIALS OF XML **(9 Periods)**

Fundamentals of XML – XML Document Structure – XML Content Models – Rules of XML Structure – Well Formed and Valid Documents – Namespaces in XML – Validating XML with DTD – Creating XML schemas – XFiles – XPath – XPointer – XLink.

UNIT – II BUILDING XML BASED APPLICATIONS **(9 Periods)**

Parsing XML Using Document Object Model – Parsing XML Using SAX – Transforming XML with XSL – Integrating XML with databases.

UNIT – III XML DATA FORMATTING **(9 Periods)**

Formatting XML for the web – Interactive Graphical Visualizations with SVG – XML and content management – XML Security.

UNIT – IV WEB SERVICES **(9 Periods)**

Architecting web services – Web services building blocks –Simple Object Access Protocol –Web Services Description language – Universal Description Discovery and Integration.

UNIT – V SEMANTIC WEB **(9 Periods)**

Basics of Resource Description Framework – RDF specifications and Data Model – RDF schema – Precursor of Semantic web – Architecture of semantic web.

CONTACT PERIODS:

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

TEXT BOOKS:

1. *Ron Schmelzer et al., "XML and Web Services", Pearson Education, 1st edition, 2008.*

REFERENCE BOOKS:

1. *Frank P. Coyle, "XML, Web Services and Data revolution", Pearson Education, 2002.*
2. *Keith Ballinger, ".NET Web Services Architecture and Implementation", Pearson Education, 1st edition, 2003.*
3. *David Chappell, "Understanding .NET A Tutorial and Analysis", Pearson Education, 2nd edition, 2002.*
4. *Kennard Scibner, Mark C.Stiver,"Understanding SOAP", SAMS publishing, 1st edition,2000.*
5. *Alexander Nakhimovsky, Tom Myers, "XML Programming: Web Applications and Web Services with JSP and ASP", Apress, 1st edition, 2002.*

COURSE OUTCOMES

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

CO1: Create and validate XML schema for an application. **[Analyze]**
CO2: Develop Web application using XML with DOM, SAX and XSL. **[Analyze]**
CO3: Format XML for web applications and manage content. **[Understand]**
CO4: Explore the building blocks of web services. **[Familiarize]**
CO5: Design and represent ontology using RDF. **[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
CO1	H	H	H	M	H	M		L	M	M	H		H	M
CO2	H	H	H	H	H	L		L	M	M	H		H	M
CO3	H	M	H	M	H	L		L	M	M	H		H	M
CO4	H	M	L	L	L	L		L	M	M	H		M	M
CO5	H	H	H	H	H	L		L	M	M	H		H	M
16IPEX15	H	H	H	H	H	L		L	M	M	H		H	M

L–Low, M–Moderate (Medium) and H–High

16IPEX16 **SEMANTIC WEB** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES:

1. 16IPC603 Web Technology

Course Objectives:

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

- Different languages used in the context of semantic web.
- Semantic web technologies and methodologies for structuring web.
- Ontology management and tools used for Ontology annotation.
- Logic and inference in Semantic web.
- Tools and Applications of semantic web.

UNIT – I INTRODUCTION **(9 Periods)**

Introduction to syntactic web and semantic web – Evolution of the web – Visual and Syntactic web – Levels of Semantics – Metadata for web information – Semantic web architecture and technologies – Contrasting Semantic with Conventional Technologies– Semantic Modeling –Potential of semantic web solutions – Challenges of adoption

UNIT – II STRUCTURING AND DESCRIBING WEB RESOURCES **(9 Periods)**

Structured Web Documents–XML– Structuring – Namespaces – Addressing – Querying – Processing RDF and Semantic Web – Basic Ideas – RDF Specification – RDF Syntax– XML and Non-XML – RDF elements – RDF relationship– Reification–Container and collaboration – RDF Schema – Editing– Parsing and Browsing RDF/XML–RQL–RDQL–SPARQL.

UNIT – III ONTOLOGY **(9 Periods)**

Ontology movement – OWL Specification, Elements and Constructs – Simple and Complex – Ontology Engineering – Constructing Ontologies – Reusing Ontologies – On-To-Knowledge Semantic Web Architecture.

UNIT – IV LOGIC AND INFERENCE **(9 Periods)**

Description Logics – Rules – Monotonic Rules – Syntax – Semantics and examples – Non-Monotonic Rules – Motivation– Syntax and Examples – Rule Markup in XML– Monotonic Rules and Non-Monotonic Rules– Rule Languages – RuleML.

UNIT – V SEMANTIC WEB TOOLS AND APPLICATIONS **(9 Periods)**

Case Study on Development Tools for Semantic Web – Protégé – Jena Framework – Applications – Semantic Desktop – Semantic Wikis – E-Learning – Application in Science – Business.

CONTACT PERIODS:

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

Text Books:

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, "A Semantic Web Primer", The MIT Press, 3rd Edition, 2012.

2. Dean Allemang and James Hendler, "Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL", Morgan Kaufmann, 2nd Edition, 2011.

Reference Books:

1. Liyang Yu, "A Developer's Guide to the Semantic Web", Springer, 2nd edition, 2011.

2. Pascal Hitzler, Markus *Krotzsch,* Sebastian Rudolph, "*Foundations of Semantic Web Technologies", Taylor and Francis, 2010.*

COURSE OUTCOMES:

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

- **CO1:** Understand and apply the semantic web technologies and methodologies. **[Understand]**
- **CO2:** Design applications using semantic web tools. **[Analyze]**
- **CO3:** Use RDF and OWL to structure and query from semantic web applications. **[Analyze]**
- **CO4:** Infer the knowledge from semantic web. **[Analyze]**
- **CO5:** Use appropriate tools for the development of semantic web. **[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
CO1	H	M	M	M	M					L	L		M	L
CO2	M	M	H	M				M	L	L	L		M	L
CO3	M	M	M	M	H	L		L		L	L		M	L
CO4	M	M	M	M	M		H			L	L		M	L
CO5	M	M	M	M	H	L			L	L	L		M	L
16IPEX16	M	M	M	M	M	L	M	M	L	L	L		M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX17 SERVICE ORIENTED ARCHITECTURE CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Characteristics, benefits and evolution of service oriented architecture.
- Activity management, communication and composition of web services.
- Principles and layers of service orientation.
- Service oriented delivery strategies, analysis and design of web services.
- Concepts used in service orientation and object orientation.

UNIT – I FUNDAMENTALS OF SOA AND WEB SERVICES (9 Periods)

Fundamentals of service oriented architecture – Common characteristics of SOA - Benefits of SOA – Evolution of SOA – SOA timeline – Web services – Message exchange patterns – Service activity – Coordination – Atomic transactions – Business activities – Orchestration – Choreography.

UNIT – II WEB SERVICE ORIENTATION (9 Periods)

Addressing– Reliable messaging– Correlation– Policies– Metadata exchange– Security– Notification and eventing – Service orientation–Anatomy of a service oriented architecture – Common principles of service orientation – Service layers– Service layer abstraction– Application service layer– Business service layer– Orchestration service layer– Agnostic services.

UNIT – III SERVICE ORIENTED ANALYSIS (9 Periods)

SOA delivery strategies – SOA delivery lifecycle phases – Top-down strategy – Bottom-up strategy – Agile strategy – Introduction to service oriented analysis – Benefits of a business centric SOA – Deriving business services – Service modeling – Step by step process – Classifying service model logic.

UNIT – IV SERVICE ORIENTED DESIGN (9 Periods)

Introduction – WSDL– Related schema language basics – WSDL language basics – SOAP language basics – Service interface design tools – Steps to composing SOA – Service design overview – Entity centric business service design – Application service design – Task centric business service design.

UNIT – V WEB SERVICES EXTENSIONS (9 Periods)

WS-BPEL language basics – WS-Coordination overview – Service oriented business process design – Comparison of service orientation and object orientation –Tale of two design paradigms – Comparison of goals – Comparison of fundamental concepts and design principles.

CONTACT PERIODS:

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

Text Books:

1. *Thomas Erl, " Service–Oriented Architecture: Concepts, Technology, and Design", Prentice Hall, 1st edition, 2005.*

Reference Books:

1. *Thomas Erl, "SOA Principles of Service Design", The Prentice Hall Service–Oriented Computing Series from Thomas Erl, 1st edition, 2008.*
2. *Newcomer, Lomow,"Understanding SOA with Web Services", Pearson Education, 1st edition, 2005.*
3. *Frank P.Coyle, "XML, Web services and the data revolution", Pearson education, 1st edition, 2002.*
4. *Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services, An Architect's Guide", Pearson Education, 2004.*

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of service oriented architecture and web services. **[Familiarize]**
CO2: Explain service orientation principles and service layers of SOA. **[Familiarize]**
CO3: Explore various service delivery strategies and service modeling. **[Familiarize]**
CO4: Use the basic tools and languages for service oriented design. **[Understand]**
CO5: Compare service and object orientation methodologies. **[Familiarize]**

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
CO1	M	H	M	H	M	L	M	M					M	L
CO2	M	H	M	M	M	L	M	M					M	L
CO3	M	H	M	M	M	L	M	M					M	L
CO4	M	H	M	H	M	L	M	M					M	L
CO5	M	H	M	H	M	L	M	M					M	L
16IPEX17	M	H	M	H	M	L	M	M					M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX18 **VIRTUALIZATION TECHNIQUES** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Virtualization concepts.
- Virtualized infrastructure design.
- Operating system virtualization.
- Storage virtualization.
- Network virtualization.

UNIT – I INTRODUCTION **(9 Periods)**

Architect for virtualization – Five step process – Discovery – Virtualization – Hardware maximization – Architectures – Manage virtualization.

UNIT – II VIRTUALIZATION INFRASTRUCTURE **(9 Periods)**

Build The Resource Pool – Planning and Preparation – Network Layer – Storage – Host Servers – Testing Levels– Virtual Lab Requirements – Reuse of Lab Deliverables – Management Practices

UNIT – III OS VIRTUALIZATION **(9 Periods)**

Hardware level virtualization – OS level Virtualization – Interception Technique on windows – Feather weight Virtual Machine– FVM states– Operations – Design of Virtualization layer – Implementation – System call log analysis – Limitations of FVM.

UNIT – IV STORAGE VIRTUALIZATION **(9 Periods)**

Storage virtualization – Enhanced Storage and Data Services – Implementation – High Availability – Performance – Capacity – SNIA storage management – Policy based service level management – Future of storage virtualization.

UNIT – V NETWORK VIRTUALIZATION **(9 Periods)**

Key Concepts – Architecture –Virtualized network Components – Logical Networks – Logical Network Design – Naming Conventions – Port profiles – Uplink port profiles, Network adapter port profiles – Logical switches– Planning logical switch design – Deployment – Operations.

CONTACT PERIODS:

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

Text Books:

1. *Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", McGraw–Hill, 2009.*
2. *Yang Yu,"OS–level Virtualization and Its Applications", ProQuest LLC, 2009.*
3. *Frank Bunn, Nik Simpson, Robert Peglar, Gene Nagle, "Technical Tutorial – Storage Virtualization", Storage Networking Association (SNIA), 2004.*

Reference Books:

1. *Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn Mitch Tulloch, "Microsoft System Center – Building a virtualized Network Solution", Microsoft press, 2004.*
2. *Matthew Portney, "Virtualization Essentials", John Wiley & Sons, 2nd edition, 2012.*
3. *Tim cerfing, Jeff buller, Chuck Enstall, Richard Ruiz, "Mastering Microsoft Virtualization", Wiley Publication, 1st edition, 2010.*
4. *William Von Hagen, "Professional Xen Virtualization", Wiley publication, 1st edition, 2008*
5. *Cody Bunch, "Automating vSphere with VMware vCenter Orchestrator: Technology Hands–on", Pearson Education, 1st edition, 2012.*

COURSE OUTCOMES:

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

CO1: Identify the needs of virtualization **[Understand]**
CO2: Use virtualization infrastructure.**[Understand]**
CO3: Create OS level virtualization. **[Understand]**
CO4: Identify storage level virtualization.**[Understand]**
CO5: Analyze network level virtualization.**[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
CO1	M	H	M	H	M	L	M	M					M	L
CO2	M	H	M	M	M	L	M	M					M	L
CO3	M	H	M	M	M	L	M	M					M	L
CO4	M	H	M	H	M	L	M	M					M	L
CO5	M	H	M	H	M	L	M	M					M	L
16IPEX18	M	H	M	H	M	L	M	M					M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX19 FUNDAMENTALS OF AUTOMATA THEORY CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- DFA, NFA and FA with epsilon transitions.
- Regular Expression and Regular Language.
- Context Free Grammar and Context Free languages.
- Pushdown Automata and Turing Machines.
- Undecidability and Intractable Problems.

UNIT – I FINITE AUTOMATA (9 Periods)

Mathematical Fundamentals – Central concepts of Automata Theory – Informal Picture of Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with epsilon transitions.

UNIT – II REGULAR EXPRESSIONS AND LANGUAGES (9 Periods)

Regular Expressions – Finite Automata and Regular Expressions – Applications of Regular Expressions – Algebraic Laws of Regular Expression – Properties of Regular Languages – Closure Properties and Decision Properties of Regular Languages – Equivalence and Minimization of Automata.

UNIT – III CONTEXT FREE GRAMMAR AND LANGUAGES (9 Periods)

Context Free Grammars – Parse trees – Applications of CFG – Ambiguity in Grammar and Languages – Normal forms for CFG – Pumping Lemma for Context Free Languages – Closure and Decision properties of CFL.

UNIT – IV PUSHDOWN AUTOMATA AND TURING MACHINES (9 Periods)

Definition – Languages of PDA – Equivalence of PDA and CFG – Deterministic PDA – Unsolvable Problems – Turing Machine – Programming Techniques for Turing Machine – Extensions to basic Turing Machine – Restricted Turing Machine – Turing Machine and Computers.

UNIT – V UNDECIDABILITY AND INTRACTABLE PROBLEMS (9 Periods)

Undecidability – Intractable Problems – Classes P and NP – NP Complete Problem – Restricted Satisfiability problem – Additional NP completeness problems.

CONTACT PERIODS:

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

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, " Introduction to Automata Theory Languages, and Computations", Pearson Education,3rd edition, 2013

Reference Books:

1. John C. Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw–Hill Publishing Company Limited,4th edition, 2011.

2. Mishra K L P and Chandrasekaran, "Theory of Computer Science, Automata Languages and Computation", Prentice – Hall of India Pvt. Ltd., 3rd edition, 2013.

3. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, third edition, 2012.

COURSE OUTCOMES:

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

CO1: Solve DFA, NFA and FA with epsilon transition. **[Understand]**
CO2: Apply Regular Expressions and Languages in Computation. **[Understand]**
CO3: Use Context Free Grammar and languages for parsing. **[Understand]**
CO4: Use PDA and Turing machine in problem solving. **[Understand]**
CO5: Understand Undecidable and Intractable problems. **[Understand]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	H	H											M	
CO2	H	H		L									M	
CO3	H	H		L	M								M	
CO4	H	H	M	M	H								H	
CO5	L	M		M	M								M	
16IPEX19	L	M	L	M	M								M	

L–Low, M–Moderate (Medium) and H–High

16IPEX20 VIRTUAL AND AUGMENTED REALITY CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Basic components, input devices and output devices of Virtual Reality systems.
- Computing architecture, Modeling and programming toolkits of VR systems.
- Various applications of VR systems.
- Basics and functional components of AR systems.
- Content, Interaction and applications of AR systems.

UNIT – I INTRODUCTION TO VIRTUAL REALITY (9 Periods)

The three I's of VR – Basic components of a VR system – VR input devices – 3D position trackers – Navigation and manipulation interfaces – Gesture interfaces – Output devices – Graphics – Sound – Haptic feedback.

UNIT – II VR ARCHITECTURE, MODELING AND PROGRAMMING (9 Periods)

VR computing architecture – Rendering pipeline – PC graphics architecture – Workstation based architecture – Distributed architecture – Modeling – Geometric modeling – Kinematics modeling – Behaviour modeling – VR Programming – Toolkits and scene graphs – Worldtoolkit – Java 3D – General haptics open software toolkits – Peopleshop.

UNIT – III VR APPLICATIONS (9 Periods)

Medical applications of VR – Education, Art and entertainment – Military applications – VR applications in manufacturing – VR in Robotics – Information visualization.

UNIT – IV AUGMENTED REALITY (9 Periods)

Introduction to Augmented Reality – Working of AR – Ingredients of AR –Hardware components of AR systems – Software components of AR systems.

UNIT – V AR APPLICATIONS (9 Periods)

Creating visual, audio and sensible contents – Interaction in AR – Application areas of augmented reality – Applying and evaluating augmented reality – Introduction to Mobile AR – Architecture of Mobile AR systems – Advantages/Disadvantages of Mobile AR.

CONTACT PERIODS:

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

Text Books:

1. Grigore C.Burdea, Philippe coiffet, "Virtual Reality: Technology", Wiley India, 2nd edition, 2003.

2. Alan B.Craig, "Understanding Augmented Reality: Concepts and Applications", Morgan Kaufmann publications, 1st edition, 2013.

Reference Books:

1. *Sherman, William R. and Alan B. Craig, "Understanding Virtual Reality – Interface, Application, and Design", Morgan Kaufmann, 2002.*
2. *Fei GAO, "Design and Development of Virtual Reality Application System", Tsinghua Press, March 2012.*
3. *Greg Kipper, Joseph Rampolla, "Augmented Reality: An Emerging Technologies Guide to AR", Syngress, 2013.*

COURSE OUTCOMES:

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

CO1: Identify and explain the components of VR systems.**[Understand]**
CO2: Model and program the VR systems **[Understand]**
CO3: Realize the importance and applications of VR systems**[Understand]**
CO4: Identify and explain the components of AR systems.**[Understand]**
CO5: Realize the importance and applications of AR systems**[Understand]**

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
CO1	H		M		L	L	L						M	L
CO2	H	H	H	M	L								H	
CO3	H					M	L						L	L
CO4	H		M		L	L	L						M	L
CO5	H	M	H	L	L	L	L						M	L
16IPEX20	H	L	M	L	L	L	L						M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX21 NATURAL LANGUAGE PROCESSING CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Techniques in Natural Language Processing.
- Natural Language Generation.
- Machine translation.
- Information retrieval techniques.

UNIT – I OVERVIEW AND LANGUAGE MODELING (9 Periods)

Origins and Challenges of NLP – Language and Grammar Processing – Indian Languages – NLP Applications – Information Retrieval – Language Modeling – Various Grammar based Language Models – Statistical Language Model.

UNIT – II WORD LEVEL AND SYNTACTIC ANALYSIS (9 Periods)

Regular Expressions – Finite State Automata – Morphological Parsing – Spelling Error Detection and correction – Words and Word classes – Part of Speech Tagging – Context Free Grammar – Constituency – Parsing – Probabilistic Parsing.

UNIT – III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING (9 Periods)

Meaning Representation – Lexical Semantics – Ambiguity – Word Sense Disambiguation – Cohesion – Reference Resolution – Discourse Coherence and Structure.

UNIT – IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION (9 Periods)

Architecture of NLG Systems– Generation Tasks and Representations – Application of NLG – Problems in Machine Translation – Characteristics of Indian Languages – Machine Translation Approaches – Translation involving Indian Languages

UNIT – V INFORMATION RETRIEVAL AND LEXICAL RESOURCES (9 Periods)

Design features of Information Retrieval Systems – Classical, Non-classical, Alternative Models of Information Retrieval – Valuation – World Net – Frame Net – Stemmers – POS Tagger – Research Corpora.

CONTACT PERIODS:

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

Text Books:

1. *Tanveer Siddiqui, U.S. Tiwary, " Natural Language Processing and Information Retrieval", Oxford University Press, 2008.*

Reference Books:

1. *Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd edition, 2008.*
2. *James Allen, "Natural Language Understanding", Benjamin/Cummings publishing company, 2nd edition, 1995.*

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of Natural Language. **[Understand]**
CO2: Analyze the Natural Language text. **[Analyze]**
CO3: Generate the Natural Language. **[Familiarize]**
CO4: Do Machine Translation. **[Understand]**
CO5: Apply Information Retrieval Techniques. **[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
CO1	H	M	L	L				L		M			M	M
CO2	H	M	M	L			M	L		M			M	M
CO3	H	M	H	M	M			L		M			M	M
CO4	H	M	H	M	H		M	L		M			H	M
CO5	H	M	H	M	H		M	L		M			H	M
16IPEX21	H	M	H	M	H		M	L		M			M	M

L–Low, M–Moderate (Medium) and H–High

16IPEX22 ARTIFICIAL INTELLIGENCE AND APPLICATIONS CATEGORY: PE

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Problem Search Strategies.
- Logical Reasoning.
- Natural Language Processing.
- Uncertainty and Reasoning.
- Learning and AI Applications.

UNIT – I PROBLEM SOLVING (9 Periods)

Introduction – Agents – Problem formulation – Uninformed Search strategies – Heuristics – Informed Search Strategies – Constraint Satisfaction.

UNIT – II LOGICAL REASONING (9 Periods)

Logical Agents – Propositional logic – Inferences – First Order Logic – Inference in First Order logic – Forward chaining – Backward chaining – Unification – Resolution.

UNIT – III NATURAL LANGUAGE PROCESSING (9 Periods)

Phases – Syntactic Processing – Semantic Analysis – Discourse and Pragmatic Processing – Statistical Natural Language Processing – Spell Checking – Parallel and Distributed AI.

UNIT – IV UNCERTAINTY (9 Periods)

Uncertainty – Review of Probability – Baye's Rule – Probabilistic Reasoning – Belief networks – Knowledge Engineering for Uncertain Reasoning – Other Approaches – Utility Theory – Decision Networks – Making Complex Decisions.

UNIT – V LEARNING AND AI APPLICATIONS (9 Periods)

Learning in Neural and Belief Networks – Reinforcement Learning – Explanation Based Learning – Robotics – Expert Systems – Fuzzy Logic Systems.

CONTACT PERIODS:

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

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd edition, 2009.

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw–Hill, 3rd edition, 2010.

Reference Books:

1. *Nils J Nilsson, "Artificial Intelligence – A New Synthesis", Morgan Kaufmann, 2007.*
2. *Mishra R B, "Artificial Intelligence", PHI Learning Pvt. Ltd., 2011.*
3. *Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI Learning Pvt. Ltd., 2010.*
4. *Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill, 2013.*

COURSE OUTCOMES:

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

- **CO1:** Solve problems using informed and uninformed searches.[**Familiarize]**
- **CO2:** Explore knowledge and reason it logically by FOL.[**Understand**]
- **CO3:** Explore statistical and syntactic approaches by Natural Language Processing with its tool. [**Understand**]
- **CO4:** Acquire knowledge of Probability theory and Belief Networks for handling uncertainty. [**Familiarize]**
- **CO5:** Describe the learning procedures for generating knowledge and applications of AI. **[Familiarize]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1			H		M	H							M	L
CO2	M		H	M	H			L			H		M	L
CO3		H			H								M	
CO4	M		H		H								M	
CO5	H	H	H		H								H	
16IPEX22	M	M	H	M	H	L		L			H		M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX23 **MOBILE COMPUTING** **CATEGORY:PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

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

- Basic concepts of mobile computing.
- Network protocol stack.
- Mobile telecommunication system.
- Ad–Hoc networks.
- Different mobile platforms and application development.

UNIT – I INTRODUCTION **(9 Periods)**

Mobile Computing vs Wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application – MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT – II MOBILE INTERNET AND TRANSPORT PROTOCOL **(9 Periods)**

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – Route Optimization – Overview of TCP/IP – Architecture of TCP/IP – Adaptation of TCP Window – Improvement in TCP Performance.

UNIT – III MOBILE TELECOMMUNICATION SYSTEM **(9 Periods)**

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT – IV MOBILE AD–HOC NETWORKS **(9 Periods)**

Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad-Hoc networks (VANET) – MANET vs VANET – Security.

UNIT – V MOBILE PLATFORMS AND APPLICATIONS **(9 Periods)**

Mobile Device Operating Systems – Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit – iOS, Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

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

Text Books:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, 2nd edition, 2012.

Reference Books:

1. *Jochen H. Schller,, "Mobile Communications", Pearson Education, 2nd edition, 2007.*
2. *Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 4th edition, 2005.*
3. *UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2nd edition, 2003.*
4. *William.C.Y.Lee, "Mobile Cellular Telecommunications–Analog and Digital Systems", Tata McGraw Hill, 2nd edition, 2006.*
5. *C.K.Toh, "AdHoc Mobile Wireless Networks", Pearson Education, 1st edition, 2002.*

COURSE OUTCOMES:

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

CO1: Explain the basics of mobile telecommunication system. **[Familiarize]**
CO2: Explain functionality of Mobile TCP/IP. **[Familiarize]**
CO3: Compare the different telecommunication standards. **[Familiarize]**
CO4: Use simulator tools and design Ad-hoc networks. **[Understand]**
CO5: Develop mobile applications for different platforms. **[Analyze]**

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	H	H	H										H	
CO2	H	H	H										H	
CO3	H	H	H										H	
CO4	H	H	H	H									H	
CO5	H	H	H	H									H	
16IPEX23	H	H	H	M									H	

L–Low, M–Moderate (Medium) and H–High

16IPEX24 **HUMAN COMPUTER INTERFACE** **CATEGORY: PE**

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

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

- Introduction of Human computer interaction.
- The design process of human computer interface.
- Models and theories used in human computer interaction process.
- Human computer interaction in mobile devices.
- Interfacing with web.

UNIT – I INTRODUCTION TO HCI **(9 Periods)**

The Human – I/O channels – Memory – Reasoning and problem solving – The computer – Devices – Memory – Processing and Networks– Interaction– Models – Frameworks – Ergonomics – Styles – Elements – Interactivity– Paradigms for Interaction.

UNIT – II DESIGN PROCESS **(9 Periods)**

Interactive Design basics – Process of Design – Scenarios – Navigation Design – Screen Design – Iteration and Prototyping – HCI in Software Process – Software Life Cycle – Usability Engineering – Iterative Design and Prototyping – Implementation Support – Programming the Application – Using Toolkits – Evaluation Techniques – Universal Design.

UNIT – III MODELS AND THEORIES **(9 Periods)**

Linguistic Models – Challenge of Display Based Systems – Physical and Device Models – Cognitive Architectures – Organizational Issues – Capturing Stakeholder Requirements – Communication and Collaboration Models – Task Decomposition – Uses of Task Analysis – Dialog Analysis and Design.

UNIT – IV MOBILE HCI **(9 Periods)**

Mobile Ecosystem – Platforms – Application frameworks – Types of Mobile Applications – Widgets – Applications – Games – Mobile Information Architecture – Mobile 2.0 – Mobile Design– Elements of Mobile Design –Tools.

UNIT – V WEB INTERFACE **(9 Periods)**

Designing Web Interfaces – Drag & Drop – Direct Selection – Contextual Tools – Overlays – Inlays and Virtual Pages – Process Flow.

CONTACT PERIODS:

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

Text Books:

1. *Alan Dix, Janet Finlay, Gregory D. Abowd Russell Beale, "Human Computer Interaction", Pearson Education, 3rd edition, 2004.*
2. *Brian Fling,"Mobile Design and Development", O"Reilly Media Inc., 1st edition, 2009.*
3. *Bill Scott and Theresa Neil, "Designing Web Interfaces", O"Reilly, 1st edition, 2009.*

Reference Books:

1. *Anabela sarment, "Issues of human computer interaction", IRM press, 2005.*
2. *Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human Computer Interaction", Wiley, 3rd edition.*
3. *Ben Shneiderman, Catherine Plaisant, "Designing the User Interface", Pearson education, 5thedition.*

COURSE OUTCOMES:

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

CO1: Compare human and computer by their performance. **[Familiarize]**
CO2: Explore various design strategies applied in HCI design. **[Understand]**
CO3: Compare the models and theories used in the design of HCI. **[Understand]**
CO4: Analyze the interface of mobile devices. **[Understand]**
CO5: Analyze the interface of web applications. **[Understand]**

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
CO1	M			L									L	
CO2	H	L	H										M	
CO3	H	M	M	L									M	
CO4	H	L	L		M								L	
CO5	H		L		L			L					L	L
16IPEX24	H	L	M	L	L			L					L	L

L–Low, M–Moderate (Medium) and H–High

16IPEX25 **SOCIAL NETWORK ANALYSIS** **CATEGORY: PE**

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

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

- Semantic web and Web data.
- Modeling and aggregating network data.
- Mining Social Network data.
- Visualization and application of Social Networks.

UNIT – I INTRODUCTION TO SEMANTIC WEB AND SOCIAL NETWORKS (9 Periods)

Limitations of current web – Semantic solutions – Development of semantic web – Emergence of social web – Network analysis – Development of Social Network Analysis – Key concepts and measures in Network analysis.

UNIT – II WEB DATA AND SEMANTICS (9 Periods)

Electronic sources for Network Analysis – Blogs and online communities – Web based networks – Knowledge representation of the semantic web – Ontology languages for semantic web – RDF – OWL.

UNIT – III MODELING AND AGGREGATING SOCIAL NETWORK DATA (9 Periods)

Network Data Representation – Ontological representation of social individuals and social relationships – Aggregating and reasoning with social network data – Developing social semantic applications – Case study – FLINK – Open academia.

UNIT – IV WEB BASED SOCIAL NETWORK EXTRACTION (9 Periods)

Context of empirical study – Data Collection – Preparing the data – Optimizing goodness of fit – Predicting the goodness of fit – Evaluation through analysis – Semantic based Social Network Analysis – Methodology – Results – Tripartite model of ontology.

UNIT – V VISUALIZATION AND APPLICATIONS (9 Periods)

Visualization and Interactions for Social Networks Exploration – Applications of Social Network Analysis – Online advertising in Social Networks.

CONTACT PERIODS:

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

Text Books:

1. Peter Mika, "Social Networks and the Semantic Web", Springer 2007.
2. Bork Furth, "Handbook of Social Network Technologies and Applications", Springer, 2010.

Reference Books:

1. *Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 2011.*
2. *Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 1st edition, 2008.*
3. *John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.*

COURSE OUTCOMES:

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

- **CO1:** Describe the need for Semantic web in Social Networks. **[Familiarize]**
- **CO2:** Identify the web data and represent in the semantic web. **[Familiarize]**
- **CO3:** Model and aggregate social network data. **[Analyze]**
- **CO4:** Evaluate the social network data and extract information. **[Analyze]**
- **CO5:** Understand the visualization and applications of social networks.**[Understand]**

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
CO1			H		M					M			M	L
CO2		H		L									M	
CO3	H	H		L	M								M	
CO4	H	H	M	M	H								H	
CO5	L	M		M	M								M	
16IPEX25	L	H	L	L	M					L			M	L

L–Low, M–Moderate (Medium) and H–High

16IPEX26 FOUNDATIONS OF IMAGE PROCESSING CATEGORY: PE

L	T	P	C
3	0	0	3

PREREQUISITES:

1. 16IPC505 Fundamentals of Digital Signal Processing.

COURSE OBJECTIVES:

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

- Basic concepts of image processing.
- Image enhancement techniques.
- Image filtering and restoration techniques.
- Segmentation and representation of images.
- Compression techniques.

UNIT – I FUNDAMENTALS AND IMAGE TRANSFORMS (9 Periods)

Elements of Digital Image Processing System – Image sensing and acquisition – Image sampling and quantization – Basic relationship between Pixels – Need for image transforms – Discrete Wavelet transform – Harr & Daubechies Wavelets – Sub band coding of images using Harr & Daubechies Wavelets.

UNIT – II IMAGE ENHANCEMENT (9 Periods)

Spatial domain methods – Frequency domain methods – Histogram modification techniques – Neighborhood averaging – Median filtering – Low pass filtering – Averaging of multiple images – Images sharpening by differentiation – high pass filtering.

UNIT – III IMAGE FILTERING AND RESTORATION (9 Periods)

Image observation models – Restoration in the presence of noise only – Spatial filtering – Mean filters – Order statistics filters – Adaptive filters – Inverse filtering – Wiener filtering – Constrained least squares filtering – Blind deconvolution.

UNIT – IV IMAGE SEGMENTATION AND REPRESENTATION (9 Periods)

Edge detection – Gradient operators – Edge linking and boundary detection – Global processing via Hough transform – Graph theoretic techniques – Thresholding – Global thresholding – Adaptive threshold – Representation – Chain codes – Polygonal approximations – Signatures –Boundary segments – Skeletons – Boundary descriptors – Shape numbers – Fourier descriptors – Statistical moments – Regional descriptors – Texture – Relational descriptors.

UNIT – V IMAGE COMPRESSION (9 Periods)

JPEG – MPEG – Scalar Quantization and Vector Quantization – Code word assignment – Uniform length and variable length codeword assignment – Differential Pulse Code Modulation – Two channel coders – Pyramid coding – Hybrid transform coding – Wavelet coding

CONTACT PERIODS:

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

Text Books:

1. Gonzalez R.C. Woods R.E, "Digital Image Processing", Prentice Hall, 3rd edition, 2008.
2. Dr.S.Annadurai, Dr.R.ShanmugaLakshmi, "Fundamentals of Digital Image Processing", Pearson Education, 2007.

Reference Books:

1. *Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw, 3rd edition, 2011.*
2. *Jain A.K, "Fundamentals of Digital Image Processing", Prentice Hall of India, 1989.*
3. *Jae S. Lim, "Two–Dimensional Signal and Image Processing", Prentice Hall Inc, 1990.*
4. *Willliam K Pratt, "Digital Image Processing", John Willey, 4th edition, 2002.*

COURSE OUTCOMES:

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

CO1: Describe basic operations of the Image Processing. **[Familiarize]**
CO2: Apply Image Segmentation Techniques. **[Understand]**
CO3: Use filtering and restoration techniques to improve image quality. **[Understand]**
CO4: Represent the image and Perform image segmentation. **[Understand]**
CO5: Compress the images using suitable compression techniques. **[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
CO1	M	M	M	M	M	L	L	L		L			M	L
CO2	H	H	H	H	H	M	M	M	L	L	L	L	H	M
CO3	H	H	H	H	H			L	M	M	M	M	H	M
CO4	H	H	H	H	H			L	M	M	M	M	H	M
CO5	H	H	H	H	H			L	M	M	M	M	H	M
16IPEX26	H	H	H	H	H	L	L	L	M	M	M	M	H	M

L–Low, M–Moderate (Medium) and H–High

16AOEX01 **NANOSCIENCE AND TECHNOLOGY** **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 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 Periods)**

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 Periods)**

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 Periods)**

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 Periods)**

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 Periods)**

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:

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

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
CO1		H		M		L							L	L
CO2	M			L	H								M	
CO3		H			L		M						L	L
CO4	H			M		L							M	L
CO5	L		H				M					M	L	L
16AOEX01	L	L	L	L	L	L	L					L	L	L

L-Low, M-Moderate (Medium) and 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 Periods)**

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 Periods)**

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 Periods)**

SEM - FESEM - EDAX - HRTEM: working principle and Instrumentation – sample preparation – Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

UNIT – IV ELECTRICAL METHODS **(9 Periods)**

Two probe and four probe methods- vander 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 Periods)**

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:

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

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
CO1		H			M	M	L						L	L
CO2	H	M	M				L					L	M	L
CO3		H	M	M	L								M	
CO4	M	H		L	M								M	
CO5		M	H		L	M						L	M	L
16AOEX02	L	H	L	L	L	L	L					L	M	L

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

16AOEX03 **ELECTROCHEMICAL TECHNOLOGY** **CATEGORY: OE**

(Common to All Branches)

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

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 Periods)**

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 Periods)**

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 electro synthesis.

UNIT – III **(9 Periods)**

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 Periods)**

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 Periods)**

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:

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

CO 1: 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.

CO 3: Students will be able to apply their technical skill in metallurgy.

CO 4: 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
CO1	L	H	M	M	H	L							M	L
CO2	L	M	H	L	H	L							M	L
CO3	H	L	H	M	M	H							M	L
CO4	M	L	L	L	M	H							M	L
CO5	L	M	H	L	H	M							M	L
16AOEX03	M	M	M	L	H	M							M	L

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

16AOEX04 **POLYMER TECHNOLOGY** **CATEGORY: OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

- 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 Periods)**

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 Periods)**

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 Periods)**

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, injection molding, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

UNIT – IV : POLYMER BLENDS AND COMPOSITES **(9 Periods)**

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 Periods)**

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

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

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	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
CO1	M	H	L	L	M	H							M	L
CO2	L	L	H	M	H	L							M	L
CO3	M	M	L	L	M	L							M	L
CO4	L	L	M	M	M	H							M	L
CO5		H	L	L	H	M							M	L
16AOEX04	L	M	M	L	M	M							M	L

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

16COEX05 DISASTER MANAGEMENT AND MITIGATION CATEGORY: OE

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

- 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 (8 Periods)

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 Periods)

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 (8 Periods)

Mitigation - types of mitigation, Obstacles in mitigation, Assessment and selection of Mitigation options, Emergency response capacity as, Incorporating Mitigation into development and relief projects. Prepareness - Government Preparedness, Public Preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT – IV RESPONSE AND RECOVERY (9 Periods)

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 Periods)

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 & International 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 Books:

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

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

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
CO1		L			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	L
CO5		M		L	L	M							L	L
16COEX05	L	M		L	L	M	M	L				L	L	L

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

16COEX06 **ENVIRONMENTAL MANAGEMENT** **CATEGORY: OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES:

16IHS2Z4 - 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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 , "EnvironmentalManagement", 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	PS O1	PS O2
CO1	M	L					M						L	L
CO2	L	M			L		H					L	L	L
CO3	L	M			L		H					L	L	L
CO4	L	M			L		H					L	L	L
CO5	M	L					M						L	L
16COEX06	L	M			L		H					L	L	L

L-Low, M-Moderate (Medium) and 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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 OUTCOME:

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

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	PS O1	PS O2
CO1				M								L	L	L
CO2							M				L	L	L	L
CO3		L		L						M			L	L
CO4		L		L						M			L	L
CO5		M						L				H	L	L
16COEX07		L		L			L	L		L	L	L	L	L

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

16MOEX08 TOTAL QUALITY MANAGEMENT FOR ENGINEERS CATEGORY: OE

(Common to All Branches Except Production)

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

Course Objectives:

- 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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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

Upon completion of this course the 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
CO1	L	H			M			L	L		L	L	M	L
CO2	L	H			M			L	L		L	L	M	L
CO3	L	H			M			L	L		L	L	M	L
CO4	L	H			M			L	L		L	L	M	L
CO5	L	H			M		L	L	L		L	L	M	L
16MOEX08	L	H			M		L	L	L		L	L	M	L

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

16MOEX09 **COMPOSITE MATERIALS** **CATEGORY: OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES:

16IBS2Z3 - Material Science

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 MANUFACTURING OF ADVANCED COMPOSITES (9 Periods)

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:

Upon completion of this course the 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	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
CO1	H	M	H			M	M				L		M	L
CO2	H	M	M	M	M		L				M		M	L
CO3	M	M	M	M		L	M				L		M	L
CO4	M	M	M	L		H	L		L		M		M	L
CO5	L	L		L		M	L					L	M	L
16MOEX09	M	M	M	L	L	M	L		L		L	L	M	L

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

16MOEX10 **AUTOMOBILE ENGINEERING** **CATEGORY: OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES:

1. 16MPC502 Thermal Engineering
2. 16MPC603 Design of Transmission systems

Course Objectives:

- The learners are able to visualize the scope of Automobile Engineering.

UNIT – I INTRODUCTON TO AUTOMOTIVES **(9 Periods)**

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 Periods)**

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 Periods)**

Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and Preliminaries of suspension systems

UNIT – IV AUXILIARY SYSTEMS **(9 Periods)**

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 Periods)**

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:

Upon completion of this course the students 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
CO1	M	M	M	L	H	M	M	M	L	L	L	H	M	L
CO2	H	M	H	H	M	H	L	L	L	M	M	L	H	M
CO3	M	M	M	L	M	H	M	L	L	M	H	L	M	M
CO4	H	M	H	M	H	M	H	H	M	M	H	L	H	M
CO5	M	L	L	L	M	H	M		L	H	H	H	L	H
16MOEX10	M	M	M	M	H	H	M	L	L	M	M	M	M	M

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

16EOEX11 RENEWABLE ENERGY SOURCES AND TECHNOLOGY CATEGORY:OE

(Common to all Branches)

	L	T	P	C
PREREQUISITES: Nil	3	0	0	3

Course Objectives:

- To elucidate the technologies used for generation and utilization of power from renewable energy resources.

UNIT – I SOLAR ENERGY **(9 Periods)**

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 Periods)**

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 Periods)**

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 Periods)**

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 Geothermalresources, 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 Periods)**

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", TataMcGraw Hill, 1996.

3. Roland Wengenmayr, Thomas Buhrke, "Renewable energy: Sustainable energy concepts for the future", Wiley-VCH, 1st edition, 2008.

COURSE OUTCOME:

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

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
CO1	H	M	M	M	M	M	M			L	L	L	M	L
CO2	H	H	M	M	M	M	M	L		L	L	L	M	L
CO3	H	M	M	M	M	M	M	M			L	L	M	L
CO4	M	H	M	L	M	H	M	M		L	L	L	M	L
CO5	M	H	H	H	M	M	M	M		L	L	L	H	L
CO6	H	M	M	M	M	M	M		H	H	L	L	M	L
16EOEX11	H	H	M	M	M	M	M	L	L	L	L	L	M	L

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

16EOEX12 **SMART GRID TECHNOLOGY** **CATEGORY:OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

- 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 Periods)

Introduction – Information and Communication technologies serving the electrical system – Integration of advanced technologies – Definitions of Smart Grids – Objectives addressed by the Smart Grid concept – Socio-economic and environmental objectives – Stakeholders involved the implementation of the Smart Grid concept – Research and scientific aspects of the Smart Grid – Smart Grids from the customer's point of view.

UNIT – II INFORMATION AND COMMUNICATION TECHNOLOGY (9 Periods)

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 Periods)

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 Periods)

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 Periods)

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 OUTCOME:

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

- **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
CO1				L	L	M	H	L	M	M	M	H	L	M
CO2	L	L	M	M	M	M	M	L	M	M	M	M	M	M
CO3				M	M	M	M	M	M	M	M	H	M	M
CO4	L			M	M	M	H		M	M	M	H	M	M
CO5	M		L	M	M	M	M		M	M	M	M	M	M
CO6	L	L	M	L	M	M	L		M	M	M	M	L	M
16EOEX12	L	L	L	M	M	M	M	L	M	M	M	H	M	M

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

16LOEX13 **PRINCIPLES OF COMMUNICATION** **CATEGORY: OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

- 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 Periods)**

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 Periods)**

Frequency modulation and phase modulation- FM and PM waveforms phase deviation and 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 Periods)**

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 Periods)**

Introduction – ASK, FSK,PSK- transmitter and receiver – QPSK transmitter and receiver – Mary PSK – Error probability in PSK, FSK.

UNIT – V SATELLITE AND OPTICAL COMMUNICATION **(9 Periods)**

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 be able to,

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
CO1	M	M	M									L	M	L
CO2	M	M	M									L	M	L
CO3	M	M	M									L	M	L
CO4	M	M	M									L	M	L
CO5	M	M	M									L	M	L
CO6	M	M	M									L	M	L
16LOEX13	M	M	M									L	M	L

L-Low, M-Moderate (Medium) and 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 Periods)

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 Periods)

Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication of 8051.

UNIT – III PROGRAMMING OF PIC18FXXX MICROCONTROLLER (9 Periods)

Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT – IV PERIPHERAL INTERFACING (9 Periods)

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 Periods)

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 8051Microcontroller", 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 students will be able to,

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
CO1	M	H	M									L	M	L
CO2	M	H	M									M	M	L
CO3	M	H	M									M	M	L
CO4	M	H	M									M	M	L
CO5	M	H	M									M	M	L
CO6	H	H	H									M	H	L
16LOEX14	M	H	M									M	M	L

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

16NOEX15 INDUSTRIAL AUTOMATION SYSTEMS CATEGORY: OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

Course Objectives:

- 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 Periods)

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 Periods)

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 Periods)

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 Periods)

Overview of DCS – DCS hardware – DCS software configuration – DCS communication – DCS supervisory computer tasks – DCS integration with PLC and Computers.

UNIT – V SCADA (9 Periods)

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
CO1	H	H	M	M	L	L	L	H	L	M	L	L	M	M
CO2	H	H	H	H	L	L	L	H	L	M	L	L	H	M
CO3	H	H	M	M	L	L	M	H	L	M	L	L	M	M
CO4	H	H	H	H	L	L	L	H	L	M	L	L	H	M
CO5	H	H	M	M	M	L	L	H	L	M	L	L	M	M
16NOEX15	H	H	M	M	L	L	L	H	L	M	L	L	M	M

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

16NOEX16 MEASUREMENTS AND INSTRUMENTATION CATEGORY: OE

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES:

16NPC305 Sensors and Transducer

Course Objectives:

- 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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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
CO1	H	H	M	H	M	H	M	L	H	M	H	H	H	H
CO2	H	M	M	M	H	H	H	M	H	L	H	H	M	H
CO3	H	H	M	H	M	H	M	L	H	M	H	H	H	H
CO4	H	H	M	H	M	H	M	L	H	M	H	H	H	H
CO5	H	H	M	H	M	H	M	L	H	M	H	H	H	H
CO6	H	H	M	H	M	H	M	L	H	M	H	H	H	H
16NOEX16	H	H	M	H	M	H	M	L	H	M	H	H	H	H

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

16SOEX17 **ENTERPRISE JAVA** **CATEGORY: OE**

(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:

- 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 Periods)**

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 Periods)**

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 Periods)**

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 Periods)**

Concept of JDBC – JDBC Driver types- Database Connection – Associating JDBC Bridge with the database – Statement Objects –Resultset – 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 Periods)**

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" , 9th Edition. 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 J2EE™ 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 handling***.[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, JSPand JFC technology in developing enterprise applications ***[Usage]***

CO5: Apply Java interconnectivity techniques like JDBC, RMI, Java Mail, JMS, JNDIin 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
CO1	H	L	H	L	H		L					M	H	L
CO2	H	M	H	M	H		L					M	H	L
CO3	H	L	H	L	H		L					M	H	L
CO4	M	L	M	L	H		L					M	H	L
CO5	H	L	H	L	H		M					M	H	L
CO6	M	L	M	L	H		L					L	H	L
CO7	H	L	H	L	H		M					M	H	L
16SOEX17	H	L	H	L	H		L					M	H	L

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

16SOEX18 **CYBER SECURITY** **CATEGORY: OE**

(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:

- 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 Periods)

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 Periods)

Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Fraudsin 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 Periods)

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 Periods)

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 Periods)

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, Computer 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
CO1	M	M	M	M	L	H	L	M				H	M	M
CO2	M	M	M	M	M	H	M	M				M	M	M
CO3	H	L	L	L	L	H	H	L				H	M	M
CO4	H	M	M	M	M	H	H	H				M	M	M
CO5	H	M	M	M	M	L	H	L				H	M	M
16SOEX18	H	M	M	M	M	H	H	M				H	M	M

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

16SOEX19 **NETWORK ESSENTIALS** **CATEGORY: OE**

(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:

- Basic taxonomy and terminology of the computer networking
- Wireless networking
- Addressing and Routing
- Routing protocols
- Troubleshooting and security issues.

UNIT – I INTRODUCTION (9 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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's, PHI, 5th edition 2011.

3. William Stallings, "Data and computer communication", 10th edition, Pearson Education, 2013.

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
CO1	M	M	H	H	H	L	L	H	H	H	H	H	H	H
CO2	H	H	H	H	H	L	L	H	H	H	H	H	H	H
CO3	L	L	L	L	H	L	L	H	L	L	L	H	M	M
CO4	L	H	M	M	H	L	L	H	H	M	L	H	H	H
CO5	H	H	H	M	H	L	L	H	H	H	M	H	H	H
CO6	H	H	H	M	H	L	L	H	H	M	L	H	H	H
CO7	H	H	H	H	H	L	L	H	H	H	M	H	H	H
CO8	H	H	H	H	H	L	L	H	H	M	L	H	H	H
CO9	H	H	H	H	H	L	L	H	H	H	M	H	H	H
16SOEX19	M	H	H	M	H	L	L	H	H	L	M	H	H	H

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 Objectives:

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Books:

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
CO1	M	L		L	L		L	L			L		L	L
CO2	M	L		L	L		L	L			L		L	L
CO3	M	M	L	M	L		L	L			L		M	L
CO4	M	M	L	M	L		M	M			L		M	L
CO5	M	M	L	M	L		M	M			M	L	M	L
16IOEX20	M	M	L	M	L		M	M			L	L	M	L

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 Objectives:

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – Apriori 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. **[Analyze]**
CO4: Mine larger data streams using suitable algorithms. **[Understand]**
CO5: Rank pages and handle large data sets efficiently. **[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
CO1	H	L	M	L	H	L							M	L
CO2	M				H			L				L	M	L
CO3		H			H							L	M	L
CO4	M	H	M		M							L	M	L
CO5	L	M	H									L	M	L
16IOEX21	M	H	M	L	H	L		L				L	M	L

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

16IOEX22 OBJECT ORIENTED PROGRAMMING USING C++ CATEGORY: OE

(Common to all Branches)

PREREQUISITES: Nil

L	T	P	C
3	0	0	3

Course Objectives:

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Books

1. E.Balagurusamy "Object oriented Programming with C++" McGraw Hill Education Ltd, 6th Edition 2013.

Reference Books

1. R.Rajaram "Object Oriented Programming and C++" New Age International 2nd edition, 2013

2. K.R. Venugopal,Rajkumar,T. Ravishankar"Mastering C++" , Tata McGraw Hill Education,2nd edition, 2013

3. Yashavant P. Kanetkarn"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
CO1	M	H	H	M	M		M	M			M		H	L
CO2	M	H	H	H	M		M	M			M		H	L
CO3	M	H	H	H	M		M	M			M		H	L
CO4	M	H	H	H	M	L	M	M			M		H	L
CO5	M	H	H	H	M		M	M			M		H	L
16IOEX22	M	H	H	H	M	L	M	M			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 Objectives:

- 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 Periods)**

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 Periods)**

Concept of Relational database, Data archiving, Data mining, Primary databases-NCBI, EMBL, DDBJ; Structure databases-PDB.

UNIT – III SEQUENCE ANALYSIS **(9 Periods)**

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 Periods)**

Protein secondary prediction-Chou fasman method, GOR method; Tertiary structure prediction-Homology modelling, Introduction to Computer aided drug design.

UNIT – V MACHINE LEARNING **(9 Periods)**

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
CO1	M	M	L	L		L			M				M	L
CO2	M	L	L	L					L			L	L	L
CO3	L		L			M			L			L	L	L
CO4	M	M	L	M	M								M	
CO5		M		H	H	M	L		M				M	L
16BOEX23	M	M	L	L	H	M	L		M			L	M	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 Objectives:

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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 AnnelieseCruger, "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	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
CO1	L	L	L										L	
CO2	L	M		L			L	M					L	L
CO3	L	M	L	L				L	M			L	L	L
CO4	L	L	L	L	M				L				L	L
CO5														
16BOEX24	L	M	L	L	M		L	M	M			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.

UNIT – I INTRODUCTION TO INDUSTRIAL BIOPROCESS (9 Periods)

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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
CO1	M	H	H										H	
CO2	H	M											M	
CO3	H	H	H	M	M	M		L	H				H	M
CO4	H	L	L			L		L					M	L
CO5	H	M	H	L	M			L					M	L
16BOEX25	H	M	H	M	M	M		L	H				M	L

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

16IOCXZ1 **HUMAN VALUES I** **CATEGORY : OC**

(Common to All Branches)

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

- Essential complementarily 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 Periods)

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 Periods)

Coexistence – Happiness and convenience – Appraisal of Physical needs – Mental and Physical health – Human relationship – Mutual Trust and Respect.

UNIT III ETHICS (5 Periods)

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, 2nd edition, 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)", Prentice Hall of India Ltd., Eastern Economy Edition, 2004.*
4. *E.G. Seebauer and Rober. L. Berry, "Fundamentals of Ethics for Scientists and 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.**[Familiarize]**

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. **[Familiarize]**

CO3: Aware of their activities like understanding, desire, thought and selection and start finding their focus of attention at different moments. **[Familiarize]**

CO4: Able to see that respect is right evaluation and only right evaluation leads to fulfillment in relationship. **[Familiarize]**

CO5: Develop an understanding of the whole existence and interconnectedness in nature. **[Familiarize]**

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
CO1	L	L				H	H	H	H	M	M	M	L	H
CO2	L	L				H	H	H	H	M	M	M	L	H
CO3	L	L				H	M	H	H	M	H	M	L	H
CO4	L	L				H	H	H	H	M	M	M	L	H
CO5	L	L				H	H	H	H	M	M	M	L	H
16IOCXZ1	L	L				H	H	H	H	M	M	M	L	H

L–Low, M–Moderate (Medium) and H–High

16IOCX02 HUMAN VALUES AND PROFESSIONAL ETHICS CATEGORY : OC

(Common to All Branches)

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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

- Engineering Ethics and Human Values
- Social responsibility of an Engineer
- Ethical dilemma while discharging duties in Professional life.

UNIT I ENGINEERING ETHICS (5 Periods)

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 Periods)

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – Balanced outlook on law – The challenger case study – Engineers as managers – Consulting engineers – Moral leadership .

UNIT III SAFETY, RESPONSIBLITIES, RIGHTS AND GLOBAL ISSUES (5 Periods)

Safety and risk – Assessment of safety and risk – Risk benefit 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.

CONTACT PERIODS:

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, 3rd edition, 1996.*
2. *M. Govindarajan,S. Natarajan and V.S. Senthil kumar, "Engineering Ethics (including human values)", Printice Hall of India Ltd., Eastern Economy Edition, 2004.*

Reference Books:

1. *Charles D.Fleddermann, "Engineering Ethics", Pearson Education, 2004.*
2. *Edmund G Seebauer and 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, 6th edition, 2000.*
4. *John R. Boatright, "Ethics and Conduct of Business", Pearson Education, 7th edition, 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.**[Familiarize]**

CO2: Sense engineering ethics, professional roles and valuing time, co–operation and commitment.**[Familiarize]**

CO3: Understand and practise code of ethics. **[Familiarize]**

CO4: Assess safety and risk and capable of doing risk benefit analysis. **[Familiarize]**

CO5: Develop and exhibit moral leadership qualities in exercising Engineering Consultations without compromising envionmental, legal and ethical issues. **[Understand]**

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
CO1	M	M	M	M	M	H	H	H	H	M	M	M	M	H
CO2	M	L	M	M	M	H	H	H	H	M	M	M	M	H
CO3	M	M	L	M	L	H	M	H	H	M	H	M	M	H
CO4	L	L	L	L	L	H	H	H	H	M	M	M	M	H
CO5	M	M	M	M	M	H	H	H	H	M	M	M	M	H
16IOCX02	M	M	M	M	M	H	H	H	H	M	M	M	M	H

L–Low, M–Moderate (Medium) and H–High

16IOCX03 YOGA FOR YOUTH EMPOWERMENT CATEGORY: OC

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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 Periods)

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 Periods)

Rules & Regulations – asana, pranayama, mudra, bandh.

UNIT – III MIND (5 Periods)

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,

CO1: YOGA which gives healthy & better living, Physical, Mental mood, Intellectual & spiritual.

CO2: Work skillfully and perfectly towards the excellence.

CO3: 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
CO1						H								L
CO2									M					L
CO3							L				L			L
16IOCX03						M	L		M		L			M

L–Low, M–Moderate (Medium) and H–High

16IOCX04 **R PROGRAMMING** **CATEGORY: OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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

- Basics of R–Programming.
- Control structures and functions.
- Coding and simulation of R–Programming

UNIT – I INTRODUCTION **(5 Periods)**

History and Overview of R – Getting Started with R – R Nuts and Bolts – Getting Data In and Out of R – Using Textual and Binary Formats for Storing Data

UNIT – II CONTROL STRUCTURES **(5 Periods)**

Control structures – functions – scoping rules of R – dates and times – Loop functions

UNIT – III CODING AND DEBUGGING **(5 Periods)**

Regular Expressions – Debugging – Profiling R Code – Data Analysis – Case Study

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

Text Books:

1. Roger D. Peng, "*R Programming for Data Science", Lean Publication, 2015.*

Reference Books:

1. *Felix Alvaro, "R: Easy R Programming for Beginners", Kindle edition.*

COURSE OUTCOMES:

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

CO1: Explain the concepts of R–Programming. **[Familiarize]**

CO2: Apply control structure and functions. **[Understand]**

CO3: Develop R–Programming for Date and Time utilizations. **[Understand]**

CO4: Debug R–Programming **[Understand]**

CO5: Implement Profiler for R Code **[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
CO1	M	H	H	H	M	M		M			L		H	M
CO2	M	H	H	H	M	M		M			L		H	M
CO3	M	H	H	H	M	M		M			L		H	M
CO4	M	H	H	H	M	M		M			L		H	M
CO5	M	H	H	H	M	M		M			L		H	M
16IOCX04	M	H	H	H	M	M		M			L		H	M

L–Low, M–Moderate (Medium) and H–High

16IOCX05 **ETHICAL HACKING** **CATEGORY: OC**

L	T	P	C
0	0	2	1

PREREQUISITES: Nil

Course Objectives:

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

- Hacking tools.
- Hacking applications and cracking passwords.
- Trojans, viruses and worms.
- Network and system hacking.
- Different types of attacks in web server and web sites.

LIST OF EXPERIMENTS

1. Making data safe using Cryptography
2. Cracking password of an Application
3. Trojans, Viruses and Worms
4. Network Sniffing
5. Hacking wireless networks
6. DoS(Denial of Service) Attacks
7. Hacking a Web Servers and websites
8. SQL Injection
9. Hacking using Social Engineering
10. Hacking Linux Systems

CONTACT PERIODS:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

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

CO1: Use ethical hacking tools[**Understand**]
CO2: Hack applications and crack passwords[**Analyze**]
CO3: Create simple viruses, Trojans and worms[**Analyze**]
CO4: Sniff network packets[**Analyze**]
CO5: Attack web servers and web sites[**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
CO1	L					H		H					L	M
CO2	H	M	M	M	H	M		H					H	M
CO3	H	M	M	M	H	M		H					H	M
CO4	H	M	M	M	M	H		H					H	M
CO5	H	M	M	M	M	H		H					H	M
16IOCX05	H	M	M	M	M	H		H					H	M

L–Low, M–Moderate (Medium) and H–High

16IOCX06 **.NET FRAMEWORK** **CATEGORY: OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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

- Basic architecture of .NET framework
- Windows and Web applications using .NET
- .NET Features

UNIT – I DESIGN AND DEVELOPMENT **(5 Periods)**

Understanding .NET – .NET Framework architecture – Design by layer – Distributed Application Layers – .NET Remoting.

UNIT – II WINDOWS AND WEB APPLICATIONS **(5 Periods)**

Windows based applications – Accessing data with ADO.NET – Web based application with ASP.NET – Web forms – Manipulating XML – Threading and Synchronization – .Net security.

UNIT – III .NET FEATURES **(5 Periods)**

Assemblies – Shared Assemblies – CLR hosting – App Domains – Reflection.

CONTACT PERIODS:

Lecture: 15 periods **Tutorial: 0 periods** **Practical: 0 periods** **Total: 15 periods**

Text Books:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4.5", Wiley, 2012

Reference Books:

1 *Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform", APress, 5th edition,2010 .*

2 *Rebecca M Riordon, "Microsoft ADO .NET: step by step", Prentice Hall of India, New Delhi, 2006.*

3 *Buczek G,"ASP.NET Developers Guide", Tata McGraw Hill, New Delhi, 1st edition, 2008.*

COURSE OUTCOMES:

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

CO1: Demonstrate the basic architecture of .NET framework. [**Understand**]
CO2: Develop Windows and Web Applications.**[Analyze]**
CO3: Apply .NET features in projects.**[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
CO1	H		H		H	L							H	L
CO2	H		H		H			L					H	L
CO3		H	H		H						H		H	L
16IOCX06	H	H	H		H	L		L			H		H	L

L–Low, M–Moderate (Medium) and H–High

16IOCX07 **AUTOMATED TESTING** **CATEGORY: OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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

- Basics of test automation.
- User Interface Controls.
- Data driven testing.

UNIT – I INTRODUCTION **(5 Periods)**

Introduction to Automation– Training Application Walkthrough– Planning before Automation– Introduction to Selenium– Installing Selenium Components

UNIT – II DEVELOPMENT ENVIRONMENT **(5 Periods)**

Using Selenium IDE– Managing User Interface Controls– Basics of Java– Creating First Selenium Web Driver Script– Selenium Methods

UNIT – III VERIFICATION AND TESTING **(5 Periods)**

Verification Point in Selenium – Shared UI Map– Using Functions– Using a Configuration File– Data Driven Testing – Parameterization

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 15 Periods**

Text Books:

1. *Navneesh Garg ,"Test Automation Using Selenium WebDriver with Java", AdactIn Group Pvt Ltd, 2014*

Reference Books:

1. *Satya Avasarala, "Selenium WebDriver Practical Guide – Automated Testing for Web Applications", PACKT, 1st edition, 2014*
2. *Unmesh Gundecha, "Selenium Testing Tools Cookbook", PACKT, 2nd edition, 2012*

COURSE OUTCOMES:

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

CO1: Install and Uninstall Selenium components**[Understand]**
CO2: Use Selenium IDE**[Understand]**
CO3: Create selenium web driver scripts**[Understand]**
CO4: Use functions and configuration files**[Understand]**
CO5: Do data driven testing**[Understand]**

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
CO1	M	L	L	M	H			L	M	L	H		M	M
CO2	M	M	M	M	H			L	M	M	H		M	M
CO3	M	M	M	M	H			L	M	M	H	L	M	M
CO4	H	H	H	H	H	L	L	L	M	M	H	L	H	M
CO5	H	H	H	H	H	L	L	L	M	M	H	L	H	M
16IOCX07	M	M	M	M	H	L	L	L	M	M	H	L	M	M

L–Low, M–Moderate (Medium) and H–High

16IOCX08 **GAME PROGRAMMING** **CATEGORY: OC**

L	T	P	C
1	0	0	1

PREREQUISITES: Nil

Course Objectives:

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

- Concepts of Game design and development.
- Core architecture of Game Engine.
- Processes, mechanics and issues in Game Design.

UNIT – I 3D GRAPHICS FOR GAME PROGRAMMING (5 Periods)

3D Transformations, 3D Modeling and Rendering, Ray Tracing, Lighting, Color, Texturing, Camera and Projections, Clipping, Character Animation, Physics–based Simulation, Scene Graphs.

UNIT – II GAME ENGINE DESIGN (5 Periods)

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real–time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

UNIT – III GAME PROGRAMMING (5 Periods)

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

Text Books:

1. *Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Cengage Learning, 4th edition, 2012.*
2. *Jason Gregory, " Game Engine Architecture", CRC Press / A K Peters, 2nd edition, 2009*

Reference Books:

1. *David H. Eberly,"3D Game Engine Design, Second Edition: A Practical Approach to Real–Time Computer Graphics", Morgan Kaufmann, 2nd editions, 2006.*
2. *Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall / New Riders, 2nd edition, 2009.*

COURSE OUTCOMES:

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

CO1: Discuss the concepts of Game design and development. **[Understand]**
CO2: Explain the Core architecture of Game Engine.**[Analyze]**
CO3: Design the processes and use mechanics for game development.**[Understand]**

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
CO1	H	M	M	M	M					L	L		M	L
CO2	M	M	H	M				M	L	L	L		M	L
CO3	M	M	M	M	H	L		L		L	L		M	L
16IOCX08	M	M	M	M	M	L	H	L	L	L	L		M	L

L–Low, M–Moderate (Medium) and H–High

16IOCX09 **USER INTERFACE TECHNOLOGIES** **CATEGORY: OC**

L	T	P	C
0	0	2	1

PREREQUISITES: Nil

Course Objectives:

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

- HTML web page creation using HTML, HTML5, CSS and CSS3.
- Development of dynamic web pages using forms and javascript.
- Usage of JQuery, AJAX and AngularJS technologies
- UI design for Android mobile applications.

LIST OF EXPERIMENTS

1. HTML web page creation
2. Programs using CSS
3. Forms in Web page
4. Programs using Javascript
5. JQuery and Events
6. AJAX
7. HTML 5
8. CSS 3
9. Angular JS
10. Android UI design.

CONTACT PERIODS:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

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

CO1: Create web pages using HTML, HTML5, CSS and CSS3. **[Analyze]**
CO2: Create dynamic web pages for handling events using Forms and javascript.**[Analyze]**
CO3: Develop web Pages using AJAX and JQuery**[Analyze]**
CO4: Develop web Pages using AngularJS.**[Analyze]**
CO5: Develop User Interface for Android applications **[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
CO1	H		M		M								M	
CO2	H		M		M								M	
CO3	H		M		M								M	
CO4	H		M		M								M	
CO5	H		M		M								M	
16IOCX09	H		M		M								M	

L–Low, M–Moderate (Medium) and H–High

16IOCX10 **UNIFIED MODELING LANGUAGE** **CATEGORY: OC**

L	T	P	C
0	0	2	1

PREREQUISITE: Nil

Course Objectives:

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

- Installation of UML software.
- Development of Class and Object Diagram.
- Interaction and Activity Diagram.
- Behavioral and Architectural modeling.

LIST OF EXPERIMENTS

1. Installation of UML package
2. Class Diagram
3. Object Diagram
4. Sequence and Collaboration Diagram
5. Use case Diagram
6. Activity Diagram
7. State Chart Diagram
8. Component and Deployment Diagram
9. Forward Engineering process
10. Reverse Engineering process

CONTACT PERIODS:

Lecture: 0 Periods **Tutorial: 0 Periods** **Practical: 30 Periods** **Total: 30 Periods**

COURSE OUTCOMES:

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

CO1: Create Class and Object Diagram. **[Understand]**

CO2: Develop Interaction and Activity diagram.**[Understand]**

CO3: Develop Behavioral and Architectural modeling**[Understand]**

CO4: Perform the forward engineering process of the software.**[Analyze]**

CO5: Perform the reverse engineering process of the software.**[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
CO1	H		M		M								M	
CO2	H		M		M								M	
CO3	H		M		M								M	
CO4	H		M		M								M	
CO5	H		M		M								M	
16IOCX10	H		M		M								M	

L–Low, M–Moderate (Medium) and H–High